Tact Repertoires and Measures of Efficiency: Comparing the Effects of Two Behavioral Intervention Models with Students with Developmental Disabilities

Dissertation

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Abstract

This dissertation reviewed experimental studies centering on the Lovaas Method (LovM), reviewed experimental studies centering on Verbal Behavior Approach (VBA) and/or studies that focused on the primary verbal operants, and compared the effects of LovM and VBA on the development of tact repertoires of three 11 to 12-year-old students with moderate to severe mental retardation. We administered the ABLLS-short form, determined current levels of performance, and implemented the protocols in an alternative school for students with developmental disabilities. Specifically, 10 targets from two categories were taught receptively to mastery criterion and then expressively to mastery criterion using the LovM, and ten different targets from the same categories were trained using VBA, which included transfer trials across operants. A within-subject alternating treatments with baseline design was used to evaluate skill acquisition and identify an optimal practice in regards to frequency of target operants mastered to criterion, measures of efficiency, maintenance, and generalization. The results of this investigation suggest that both protocols are effective in teaching receptive and tact target operants; however, across all participants, VBA resulted in fewer errors and was more efficient in teaching tact operants. Limitations and recommendations for future research are discussed.
Dedication

Dedicated to my wife, Darla.

Without her, I would be dead in days.
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I am indebted to the participants; without them, and people like them, my understanding would not be possible.

I would like to thank the educational staff and principal who contributed and allowed me to conduct this research within their classrooms and school. For their participation, patience, and flexibility I am very grateful.

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Vita

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Chapter 1: Introduction

Language can be described as a combination of visual, auditory, and tactile symbols of communication (Beukelman & Mirenda, 2005; Bondy & Frost, 2002; Downing, 2005). Although all animals display sophisticated communicative systems, language is considered to be a complex (Vargas, 2008) and exclusively human mode of communication (Chomsky, 1965). Quite simply, we use language to interact with each other. When discussing language, it is important to distinguish between its formal and functional properties. Formal properties refer to the form and structure (e.g., syntax, grammar, etc.), and the functional aspects of language refer to the causes of language (i.e., the behavior of the speaker; Michael, 2007a). Linguists explore the formal aspects of language; however, this dissertation will focus on the functional properties of language. Three perspectives categorize the functional properties of language: (a) biological—language is caused by physiological processes and functions (Chomsky, 1965); (b) cognitive—internal processing systems control language and store information (Bloom, 1970; Piaget, 1952); and (c) behavioral/environmental—language is the result of external controlling variables (Michael, 2007a; Skinner, 1957). This dissertation will examine the behavioral perspective used to analyze the functional properties of language.
In the behavioral perspective, language is a form of learned operant behavior resulting from external controlling variables (Skinner, 1957). This perspective is lawful and orderly, based on the scientific knowledge gained from the experimental analysis of behavior, yet parsimonious and subject to experimentation. The focus of a behavioral account of language is a precise description, credible prediction, and supportive control of verbal behavior (Cooper, Heron, & Heward, 2007; Skinner, 1957).

Verbal Behavior

In *Verbal Behavior*, Skinner (1957) analyzed language by emphasizing the speaker and categorized verbal operants, described below, by their functional relations to antecedents and consequences rather than by their form and structure. Skinner defined verbal behavior as “behavior reinforced through the mediation of other persons” (Skinner, 1957, p. 2). For example, a thirsty individual can obtain water (i.e., a reinforcing stimulus) by either directly acting on his or her environment by physically walking to a water source and consuming water, or by indirectly acting on the environment by asking some other person (i.e., a listener) to bring water to consume (e.g., “On your way back from the kitchen, would you please bring me a glass of water?”). Receiving reinforcement (i.e., a cool glass of water to drink) can be mediated by the behavior of the listener. Because of this mediation, verbal behavior requires a separate analysis; however, it does not require a new behavioral account, as it is subject to the same contingencies of reinforcement as non-verbal behavior (i.e., behavior that directly interacts with the environment (Skinner, 1938/1953/1957).
Skinner (1957) stated, “In defining verbal behavior as behavior reinforced through the mediation of other person we do not, and cannot, specify any one form, mode, or medium; any movement capable of affecting another organism may be verbal” (p. 14). Because of the conspicuousness of vocal verbal behavior, we are most likely to attend to it; however, in addition to vocal and non-symbolic forms of communication, there are a variety of written, sign, and pictorial non-vocal verbal behaviors that can stimulate the behavior of a listener (Beukelman & Mirenda, 2005; Bondy & Frost, 2002; Downing, 2005; Skinner, 1957; Vargas, 2008).

**Verbal Operants**

The verbal behavior unit of analysis is the functional relation between a type of responding and the relevant independent variables (i.e., motivating operations, discriminative stimuli, and consequences). To clarify verbal responses by their different functions, Skinner (1957) defined six types of elementary verbal operants: (a) mand, (b) tact, (c) echoic, (d) intraverbal, (e) textual, and (f) transcription. In addition, he also detailed the audience relation (i.e., roles and influences of the listener), secondary verbal operants (i.e., autoclitic behavior and copying a text), the complexity of multiple controlled verbal behavior, thinking, and the effects of the verbal community (Michael, 1982/1984; Skinner; Sundberg & Michael, 2001; Vargas, 2008). In this paper, however, only the primary verbal operants (i.e., mand, tact, echoic, and intraverbal) will be discussed.

**Mands.** The mand is “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant
conditions of deprivation or aversive stimulation” (Skinner, 1957, p. 35–36). The antecedent variable is a state of deprivation or aversive stimulation, and the consequence for a mand operant is a specific reinforcing stimulus. The conditions of deprivation or aversive stimulation may be more currently labeled as motivating operations (for a discussion of motivating operations, see Laraway, Snyderski, Michael, & Poling, 2001; Michael, 1982b; and Michael, 2007b).

Specifically, a mand is when an individual implies, requests, states, demands, etc. what he or she wants and/or needs. Because the mand specifies the reinforcer, it primarily benefits the speaker (Skinner, 1957). For example, a thirsty child may say to her father, “I want a drink of water,” and the father gives the child a glass of water; this statement is a mand. The same would be true if the child said, “May I please have a glass of water?” or even if she said “Water, now!” Where the former is a request and the latter is an order, the controlling variables of deprivation or aversive stimulation (i.e., thirst) and specification of reinforcement (i.e., water) is what identifies this verbal behavior as a mand.

Mands are the first verbal behavior displayed (Bijou & Baer, 1965; Novak, 1996). Infant mands occur in the form of cries and result in the child receiving food, comfort, warmth, attention, and dry diapers. Because the mand specifies its reinforcement and benefits the speaker, it is considered the most important verbal operant (Sundberg & Partington, 1998). Bourret, Vollmer, and Rapp (2004) evaluated an assessment protocol and developed the manding skills of three participants, one with autism spectrum disorder, one with moderate mental retardation, and one with mild mental retardation. In
a multiple baseline design the authors implemented shaping, stimulus fading, and prompt fading strategies to successfully teach manding. First, the researchers conducted a reinforcer assessment and selected appropriate reinforcers. During training, a nonspecific prompt (e.g., “if you want this, ask me for it”) was initially delivered 10 s into each trial. If a full correct response occurred at any time, it resulted in access to reinforcement; other responses resulted in no consequence. Second, the nonspecific prompt was replaced with a model prompt (e.g., “if you want this, say “Ball”) 10 s into each trial. Third, if correct responding did not occur, shaping and prompt fading were implemented. At this stage, the target prompt and criterion for reinforcement within 10 s following the prompt was a “b” sound (i.e., the target prompt was “If you want this, say “b” and the emission of a “b” sound within 10 s of that prompt resulted in reinforcement). Then, the target prompt and reinforcement criterion were faded to “ba.” Finally, the target prompt and reinforcement criterion were faded to “ball.” Although some prompts were presented with brief pauses between components, only utterances emitted smoothly, with no pauses between component sounds, were scored as correct responses. The authors successfully used the pretreatment assessment to determining response topography and the procedures were successful in establishing mands for all three participants.

**Tacts.** The tact is “a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or property of an object or event” (Skinner, 1957, p. 81–82). The antecedent variable is a nonverbal stimulus and the consequence for a tact operant is what Skinner (1957) described as generalized conditioned reinforcement (i.e., praise and approval). A nonverbal stimulus can be as
simple as a baseball or picture of a baseball. Additionally, a nonverbal stimulus can be as complex as a game of baseball (i.e., events); a baseball in flight (i.e., objects in a transitory phase); a baseball on top of a table (i.e., relations between objects), the seams of a baseball (i.e., the properties of objects), or a pitcher throwing a fastball (i.e., properties of actions; Michael, 2007a).

Tacting is not the same as referencing. When referencing a stimulus, one refers to it without actually being in the present of the referenced stimulus. However, in order for tacting to occur, the speaker must be in the presence/property of a nonverbal stimulus (Vargas, 2008). For example, a child in the park with her father and standing in front of the pond, says “Water!” and in response her father says “That’s right.” The presence of the nonverbal stimulus (i.e., the pond) controlled the child’s response. It is important to note that the child did not say water because she wanted water, as in the case of the mand. The child contacted her environment (i.e., the pond) through her verbal behavior, which was consequated with a statement of praise (i.e., generalized conditioned reinforcement) by her father.

Barbera and Kubina (2005) implemented an experiment to evaluate a combination of two transfer procedures to enhance the tact repertoire of a child with autism. After determining targets, instruction consisted of one timed 5 min session per day using a receptive to echoic to tact transfer procedure. Three nonverbal stimuli were displayed and the participant was directed to touch one of the stimuli and then prompted to imitate a model of the name of the nonverbal stimulus. The receptive and echoic procedures were followed by a tact trial where the participant was instructed to verbally label the
nonverbal stimulus. The receptive and echoic antecedents were systematically faded. Using the receptive to echoic to tact transfer procedure, the authors effectively taught 30 tacts.

**Echoics.** Whereas mands are under the control of motivating operations and specific reinforcement, and tacts are under the control of nonverbal stimuli and generalized conditioned reinforcement, some verbal operants are “verbal behavior under the control of verbal behavior” (Skinner, 1957, p. 52). This broad category of verbal behavior would later be simplified, and come to be referred to separately as echoic and intraverbal operants (Michael, 1982a; Vargas, 1986; Vargas, 2008).

In the echoic operant, the antecedent variable is a verbal stimulus (i.e., something a speaker has said) with point-to-point correspondence and formal similarity, and the consequence is generalized conditioned reinforcement (Skinner, 1957). Specifically, an echoic is when a speaker is repeating what someone else has just said. For example, a student saying “ball” after hearing the word spoken by his or her teacher is an echoic response. Point-to-point correspondence has occurred when the response matches the antecedent stimulus; formal similarity has occurred when the antecedent variable and response physically resemble each other and share the same sense mode (i.e., visual, auditory, or tactile; Michael, 2007a; Skinner). Therefore, from the previous example, the stimuli have point-to-point correspondence because the student’s response, “ball,” matches the teacher’s antecedent stimulus, “ball,” and formal similarity exists between the stimulus and response because both were auditory.
The echoic repertoire is important for teaching language to children with developmental disabilities; it plays a critical role in the process of teaching other verbal operants (Sundberg & Partington, 1998). Drash, High, and Tudor (1999) used mand training and direct reinforcement to establish the echoic repertoires of three participants with autism spectrum disorder. Drash et al. used high-rate sounds paired with specific reinforcers with similar vocal topographies (e.g., “ahh” was reinforced with apple, “mmm” was reinforced with an M&M, etc.) By immediately repeating the participants’ sounds and prompting them to imitate prior to receiving the reinforcer, the participants’ verbal responses became multiply controlled as mands and echoics. By fading the specific reinforcer and using generalized conditioned reinforcement for echoic responses, the authors successfully established echoic repertoires.

**Intraverbals.** An intraverbal is the other primary verbal operant categorized as “verbal behavior under the control of verbal behavior” (Skinner, 1957, p. 52). The antecedent variable is a verbal stimulus (i.e., something a speaker has said) and the consequence for the intraverbal operant is generalized conditioned reinforcement (Skinner, 1957; Michael, 1982a; Vargas, 1986; Vargas, 2008). Intraverbal responses do not have point-to-point correspondence with the verbal stimuli that evoke them; therefore, the stimulus and response do not match each other. For example, a person is responding with an intraverbal operant by saying “Moo” when asked “What does a cow say?” or responding “Bill” when asked “What’s your name?” Singing songs, telling jokes, describing activities, and conversational exchanges are just some of the many responses that make up one’s intraverbal repertoire. The intraverbal category is
enormous; in fact, most human verbal interactions are intraverbal exchanges (Vargas, 2008). Goldsmith, LeBlanc, and Sautter (2007) taught children with autism intraverbal operants using a tact to intraverbal transfer procedure. Following assessment and tact training, intraverbal training involved tact prompts, errorless learning, and schedule thinning. Each trial began by presenting picture cards for the training category and the category-specific verbal stimulus (e.g., ‘‘What are some fruits?’’). For initial trials, a tact prompt was presented immediately after the question (i.e., errorless learning). Correct tacts resulted in praise, edible reinforcement, and immediate presentation of the next picture with an expectant look. Incorrect tacts or no response resulted in a correction sequence, which was repeated until the child responded correctly. Subsequent trials included a 3 s delay before the prompt sequence was initiated. If at least one independent response occurred, the delay remained in place for the following trials. If no independent response occurred during the delay, subsequent trials were conducted using the errorless learning procedure followed by a probe trial. Each correct response resulted in praise and an edible with up to a 3 s pause for continued responding until all five members were named. If the child failed to provide all five intraverbals, the remainder of the trial entailed immediate prompts (e.g., picture, echoic) for the remaining category items. After three trials with one or more correct intraverbals, differential reinforcement of independent responses was initiated. Independent responses resulted in praise and edibles while prompted responses resulted in praise only. When four or more independent responses occurred for three consecutive trials, schedule thinning was initiated and resulted in no specific reinforcement with only periodic general praise (e.g., ‘‘nice
work”). Although maintenance and generalization were limited, the procedure was effective at teaching participants to name items associated with pre-selected categories.

**Relevance to Education**

Typically, students with developmental disabilities present with a deficit in language (Beukelman & Mirenda, 2005; Downing, 2005; Sundberg & Partington, 1998). Specifically, these students fail to communicate in an appropriate manner. This failure to interact verbally the way children typically communicate often results in a repertoire of problematic and challenging behaviors. For example, instead of verbally asking for a favorite toy, a child with autism may tantrum until a parent (after multiple guesses) presents the correct object, or instead of asking for help or a break from challenging work, a student with mental retardation may escape by whining and throwing materials (Sundberg & Partington).

Because humans primarily interact with each other via verbal behavior, interventions that teach verbal behavior would be beneficial to the education of students with significant disabilities (Carr & Firth, 2005; Sundberg & Michael, 2001; Sundberg & Partington, 1998). A functional and precise description of language would increase the probability of accurate prediction and enhance educators’ ability to teach efficient communication skills to individuals with significant disabilities. For students with significant disabilities and educators who work with them, this enhanced ability to communicate effectively would add to their ability to control their environment and improve their quality of life (Beukelman & Mirenda, 2005; Downing, 2005; Mancil, 2006). By understanding verbal behavior, we can predict the occurrences of specific
instances and control or produce such behavior by altering the conditions under which it occurs. Different methods for teaching verbal behavior exists (i.e., behavior-based and non-behavior based instruction); however, this paper will focus solely on behavior-based interventions.

**Behavior-Based Interventions**

Behavior-based interventions (BBI) rest on the foundation of scientific principles of behavior (Skinner, 1938/1953) and are used to build meaningful repertoires and reduce challenging behavior. BBI address all areas of deficit by progressively building skills and teaching socially appropriate repertoires to replace and reduce inappropriate behaviors. BBI employ active learning by providing multiple opportunities to respond, and makes use of data to plan and evaluate progress toward skill mastery; the aim is skill maintenance and generalization. These interventions focus on teaching small, measurable units of behavior, from simple responses (e.g., attending) to complex behavior such as a conversation about abstract concepts (e.g., a dialogue on different aspects of Applied Behavior Analysis) by breaking them down into component parts. Components are presented using discrete trials or specific cues or instruction, and responses are followed by consequences. Teaching trials are repeated many times (Cooper, Heron, & Heward, 2007; Green, 1996; Heward, 2009). There are a variety of behavior-based interventions (e.g., Direct Instruction, Incidental Teaching, etc.); however, this paper will focus on two behavior-based language development models: The Lovaas Method and the Verbal Behavior Approach.
The Lovaas Method

The Lovaas Method (LovM) is a behavioral treatment for individuals with developmental disabilities, namely young children with autism. LovM is based on over 40 years of development and results from the treatment-research project with children with developmental disabilities in the Psychology Department at the University of California, Los Angeles (Lovaas, 1993). LovM primarily begins with home-based treatment that typically leads to a combination of home, community, and school-based intervention. The method focuses on providing fully comprehensive individualized instruction by implementing one-on-one (at least initially) training for 35—40 hours per week. This instruction is mainly implemented using discrete trial instruction. Discrete trial instruction consists of four parts: (a) the instructor’s presentation of a antecedent stimulus/question/instruction/cue; (b) the learner’s response; (c) the consequence, positive reinforcement for correct responses and “No” (Smith, Mruzek, Wheat, Hughes, Wynn, 2006; Wynn, 2000; Wynn & Smith, 2003) or some other form of “mild verbal feedback” (Anderson, Taras, & Cannon, 1996 pg. 187) for incorrect or non-responses; and (d) the inter-trial interval, a short pause between the consequence and the next instruction/trial (Anderson, Taras, & Cannon, 1996; Cooper, Heron, & Heward, 2007). It is suggested that for LovM to be implemented effectively, treatment must be delivered by individuals with extensive training in the methods (via one-two day workshops) and under ongoing supervision by professionals with advanced training and experience (Maurice, Green, & Luce, 1996).
Application of LovM is derived from *Teaching Developmentally Disabled Children: The Me Book* (Lovaas et al., 1980). This book is a training manual that details the principles of behavior therapy as they relate to providing instruction to individuals with developmental disabilities. The manual consists of seven units: (a) Basic information; (b) Getting ready to learn; (c) Imitation, matching and early language; (d) Basic self-help skills; (e) Intermediate language; (f) Advanced language; and (g) Expanding your child's world. Five videotapes supplement the manual. In addition, application of LovM centers on Lovaas’s 2003 publication: *Teaching individuals with developmental delays: Basic intervention techniques* and other books have documented the use of the LovM (Maurice, 1993) and served as a manual for parents and professionals (Maurice, 1996). Among other research reports, these texts are the primary sources for the application of intensive behavioral therapy for children with autism.

The LovM has been referred to as the dominant treatment for autism (Time, 2009) as it presents with a great deal of supportive-empirical data in the form of outcome research (e.g., McCeachin, Smith, & Lovaas, 1993) and component investigations (e.g., Gutierrez et al., 2009). In 1987, Lovaas disseminated the results of a longitudinal study of behavior modification treatment for two groups of similarly constituted young children with autism. In this study, the experimental group of 19 participants with autism received 35—40 hours of one-on-one intensive behavior intervention from trained university students. Instruction focused on increasing attending, imitation, independent toy play, cooperative peer play, social skills, and receptive and expressive language skills. In addition, aggressive, stereotypic, and ritualistic behavior and tantrums were addressed.
Participants in comparison group I received a variety of other interventions in addition to 10 hours a week of behavioral intervention. Participants in comparison group II received other non-intensive behavioral treatments. After 6 to 7 years, all participants in each group were re-evaluated and their educational placements with examined. Of the 19 children in the treatment group, 47% successfully completed general education first grade placement and obtained 94–120 scores on IQ tests (i.e., an average gain of 37 IQ points over the course of treatment). In contrast, one only one participant from to two comparison groups successfully completed first grade (i.e., general education setting) and achieved an IQ in the average range. The participants in the original study (Lovaas, 1987), who had achieved normal functioning by the end of first grade, participated in a long-term follow-up study (McEachin, Smith, & Lovaas, 1993). These children were re-evaluated when they were 13-years-old and compared with the children in the minimal treatment comparison group. McEachin and colleagues had IQ tests, adaptive behavior scales, and personality inventories administered to participants in the treatment group, as well as to age-matched typically developing children. Similar evaluations were conducted with children from the comparison groups. Educational placements were also analyzed. Results indicated that the effects of the intensive behavior treatment (Lovaas et al., 1980) had maintained over time. All but one of the former participants continued to succeed in general education classroom settings. Therefore, the proportion, 47%, of intensively treated participants who attained normal functioning in general education classroom remained. In addition, IQ score gains shown at the end of first grade were maintained, and remained on average 30 points higher than those of the comparison groups. Adaptive
behavior scores and personality measures were also significantly higher than those of the comparison groups, whose special education school placements had also remained unchanged (Green, 1996). Although young children with autism have been the dominant target population, other investigations have reported significant success with intensively treated participants in the moderate-to-severe range of mental retardation/intellectual disabilities (e.g., Smith, Eikeseth, Klevstrand, & Lovaas, 1997). The results of these investigations have led to some LovM core beliefs. First, the intervention of choice is fully comprehensive intensive explicit instruction. Second, intervention should begin as early as possible, before the age of five. Third, for children with autism, findings indicate that one-on-one instruction is most beneficial (i.e., compared to group instruction or full inclusion). Finally, intensive instruction should occur throughout most of every day at 35─40 hours per week, for a minimum of 2 years (Green, 1996).

In interventions for children with developmental disabilities, a fundamental question is how to sequence language instruction. For example, should instructors focus on receptive (i.e., listener skills) before expressive language (i.e., verbal operants), or vice versa? One widely held view on this subject is that the “brain and nervous system are biologically programmed to acquire language . . . in a particular sequence . . . [and that this] sequence is listening before speaking” (Asher, 1977, p. 134, italics in original; see also Lenneberg, 1962; Whitehurst, 1977). Consistent with this view of language development, some studies of typically developing children suggest that they master receptive language before expressive skills (see, Dollaghan, 1985; Fraser, Bellugi, & Brown, 1963). For the development of language, LovM suggests that children with
developmental disabilities are like typically developing children in that they both tend to acquire receptive language before demonstrating expressive language skills (Rosenberg & Abbeduto, 1993; Wynn & Smith, 2003). Therefore, programming in LovM centers on the establishment of receptive language skills (i.e., listener skills) as a foundation for the development of expressive language skills (i.e., elementary verbal operants). For example, initial treatment sessions are composed of setting up a structured teaching environment and establishing compliance. In addition, early programming/instruction consists of toy play, non-verbal imitation, matching, receptive labeling, and teaching learners to follow simple one-step instructions (Wynn, 2000).

**Verbal Behavior Approach**

In 1998, Sundberg and Partington published a comprehensive language-training curriculum that provides educators with language training protocols and assessment and progress-monitoring tools that can be used to develop individualized education programs. The curriculum, *Teaching Language to Children with Autism or Other Developmental Disabilities*, focuses on establishing rapport with a student to provide instruction on mands, echoics, tacts, and intraverbals. In addition, instruction is available for motor imitation, matching-to-sample, listener skills (i.e., responding to commands, identifying objects by touching or pointing, etc.), and the ability to identify objects or events by their function, feature, and class. The progress-monitoring tool, *The Assessment of Basic Language and Learning Skills* (ABLLS), allows practitioners to identify students’ current level of performance. Additionally, rather than an annual standardized event, the administration of the ABLLS is an on-going process where language is assessed in a
variety of contexts, under different stimulus conditions, motivational variables, and includes both parent and teacher observations. The information gathered with this assessment tool can be used to develop educational goals and objectives (Sundberg & Michael, 2001; Sundberg & Partington, 1998). Although previous researchers have empirically investigated each of the primary verbal operants, the work of Sundberg and Partington made the behavioral account of language more accessible to parents and practitioners. Therefore, this user-friendly language training protocol is commonly referred to as the Verbal Behavior Approach (Barbera & Rasmussen, 2007).

When developing verbal repertoires, the Verbal Behavior Approach (VBA) does not specify any one form, mode, or medium. However, vocal speech is the primary goal as it has the significant advantage of a large speaking community that can model, prompt, and reinforce vocal words without specialized training. If vocal speech is not an option (or the vocal repertoire develops slowly), sign language is encouraged. In VBA, sign language is preferred over stimulus selection-based systems (i.e., PECS and pointing systems) as sign language is a topography-based language making it conceptually similar to vocal speech. In addition, like vocal speech, sign language is highly transportable and has single stimulus and response relations. Although topography-based systems are preferred, the form of communication depends primarily on what system will most benefit the student; therefore, selection-based systems are recommended if vocal speech and sign language training are unsuccessful (Sundberg & Partington, 1998).

The verbal behavior approach (VBA) is an alternative to other forms of early and intensive behavioral intervention models (Carr & Firth, 2005; Sundberg & Partington,
Although the VBA shares some similarities (e.g., treatment intensity, hierarchically organized curricula, operant training techniques, prompting and prompt fading strategies, discrete trial training, etc.) with other intensive behavioral intervention models, there are some important differences. For example, the verbal behavior approach also employs Natural Environment Training, which promotes generalization by continuing language training in the presence of stimuli and motivational variables that must eventually control and maintain verbal behavior. In addition, whereas other models use a traditional psycholinguistic account of language that is reflected by the use of terms like “expressive” and “receptive” language, the VBA uses a Skinnerian account of language. This Skinnerian approach is used to (a) teach the multiple functions of language (i.e., mand, tact, echoic, intraverbal, etc.) and (b) teach language by using the ultimate controlling variables specific to each function (Carr & Firth, 2005; Sundberg & Michael, 2001; Sundberg & Partington, 1998).

When compared to other models the VBA is not as standardized across clinics and practitioners. This lack of standardization may be a consequence of the fact that the VBA was developed in clinical practice, as opposed to being produced in the experimental research base of a university setting (Carr & Firth, 2005). An internet search for “verbal behavior approach” or “applied verbal behavior” results in a few books and a list of clinics and service providers. A lack of standardization yet wealth of services may result in a research-to-practice gap. Gaps between empirical evidence and applied implementation can result in a failure to be conceptually systematic and produce a “bag of tricks,” instead of clear and concise scientific methodology (Cooper, Heron, &
Heward, 2007). In fact, the position of Carr and Firth (2005) is that although the VBA is conceptually sound only a modest literature base supports it and that no outcome research exists to directly support its widespread application.

Several previous reviews have documented the influence of *Verbal Behavior*. McPherson, Bonem, Green, and Osdone (1984) conducted a citation analysis of studies that cited *Verbal Behavior* published between 1961 and 1980. In 1991, Eshleman quantitatively reviewed five behavioral journals through 1984 and Association for Behavior Analysis conference convention programs (1975 to 1991). Oah and Dickinson (1989) conducted a narrative review of empirical studies with human and animal subjects. In 2006, Sautter and LeBlanc published a review of empirical studies on human verbal behavior published between 1989 and 2004 and examined publication trends with regard to frequency. Previously cited reviews indicated that the overall volume of empirical literature on verbal behavior was limited; however, Sautter and LeBlanc reported a recent increase in studies in the verbal behavior arena. Therefore, the “three fold” increase in empirical support for Skinner’s analysis of verbal behavior suggests a continuation of an increasing publication trend.

Since the 1998 publication of Sundberg and Partington’s language-training curriculum, the VBA as been widespread in applied settings and a diverse range of investigations have examined Skinner’s verbal operants. Since the 1980 publication of Lovaas’s *Teaching Developmentally Disabled Children: The Me Book*, the LovM has been widely implemented, is viewed by the mainstream media as the dominant treatment for autism (Time, 2009), and a variety of investigations have examined the instructional
protocol. Hence, an up to date review of LovM, VBA, and verbal behavior is warranted. Specifically, a review of empirical investigations of the LovM from 1999 to 2009 to determine what has been reported regarding the protocol, and a review of empirical investigations of the VBA and primary verbal operants with participants with developmental disabilities is necessary. Therefore, the function of this paper is three fold; first, to review experimental studies focusing on the LovM; second, to review experimental studies investigating VBA and/or verbal behavior (i.e., empirical investigations of (a) Sundberg and Partington’s (1998) language training protocol and (b) the primary verbal operants); and third, to compare the effects of two behavior-based language development models, LovM and VBA (i.e., Sundberg and Partington’s language-training protocol).
Chapter 2: Literature Review

The purpose of this review is to examine Lovaas Method (LovM) empirical investigations published between 1999 and 2009 to determine what has been reported regarding the protocol. In addition, this review will analyze empirical investigations of the Verbal Behavior Approach (VBA) and primary verbal operants focused studies published between 1999 and 2009 to determine what has been reported regarding the VBA protocol and operant studies.

Search Procedures, The Lovaas Method

Studies were first identified via a computer search. In addition to the terms (a) language; (b) receptive object labels; (c) expressive object labels; (d) mand, mands, and manding; (e) echoic and echoics; (f) tact, tacts, and tacting; and (g) intraverbal and intraverbals, the key words Lovaas, Lovaas Method, Intensive behavior intervention/treatment, and discrete trial training/instruction were searched in educational research databases. The educational research databases searched were (a) Academic Search Complete, (b) Academic Search Premier, (c) Education Research Complete, (d) Educational Resource Information Center [ERIC], (e) PsycCRITIQUES, (f) Psychology & Behavioral Sciences Collection, and (g) PsycINFO 1967–present. In addition to a computer search, a hand search of identified articles was conducted.
Inclusion Criteria. Studies were selected for inclusion based on five criteria. First, the aforementioned terms and/or key words appeared in the title or abstract of the article. Second, the article was published between 1999 and 2009. Third, the study included at least one participant with a developmental disability. Fourth, when describing the treatment procedures, the authors cited Lovaas et al., 1980 and/or Lovaas, 1987. Finally, the study was empirical. That is, the study included clearly defined dependent and independent variables and results were evaluated using a controlled experimental design (i.e., a With-in or Between Subject design).

Exclusion Criteria. Excluded from this review were studies that appeared to implement the Lovaas Method, intensive behavior intervention, or discrete trial training but did not cite Lovaas et al, 1980 and Lovaas, 1987 when describing the treatment procedures. Studies conducted with only typically developing participants were also excluded. In addition, non-experimentally controlled studies (e.g., descriptive studies, correlational studies, etc.) were not included in this review. The restricted search yielded 13 empirical studies, all published between 1999 and 2009.

Participant Characteristics, The Lovaas Method

Tables 2.1, 2.2, 2.3, and 2.4 display participant characteristic data for the Lovaas Method (LovM) overall, outcome and/or comparison, training, and aspects of discrete trial training/teaching/instruction (DTT) studies, respectively.

Table 2.1 displays participant characteristic data for all identified LovM investigations. Overall, the investigations included 297 participants, 217 males (73%) and 36 females (11%). Gender of 44 participants (15%) could not be identified. Participant
median age range was 20–76 months, except for one study having participants with a median age of 21 years. The majority of participants were diagnosed with Autism/Autism Spectrum Disorder (ASD), 206 (69%). Additional diagnoses were Pervasive Developmental Disorder-Not Otherwise Specified, 30 (10%) and Other (e.g., Cerebral Palsy, etc.), 11 (4%); in one study (Randell et al., 2007) the participants of focus did not have a disability. Seven studies reported participants’ IQ; in addition, participant verbal repertoires (prior to implementation of the independent variable) were described as low—12 (92%) and in one study (Randell et al., 2007) the participants of focus were described as high (8%). LovM intervention settings were home, 133 (45%); school, 52 (18%); and clinic, 112 (38%). The focus of the 13 LovM interventions was outcome and/or comparison research, 8 (62%); training of LovM, 2 (15%); and various aspects of discrete trial training/teaching/instruction, 3 (23%).

Outcome and/or Comparison. Table 2.2 displays participant characteristic data for the eight LovM outcome and/or comparison centered investigations. LovM outcome and/or comparison investigations included 221 participants, 156 males (71%) and 21 females (10%), the gender of 44 (20%) could not be identified. Participant median age range was 20–45 months. The majority of participants were diagnosed with ASD, 191 (86%), other participants were diagnose with Pervasive Developmental Disorder-Not Otherwise Specified, 30 (14%). Six studies reported participants’ IQ, and all participant verbal repertoires (prior to implementation of the independent variable) were described as low, 221 (100%). Outcome and/or comparison intervention settings were home, 127 (57%); school, 34 (15%); and clinic, 60 (27%).

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Training. Table 2.3 displays participant characteristic data for the two LovM training focused investigations. These studies centered on parent training and the training of novice tutors. LovM training investigations included 52 participants, 44 males (85%) and 8 females (15%). In one study, the participant median age was 48 months; in the other study, the participant median age was 21 years. Two participants were diagnosed as Other (4%); in one study the participants of focus (undergraduate and graduate students) did not have a disability. None of these studies reported participants’ IQ; two participants’ pre-intervention verbal repertoires were described as low (4%) and other participants were described as high, 50 (96%). All LovM training focused interventions were conducted in clinical settings (100%).

DTT. Table 2.4 displays participant characteristic data for the three investigations centered on aspects of LovM discrete trial training/teaching/instruction (DTT). LovM DTT studies included 24 participants, 17 males (71%) and 7 females (29%). Participant median age range was 47–76 months. The majority of participants were diagnosed with ASD, 15 (63%), other participants were diagnosed as Other, 9 (38%). Only one study reported participants’ IQ, and all participant verbal repertoires (prior to implementation of the independent variable) were described as low (100%). LovM DTT intervention settings were home, 6 (25%), and school, 18 (75%).
<table>
<thead>
<tr>
<th>Citation</th>
<th>n</th>
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<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
<th>S</th>
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<tr>
<td>Ben-Itzchak &amp; Zachor (2007)</td>
<td>29</td>
<td>20 – 32</td>
<td>M: 25</td>
<td>ASD</td>
<td>M: 70.0 (50 – 103)</td>
<td>L</td>
<td>Cl</td>
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<td>Crockett et al. (2007)</td>
<td>2</td>
<td>48</td>
<td>M: 2</td>
<td>ASD + MR (m-s): 1 ASD: 1</td>
<td>NA</td>
<td>L</td>
<td>Cl</td>
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<td>Downs et al. (2007)</td>
<td>12</td>
<td>Tx: 6</td>
<td>M: 49</td>
<td>CP</td>
<td>PreTx: 64.83 (42 – 89)</td>
<td>L</td>
<td>Sch</td>
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<tr>
<td></td>
<td></td>
<td>Com: 6</td>
<td>F: 2</td>
<td>C/Cog/A</td>
<td>PostTx: 67.83 (46 – 102)</td>
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<td></td>
<td></td>
<td>M: 48 (32 – 63)</td>
<td>Com</td>
<td>ASD: 2</td>
<td>Com</td>
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<tr>
<td></td>
<td></td>
<td>M: 3</td>
<td>F: 3</td>
<td>Cog</td>
<td>PreTx: 63.67 (43 – 122)</td>
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<td></td>
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<td></td>
<td></td>
<td>S/A</td>
<td>PostTx: 63.67 (43 – 101)</td>
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<td>3</td>
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<td>M: 2</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Cl</td>
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<tr>
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<td>61</td>
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<td>M: 31</td>
<td>ASD: 24</td>
<td>L</td>
<td>Tx</td>
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<td></td>
<td></td>
<td>Com I: 16</td>
<td>M: 37</td>
<td>- PDD: 5</td>
<td>- PreTx: M = 58.54</td>
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<td></td>
<td></td>
<td>Com II: 16</td>
<td>M: 35</td>
<td>- ASD: 12</td>
<td>- PostTx: M = 89.88</td>
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<td></td>
<td></td>
<td>- Com I</td>
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<td></td>
<td>- ASD: 12</td>
<td>- PreTx: M = 53.69</td>
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<td></td>
<td></td>
<td>- Com II</td>
<td>- PostTx: M = 62.13</td>
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<td></td>
<td></td>
<td>- ASD: 9</td>
<td>- Com II</td>
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<td></td>
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<td>- PDD: 7</td>
<td>- PreTx: M = 59.88</td>
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<td></td>
<td></td>
<td>- PostTx: M = 68.81</td>
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<tr>
<td>Randell et al. (2007)</td>
<td>50</td>
<td>M: 21 yrs</td>
<td>M: 42</td>
<td>None</td>
<td>NA</td>
<td>H</td>
<td>Cl</td>
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<tr>
<td></td>
<td></td>
<td>F: 8</td>
<td></td>
<td>(graduate students)</td>
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Table 2.1. Participant Characteristics of Lovaas Method Studies, Overall
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<th>n</th>
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<td>Reed et al. (2007)</td>
<td>27</td>
<td>Tx</td>
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<td>ASD</td>
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<td>- M: 43</td>
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<td>- F: 0</td>
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<td></td>
<td>Com I</td>
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<tr>
<td></td>
<td></td>
<td>- M: 41</td>
<td></td>
<td></td>
<td>- M: 13</td>
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<td></td>
<td></td>
<td>- F: 0</td>
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<tr>
<td>Remington et al. (2007)</td>
<td>44</td>
<td>30–42</td>
<td>NA</td>
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<td>Tx</td>
<td>L</td>
<td>H</td>
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<td></td>
<td></td>
<td>- Tx: 23</td>
<td></td>
<td></td>
<td>PreTx: 61.43</td>
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<td></td>
<td></td>
<td>- Com: 21</td>
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<td></td>
<td>PostTx: 73.48</td>
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<td>23</td>
<td>24–42</td>
<td>M: 19</td>
<td>ASD</td>
<td>Tx: PreTx: 50.85</td>
<td>L</td>
<td>H</td>
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<tr>
<td></td>
<td></td>
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<td>F: 4</td>
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<td>PostTx: 73.08</td>
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<td></td>
<td></td>
<td>- Com: 10</td>
<td></td>
<td></td>
<td>PreTx: 52.10</td>
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<td></td>
<td></td>
<td></td>
<td>PostTx: 79.60</td>
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<tr>
<td>Smith et al. (2000)</td>
<td>6</td>
<td>35–45</td>
<td>M</td>
<td>ASD</td>
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<td>L</td>
<td>H</td>
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<td>- Tx: 15</td>
<td>- M: 36</td>
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<td>PostTx: 66.49</td>
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<td>PreTx: 50.69</td>
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<td></td>
<td></td>
<td>- M: 36</td>
<td></td>
<td></td>
<td>PostTx: 49.67</td>
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Table 2.1 continued

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<td>Wynn &amp; Smith (2003)</td>
<td>6</td>
<td>47 – 76</td>
<td>M</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>H</td>
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Age displayed in Months
Tx = Treatment group
Com = Comparison group
PreTx = Pre-treatment
PostTx = Post-treatment
ASD = Autism/Autism Spectrum Disorder
MR (m-s) = Moderate – Severe Mental Retardation/Intellectual Disability
PDD = Pervasive Developmental Disorder – Not Otherwise Specified
CP = Cerebral Palsy
Cog = Cognitive Delay
C/Cog = Communication/Cognitive Delay
C/Cog/A = Communication/Cognitive/Adaptive Delay
CD = Cognitive Delay
S/A = Social/Adaptive Delay
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)
S (H / Sch / Cl) = Setting (Home / School / Clinic)
<table>
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<th>VR</th>
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<tr>
<td>Ben-Itzchak &amp; Zachor (2007)</td>
<td>29</td>
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<td>44</td>
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<td></td>
<td></td>
<td>- Tx: 23</td>
<td></td>
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<td>- PreTx: 61.43</td>
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<td>- Com: 21</td>
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Table 2.2. Participant Characteristics of Lovaas Method Outcome and/or Comparison Studies
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<td>Sallows et al.</td>
<td>23</td>
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<td>M: 19</td>
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<td>PostTx: 73.08</td>
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<tr>
<td>Smith et al.</td>
<td>6</td>
<td>35 – 45</td>
<td>M</td>
<td>ASD</td>
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<td>Smith, Groen, &amp; Wynn</td>
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<td></td>
<td></td>
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<td>PreTx: 50.53</td>
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<td></td>
<td></td>
<td>PostTx: 66.49</td>
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Age displayed in Months
Tx = Treatment group
Com = Comparison group
PreTx = Pre-treatment
PostTx = Post-treatment
ASD = Autism/Autism Spectrum Disorder
MR (m-s) = Moderate – Severe Mental Retardation/Intellectual Disability
PDD = Pervasive Developmental Disorder – Not Otherwise Specified
CP = Cerebral Palsy
Cog = Cognitive Delay
C/Cog = Communication/Cognitive Delay
C/Cog/A = Communication/Cognitive/Adaptive Delay
CD = Cognitive Delay
S/A = Social/Adaptive Delay
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)
S (H / Sch / Cl) = Setting (Home / School / Clinic)
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<th>Gender</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
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<tr>
<td>Crockett et al.</td>
<td>2</td>
<td>48</td>
<td>M: 2</td>
<td>ASD + MR (m-s): 1</td>
<td>NA</td>
<td>L</td>
<td>Cl</td>
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<td>(2007)</td>
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<td>ASD: 1</td>
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<tr>
<td>Randell et al.</td>
<td>50</td>
<td></td>
<td>M: 21 yrs</td>
<td>None (graduate students)</td>
<td>NA</td>
<td>H</td>
<td>Cl</td>
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<tr>
<td>(2007)</td>
<td></td>
<td></td>
<td>F: 8</td>
<td>None (graduate students)</td>
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</table>

Age displayed in Months
Tx = Treatment group
Com = Comparison group
PreTx = Pre-treatment
PostTx = Post-treatment
ASD = Autism/Autism Spectrum Disorder
MR (m-s) = Moderate – Severe Mental Retardation/Intellectual Disability
PDD = Pervasive Developmental Disorder – Not Otherwise Specified

CP = Cerebral Palsy
Cog = Cognitive Delay
C/Cog = Communication/Cognitive Delay
C/Cog/A = Communication/Cognitive/Adaptive Delay
CD = Cognitive Delay
S/A = Social/Adaptive Delay
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)
S (H / Sch / Cl) = Setting (Home / School / Clinic)

Table 2.3. Participant Characteristics of Lovaas Method Training Studies
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<th>n</th>
<th>Age</th>
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<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
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<td>Downs et al.</td>
<td>12</td>
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<td>L</td>
<td>Sch</td>
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<td></td>
<td>Com</td>
<td>Com</td>
<td>C/Cog/A</td>
<td>Com</td>
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<td></td>
<td></td>
<td>M: 48 (32 – 63)</td>
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<td>ASD: 2</td>
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<td>PostTx: 63.67 (43 – 101)</td>
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<td>S/A: 2</td>
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<td>Smith et al.</td>
<td>6</td>
<td>M: 61 (38 – 92)</td>
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<td>Wynn &amp; Smith</td>
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<td>NA</td>
<td>L</td>
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<td>(2003)</td>
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<td>Com = Comparison group</td>
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<td>PreTx = Pre-treatment</td>
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<td>PostTx = Post-treatment</td>
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<td>ASD = Autism/Autism Spectrum Disorder</td>
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<td>MR (m-s) = Moderate – Severe Mental Retardation/Intellectual Disability</td>
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<tr>
<td>VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)</td>
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<tr>
<td>S (H / Sch / Cl) = Setting (Home / School / Clinic)</td>
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Table 2.4. Participant Characteristics of Lovaas Method DTT Studies
Tables 2.5, 2.6, 2.7, and 2.8 display intervention characteristic data for Lovaas Method (LovM) overall, outcome and/or comparison, training, and aspects of discrete trial training/teaching/instruction (DTT) studies, respectively.

Table 2.5 displays intervention characteristic data for all identified LovM investigations. Overall, eight of the identified studies (62%) used a between-subjects (i.e., group) design, with the remaining five investigations (38%) implementing some form of within-subject (i.e., single-subject/single-case) design. Inter-observer agreement (IOA) was reported in six studies (46%); seven investigations (54%) did not report IOA. Procedural integrity (INT) was reported in four studies (31%); nine investigations (69%) did not report any INT data.

Outcome and/or Comparison. Table 2.6 displays intervention characteristic data for the eight LovM outcome and/or comparison centered investigations. LovM outcome and/or comparison investigations included six studies (75%) implementing a between-subjects design, with the remaining two investigations (25%) employing some form of within-subject design. IOA was reported in four studies (50%); four investigations (50%) did not report IOA. INT was reported in two studies (25%); six investigations (75%) did not report any INT data.

Training. Table 2.7 displays intervention characteristic data for the two LovM training focused investigations. These studies centered on parent training and the training of novice tutors. In LovM training investigations, one study (75%) implementing a between-subjects design and the other investigation (50%) employed some form of a
within-subject design. IOA was reported in only of the two studies (50%). INT was not reported in either study.

**DTT.** Table 2.8 displays intervention characteristic data for the three investigations centered on aspects of LovM discrete trial training/teaching/instruction (DTT). These studies centered on implementation within a preschool setting, error correction strategies, and generalization. LovM DTT studies included one study (33%) implementing a between-subjects design. The other two investigations (67%) employed some form of within-subject design. IOA was reported in one study (33%); the other two investigations (67%) did not report IOA. INT was reported in two of the three studies (67%) with one investigation (33%) not reporting INT data.
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Ben-Itzhak & Zachor (2007) | ● Outcomes  
● Pre-intervention variables | 1 year of IBI                | Between- Subjects  
- One-way MANOVA with repeated measure  
- Pre - Post | N   | N   | ● Significant progress in all six developmental-behavioral domains  
● Children with higher initial cognitive levels and children with fewer social interaction deficits demonstrated significant acquisition of skills  
● Significant progress in expressive language was associated with the child’s social abilities |
| Crockett et al. (2007)   | ● Parent training  
● Skill acquisition and generalization | ● IPT  
● DTT | Within- Subjects  
- Multiple-baseline | Y   | N   | ● Parent training program was successful  
● Parents demonstrated skill generalization |
| Downs et al. (2007)     | DTT implementation within preschool program | DTT                          | Between- Subjects  
- Mann-Whitney U test | N   | Y   | ● DTT practically and effectively implemented  
● DTT resulted in positive changes in adaptive behavior development and social-emotional functioning |
| Gutierrez et al. (2009) | ● Comparison of DTT procedures  
● Receptive discrimination | DTT  
- No distracter  
- Distracter present | Within-Subjects  
- Alternating treatments | Y   | N   | Mixed results  
● No difference at 1-month follow-up |

Table 2.5. Intervention Characteristics of Lovaas Method Studies, Overall
<table>
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<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Howard et al. (2005) | Comparison of three treatment approaches | • Early IBI  
- 1:1, adult : child ratio  
- 25–40 h per wk  
• Intensive ‘‘eclectic’’ intervention  
- Mix of methods  
- 1:1 or 1:2 ratio  
- 30 h per week  
• Non-intensive intervention programs  
- Mix of methods  
- Small groups  
- 15 h per week | Between- Subjects  
- Multiple Regression | N   | N   | • Early IBI group had highest mean standard scores in all skill domains  
• No significant differences between comparison group mean scores |
| Randell et al. (2007)| Training novice tutors               | Interactive computer simulation software           | Between- Subjects  
- T-test  
- One way ANOVA | N   | N   | Simulation software resulted in significant increases in participants’ procedural and declarative knowledge of DTT |
| Reed et al. (2007)  | • Outcome  
• Comparison   | Home-based intervention  
- High-intensity  
- Low-intensity | Between- Subjects  
- ANOVA | N   | N   | High-intensity intervention produced significantly greater gains than low intensity intervention |
| Remington, et al. (2007) | • Outcome  
• Measure of parent-wellbeing | Early IBI  
- 2 years   | Between- Subjects  
- ANCOVA | Y   | N   | • Significant differences favoring IBI  
• No evidence that intervention created increased problems on measures of parental well-being |
| Sallows et al. (2005) | • Outcomes  
• Comparison | IBI  
- Clinic-directed  
- Parent-directed | Between- Subjects  
- ANCOVA | Y   | Y   | • Outcome was similar for both groups  
• 48% of all children demonstrated rapid learning  
- achieved average post-treatment scores  
- at age 7, were succeeding in general education classrooms |
Table 2.5 continued

<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
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<tr>
<td>Smith et al. (2000)</td>
<td>Parent-directed</td>
<td>Early IBI</td>
<td>Within-Subjects</td>
<td>Y</td>
<td>Y</td>
<td>All participants acquired skills</td>
</tr>
<tr>
<td></td>
<td>intervention</td>
<td>2 – 3 years</td>
<td>Multi</td>
<td></td>
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<td>Few had significant improvement on standardized tests</td>
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<td>Outcome</td>
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<td>Parent-directed intervention was less consistent</td>
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<tr>
<td>Smith, Groen, &amp; Wynn (2000)</td>
<td>Outcomes</td>
<td>Early IBI</td>
<td>Between</td>
<td>N</td>
<td>N</td>
<td>Significant increases in IQ</td>
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<td>Comparison</td>
<td>Intensive treatment</td>
<td>T-test</td>
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<td>Intensive treatment group outperformed the parent training group</td>
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<tr>
<td>Smith et al. (2006)</td>
<td>Error Correction</td>
<td>DT</td>
<td>Within-Subjects</td>
<td>Y</td>
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<tr>
<td>Wynn &amp; Smith (2003)</td>
<td>Generalization</td>
<td>Expressive and receptive training</td>
<td>Within-Subjects</td>
<td>N</td>
<td>N</td>
<td>Cross-modal generalization more evident in expressive first condition</td>
</tr>
<tr>
<td></td>
<td>Cross-modal</td>
<td>on word pairs</td>
<td>Multiple-baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IOA = Inter-observer Agreement  
INT = Procedural Integrity  
IBI = Intensive Behavior Intervention  
DTT = Discrete trial teaching/training  
IPT = Intensive parent training program  
per wk = per week
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Ben-Itzchak & Zachor (2007) | ● Outcomes                                 | 1 year of IBI                     | Between-Subjects                              | N   | N   | ● Significant progress in all six developmental-behavioral domains  
● Children with higher initial cognitive levels and children with fewer social interaction deficits demonstrated significant acquisition of skills  
● Significant progress in expressive language was associated with the child’s social abilities |
|                          | ● Pre-intervention variables               |                                   |                                               |     |     |                                                                                                                                          |
| Gutierrez et al. (2009)  | ● Comparison of DTT procedures            | DTT                               | Within-Subjects                                | Y   | N   | Mixed results  
● No difference at 1-month follow-up                                                                                                      |
|                          | ● Receptive discrimination                |                                   |                                               |     |     |                                                                                                                                          |
| Howard et al. (2005)     | Comparison of three treatment approaches  | ● Early IBI                       | Between-Subjects                              | N   | N   | ● Early IBI group had highest mean standard scores in all skill domains  
● No significant differences between comparison group mean scores                                                                             |
|                          |                                            | ● 1:1, adult : child ratio        | Multiple Regression                           |     |     |                                                                                                                                          |
|                          |                                            | ● 25–40 h per wk                  |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● Intensive “eclectic” intervention |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● Mix of methods                  |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● 1:1 or 1:2 ratio                |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● 30 h per week                   |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● Non-intensive intervention      |                                               |     |     |                                                                                                                                          |
|                          |                                            | programs                          |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● Mix of methods                  |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● Small groups                    |                                               |     |     |                                                                                                                                          |
|                          |                                            | ● 15 h per week                   |                                               |     |     |                                                                                                                                          |
| Reed et al. (2007)       | ● Outcome                                  | Home-based intervention           | Between-Subjects                              | N   | N   | High-intensity intervention produced significantly greater gains than low intensity intervention                                           |
|                          | ● Comparison                               |                                   |                                               |     |     |                                                                                                                                          |
|                          |                                            | - High-intensity                  |                                               |     |     |                                                                                                                                          |
|                          |                                            | - Low-intensity                   |                                               |     |     |                                                                                                                                          |

Table 2.6. Intervention Characteristics of Lovaas Method Outcome and/or Comparison Studies
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remington et al. (2007)</td>
<td>Outcome, Parent-wellbeing</td>
<td>Early IBI - 2 years</td>
<td>Between-Subjects ANCOVA</td>
<td>Y</td>
<td>N</td>
<td>• Significant differences favoring IBI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• No evidence that intervention created increased problems on measures of parental well-being</td>
</tr>
<tr>
<td>Sallows et al. (2005)</td>
<td>Outcomes, Comparison</td>
<td>IBI - Clinic-directed - Parent-directed</td>
<td>Between-Subjects ANCOVA</td>
<td>Y</td>
<td>Y</td>
<td>• Outcome was similar for both groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 48% of all children demonstrated rapid learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• achieved average post-treatment scores</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• at age 7, were succeeding in general education classrooms</td>
</tr>
<tr>
<td>Smith et al. (2000)</td>
<td>Parent-directed intervention, Outcome</td>
<td>Early IBI - 2 – 3 years</td>
<td>Within-Subjects Multiple-baseline</td>
<td>Y</td>
<td>Y</td>
<td>• All participants acquired skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Few had significant improvement on standardized tests</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Parent-directed intervention was less consistent</td>
</tr>
<tr>
<td>Smith, Groen, &amp; Wynn (2000)</td>
<td>Outcomes, Comparison</td>
<td>Early IBI - Intensive treatment - Parent training</td>
<td>Between-Subjects T-test</td>
<td>N</td>
<td>N</td>
<td>• Significant increases in IQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Intensive treatment group outperformed the parent training group</td>
</tr>
</tbody>
</table>

IOA = Inter-observer Agreement  
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per wk = per week
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Crockett et al. (2007) | ● Parent training  
● Skill acquisition  
and generalization | ● IPT  
● DTT | Within-Subjects  
- Multiple-baseline | Y   | N   | ● Parent training program was successful  
● Parents demonstrated skill generalization |
| Randell et al. (2007) | Training novice tutors | Interactive computer simulation software | Between-Subjects  
- T-test  
- One way ANOVA | N   | N   | Simulation software resulted in significant increases in participants’ procedural and declarative knowledge of DTT |

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DTT = Discrete trial teaching/training  
IPT = Intensive parent training program  
per wk = per week

Table 2.7. Intervention Characteristics of Lovaas Method Training Studies
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Downs et al. (2007) | DTT implementation within preschool program | DTT          | Between- Subjects - Mann-Whitney U test | N   | Y   | • DTT practically and effectively implemented  
• DTT resulted in positive changes in adaptive behavior development and social-emotional functioning |
| Smith et al. (2006) | Error Correction       | DTT          | Within-Subjects - Alternating treatments | Y   | Y   | Mixed results                                                             |
| Wynn & Smith (2003) | Generalization Cross-modal | Expressive and receptive training on word pairs | Within-Subjects - Multiple-baseline | N   | N   | Cross-modal generalization more evident in expressive first condition     |

IOA = Inter-observer Agreement  
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Table 2.8. Intervention Characteristics of Lovaas Method DTT Studies
Overview of studies

Outcomes and/or Comparison. A major theme of the eight Lovaas Method (LovM) outcome and/or comparison centered investigations were the effects of 2 to 3 years of LovM and its impact on change in participant IQ, adaptive behavior, and other skill domains. For example, Remington, and colleagues (2007) implemented home-based early intensive behavioral intervention with 23 preschool children with autism and compared them to group (n = 21) of preschool children receiving a variety of non-intensive interventions (i.e., speech therapy, dietary, prescription medication, vitamin, and homeopathic interventions). Although the groups did not differ on baseline assessments, after 2 years the group receiving intensive behavioral intervention demonstrated significant increases on measures of intelligence, language, daily living skills, positive social behavior, and a statistical measure of best outcome for individual children. In addition, parental well-being was assessed in the treatment group and results produced no evidence that behavioral intervention created increased problems for families of children receiving it.

Another focus of outcome and/or comparison centered investigations was the interaction between pre-intervention variables and outcome, and comparison of treatment approaches (e.g., degree of intensity). For example, Ben-Itzchak and Zachor (2007) assessed the relation between pre-intervention variables (i.e., cognition, socialization, and communication) and outcome in 25 young children with autism receiving intensive behavioral intervention. Six developmental-behavioral domains including, imitation, receptive language, expressive language, nonverbal communication skills, play skills, and
stereotyped behaviors were assessed pre- and post-1 year of intervention. Significant progress was reported in all six developmental-behavioral domains after 1 year of intervention; however, children with higher initial cognitive levels and children with fewer deficits social interaction skills showed better acquisition of skills in receptive and expressive language, and play skills. In addition, Reed, Osborne, and Corness (2007) investigated the effectiveness of high-intensive (mean 30 hr/week) vs. low-intensive (mean 12 hr/week) home-based early behavioral intervention for children with autism spectrum disorders. High-intensity behavioral intervention produced significantly greater gains than low-intensity intervention on measures of severity of autism and intellectual, educational, and adaptive behavioral functioning.

Training. The major theme of LovM training focused investigations was the instructor skill development of parents and novice trainers. For example, Randell, Hall, Bizo, and Remington (2007) investigated the development of an interactive computer simulation software that presents a realistic virtual child with whom instructors/tutors of children with autism can learn and practice DTT techniques. Participants receiving simulation software training demonstrated significantly greater procedural and declarative knowledge of DTT than subjects in the control group did.

DTT. The major theme of the three LovM discrete trial training/teaching/instruction (DTT) centered investigations was the practicality and efficiency of DTT procedures. For example, Smith, Mruzek, Wheat, and Hughes (2006) examined three error correction procedures (error statement (saying 'no'), modeling the correct response, and No Feedback) for discrete trial discrimination training. Six children
with autism (age 3–7 years) were taught to match words to pictures with each of the three error correction procedures, and the number of trials to mastery were compared across conditions. Two participants acquired skills more quickly with an error correction procedure than with no feedback, but showed no difference between error correction procedures; one did best with error statement; and one did best with modeling. The results of the Smith et al. study indicate that the choice of error correction procedure can have a large effect on rate of skill acquisition but that the optimal procedure may vary across individuals. Wynn and Smith (2003) examine generalization between expressive and receptive language in six boys with autism. Participants received training on word pairs (e.g. hot/cold). Half the pairs were taught expressively and then receptively; the other half were taught in the reverse order. Overall, participants in the 'expressive first' condition demonstrated cross-modal generalization more often than the 'receptive first' condition. However, one child displayed the opposite pattern, and three other children's patterns varied across training stimuli.

*Search Procedures, Verbal Behavior Approach*

Studies were first identified via computer search. In addition to the terms (a) mand, mands, and manding; (b) echoic and echoics; (c) tact, tacts, and tacting; and (d) intraverbal and intraverbals, the key words verbal behavior, verbal behavior approach, applied verbal behavior, and verbal behavior analysis were searched in educational research databases (i.e., *Academic Search Complete, Academic Search Premier*, *Education Research Complete, Educational Resource Information Center [ERIC]*, *PsycCRITIQUES, Psychology & Behavioral Sciences Collection*, and *PsycINFO*)
In addition to a computer search, a hand search of identified articles was conducted.

**Inclusion Criteria.** Studies were selected based on four criteria. First, the aforementioned terms and/or key words appeared in the title or abstract of the article. Second, the articles were published between 1999 and 2009. Third, study participants included at least one participant with a developmental disability. Finally, the study was empirical. That is, the study included clearly defined dependent and independent variables and results were evaluated using a controlled experimental design (i.e., a Within or Between Subject design).

**Exclusion Criteria.** Excluded from the search were studies pertaining to non-verbal operants (i.e., duplces, matching-to-sample, and listener skills). Studies conducted with typical developing participants were also excluded. In addition, non-experimentally controlled studies (e.g., descriptive studies, correlational studies, etc.) were not included in this review. The restricted search yielded 39 empirical studies, all published between 1999 and 2009. Although, all studies identified examined one or more of the verbal operants and used one or more procedural recommendations suggested in Sundberg and Partington’s (1998) language training curriculum, this review did not identify any studies that have investigated Sundberg and Partington’s language training protocol.

**Participant Characteristics, Verbal Behavior Approach**

Tables 2.9, 2.10, 2.11, and 2.12 display participant characteristic data for mand, echoic, tact, and intraverbal operants, respectively. The focus of the 39 interventions was
Mand, 17 (44%); tact, 7 (18%); echoic, 10 (26%); and intraverbal, 5 (13%), operant investigations. Overall, the investigations included 116 participants.

**Mand Studies.** Mand operant investigations included 55 participants, 31 males (56%) and 18 females (33%). Participant age median was 19 (range, 1 to 58). The majority of participants were diagnosed with Autism Spectrum Disorder (ASD), 38 (69%). Additional diagnoses were Mental Retardation-Mild (MR-Mild), 2 (4%); Mental Retardation-Moderate (MR-Mod), 3 (5%); Mental Retardation-Server (MR-Ser), 14 (25%); Developmental Delays (DD), 3 (5%); and Other (e.g., Down Syndrome, etc.), 8 (15%). Only 10 studies reported participants’ IQ; however, participant verbal repertoires, prior to implementation of the independent variable, were described as low, 41 (75%); mid-level, 9 (16%); and high, 5 (9%). Mand intervention settings were school, 10 (59%); home, 4 (23%); and clinic, 4 (24%).

**Tact Studies.** Tact operant investigations included 22 participants, 17 males (77%) and 5 females (23%). Participant age median was 7 (range, 3 to 17). The majority of participants were diagnosed with ASD, 38 (69%); other participant diagnoses were DD, 6 (27%), and Other, 5 (23%). Only one study reported participants’ IQ; however, participants’ pre-intervention verbal repertoires were described as low, 10 (45%) and high, 12 (55%). Tact intervention settings were school, 4 (57%); home, 2 (29%), and clinic, 2 (29%).

**Echoic Studies.** Echoic operant investigations included 27 participants, 15 males (56%) and 7 females (26%). However, the gender of five participants was not provided. Participant age median was 3 (range, 1 to 8). Participants were diagnosed with ASD, 22
(81%), and DD, 5 (19%). None of the studies reported participants’ IQ; however, participants’ pre-intervention verbal repertoires were described as low, 24 (89%), mid-level, 3 (11%), and none were identified a high. Echoic intervention settings were school, 6 (60%), home, 4 (40%), or clinical setting, 2 (20%).

**Intraverbal Studies.** Intraverbal operant investigations included 12 participants, 11 males (92%) and 1 female (8%). Participant age median was 5 (range, 4 to 8). Participants were diagnosed with ASD, 4 (33%); MR-Mild, 1 (8%); and Other, 7 (58%). Only one study reported participants’ IQ; however, all participant verbal repertoires, prior to investigation, were described as high. Intraverbal intervention settings school, 4 (80%), and clinic, 1 (20%).
<table>
<thead>
<tr>
<th>Citation</th>
<th>n</th>
<th>Age</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bourret, Vollmer, &amp; Rapp, 2004</td>
<td>3</td>
<td>M: 13 (6 – 18)</td>
<td>M</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MR – Mod</td>
<td></td>
<td></td>
<td>Sch = 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MR – Mild</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buckley &amp; Newchok (2005)</td>
<td>1</td>
<td>7</td>
<td>M</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Sch</td>
</tr>
<tr>
<td>Murphy, Barnes-Holmes, &amp; Barnes-Holmes (2005)</td>
<td>7</td>
<td>M: 7 (5 – 9)</td>
<td>M: 4 F: 3</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Sch</td>
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</table>

Table 2.9. Participant Characteristics of Mand Operant Focused Interventions
### Table 2.9 continued

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<th>IQ</th>
<th>VR</th>
<th>S</th>
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<tr>
<td>Yoon &amp; Feliciano (2007)</td>
<td>6</td>
<td>(2 – 5)</td>
<td>NA</td>
<td>“Educational disabilities”</td>
<td>NA</td>
<td>H: 2</td>
<td>Sch</td>
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<td>M: 2</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>L: 2</td>
<td></td>
</tr>
</tbody>
</table>

Age displayed in Years  
ASD = Autism/Autism Spectrum Disorder  
MR – Mod = Mental Retardation/Intellectual Disability - Moderate  
MR – Ser = Mental Retardation/Intellectual Disability - Severe  
PDD = Pervasive Developmental Disorder – Not Otherwise Specified  
DD = Developmental delay  
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)  
S (H / Sch / Cl) = Setting (Home / School / Clinic)
<table>
<thead>
<tr>
<th>Citation</th>
<th>n</th>
<th>Age</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>VR (L / M / H)</th>
<th>S (H / Sch / Cl)</th>
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<tr>
<td></td>
<td></td>
<td>F: 2</td>
<td></td>
<td>Typical : 2</td>
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<tr>
<td>Barbera &amp; Kubina (2005)</td>
<td>1</td>
<td>7</td>
<td>M</td>
<td>ASD: 63</td>
<td>NA</td>
<td>H</td>
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<tr>
<td>Pistoljevic &amp; Greer (2006)</td>
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<td>M: 3 (3 – 4)</td>
<td>M: 1</td>
<td>ASD: 2</td>
<td>NA</td>
<td>H</td>
<td>Sch: 1</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PDD: 1</td>
<td></td>
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</tr>
<tr>
<td>Schauffler &amp; Greer (2006)</td>
<td>2</td>
<td>13</td>
<td>M: 1</td>
<td>EBD: NA</td>
<td></td>
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<tr>
<td>Williams, Carnerero, &amp; Pérez-González</td>
<td>6</td>
<td>M: 9 (7 – 10)</td>
<td>M: 5</td>
<td>ASD: NA</td>
<td></td>
<td>H</td>
<td>Sch: 1</td>
</tr>
<tr>
<td>(2006)</td>
<td></td>
<td></td>
<td>F: 1</td>
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</tr>
</tbody>
</table>

Age displayed in Years  
ASD = Autism/Autism Spectrum Disorder  
EBD = Emotional Behavior Disorder  
DD = Developmental delay  
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)  
S (H / Sch / Cl) = Setting (Home / School / Clinic)

Table 2.10. Participant Characteristics of Tact Operant Focused Interventions
<table>
<thead>
<tr>
<th>Citation</th>
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<th>Age</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
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<td>Carroll &amp; Klatt (2008)</td>
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<td>&lt; 2</td>
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<td>M: 1</td>
<td>H</td>
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<td></td>
<td></td>
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<td>F: 1</td>
<td></td>
<td></td>
<td>L: 1</td>
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<td>Drash, High, &amp; Tudor</td>
<td>3</td>
<td>2 (2 – 3)</td>
<td>M</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Cl</td>
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<td>(1999)</td>
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<td>(2 – 3)</td>
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<tr>
<td>Esch, Carr, &amp; Michael</td>
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<td>M: 7 (6 – 8)</td>
<td>M: 1</td>
<td>ASD</td>
<td>NA</td>
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<td>Sch</td>
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<tr>
<td>(2005)</td>
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<td>(6 – 8)</td>
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<td>Miguel, Carr, &amp; Michael</td>
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<td>M</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Sch</td>
</tr>
<tr>
<td>(2001)</td>
<td></td>
<td>(3 – 5)</td>
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<td>Normand &amp; Knoll (2006)</td>
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<td>M</td>
<td>ASD</td>
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<td>Ross &amp; Greer (2003)</td>
<td>5</td>
<td>M: 6 (5 – 7)</td>
<td>NA</td>
<td>ASD</td>
<td>NA</td>
<td>L</td>
<td>Sch</td>
</tr>
<tr>
<td>Stock, Schulze, &amp; Mirenda</td>
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<td>M: 3 (2 – 4)</td>
<td>M: 1</td>
<td>ASD</td>
<td>NA</td>
<td>L: 1</td>
<td>H</td>
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<tr>
<td>(2008)</td>
<td></td>
<td>(2 – 4)</td>
<td>F: 2</td>
<td></td>
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<td>M: 2</td>
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<tr>
<td>(2007)</td>
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<td>(3 – 5)</td>
<td></td>
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<td>Ward, Osnes, &amp; Partington</td>
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<td>Cl</td>
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<tr>
<td>(2007)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoon &amp; Bennett (2000)</td>
<td>3</td>
<td>M: 3 (3 – 4)</td>
<td>M</td>
<td>DD</td>
<td>NA</td>
<td>L</td>
<td>Sch</td>
</tr>
<tr>
<td>(2000)</td>
<td></td>
<td>(3 – 4)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Age displayed in Years  
ASD = Autism/Autism Spectrum Disorder  
DD = Developmental delay  
VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)  
S (H / Sch / Cl) = Setting (Home / School / Clinic)

Table 2.11. Participant Characteristics of Echoic Operant Focused Interventions
<table>
<thead>
<tr>
<th>Citation</th>
<th>n</th>
<th>Age</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>VR</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingvarsson, Tiger, Hanley, &amp; Stephenson (2007)</td>
<td>2</td>
<td>5</td>
<td>M</td>
<td>MR – Mild</td>
<td>NA</td>
<td>H</td>
<td>Sch</td>
</tr>
<tr>
<td>Finkel &amp; Williams (2001)</td>
<td>1</td>
<td>6</td>
<td>Male</td>
<td>ASD</td>
<td>NA</td>
<td>H</td>
<td>Sch</td>
</tr>
</tbody>
</table>

**Age displayed in Years**

**ASD = Autism/Autism Spectrum Disorder**

**MR – Mild = Mental Retardation/Intellectual Disability - Mild**

**LD = Learning Disability**

**PDD = Pervasive Developmental Disorder – Not Otherwise Specified**

**VR (L / M / H) = Verbal repertoire (Low-level / Mid-level / High-level)**

**S (H / Sch / Cl) = Setting (Home / School / Clinic)**

Table 2.12. Participant Characteristics of Intraverbal Operant Focused Interventions
Intervention Characteristics, Verbal Behavior Approach

Tables 2.13, 2.14, 2.15, and 2.16 display intervention characteristic data for mand, echoic, tact, and intraverbal operants, respectively. None of the identified studies used a group or between subjects design. Most mand investigations evaluated the functional relation between independent and dependent variables with some form of multiple baseline design (i.e., multiple probe, delayed multiple baseline, multiple baseline with a reversal design, etc.), 9 (53%). Other implemented designs were a reversal, 5 (29%), and alternating treatment, 3 (18%). Most echoic investigations implemented some form of multiple baseline design, 8 (80%), with reversal and alternating treatment design each employed once (10%). Most tact investigations implemented some form of multiple baseline design, 5 (71%), with reversal and alternating treatment design each employed once (10%). All intraverbal focused interventions implemented some form of multiple baseline design.
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bourret, Vollmer, &amp; Rapp, 2004</td>
<td>Assessment &amp; Skill acquisition</td>
<td>Shaping, stimulus fading, &amp; prompt fading</td>
<td>Within- Subjects Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>Pretreatment assessment was effective at determining response topography and procedures were successful in establishing mands</td>
</tr>
<tr>
<td>Buckley &amp; Newchok, 2005</td>
<td>High vs. low effort</td>
<td>Low effort mand training followed by FCT</td>
<td>Within- Subjects Reversal</td>
<td>Y</td>
<td>N</td>
<td>High effort mand did not compete with a FR3 schedule for aggression</td>
</tr>
<tr>
<td>Chambers &amp; Rehfeldt, 2003</td>
<td>PECS vs. Sign</td>
<td>Training with PECS and Sign</td>
<td>Within- Subjects Alternating treatments</td>
<td>Y</td>
<td>N</td>
<td>Both PECS and sign were effective in establishing mand skills PECS required less training and resulted in better generalization</td>
</tr>
<tr>
<td>Finkel, Weber, &amp; Derby, 2004</td>
<td>Braille Communication Exchange System (BECS) for vocal mands</td>
<td>Direct instruction for BEC</td>
<td>Within- Subjects Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>Effective in increasing communication exchanges</td>
</tr>
<tr>
<td>Halvey &amp; Rehfeldt, 2005</td>
<td>Derived mands</td>
<td>Conditional discrimination training</td>
<td>Within- Subjects Multiple probe</td>
<td>Y</td>
<td>N</td>
<td>Effective in establishing derived mands</td>
</tr>
<tr>
<td>Hernandez, Hanley, Ingvarsson, &amp; Tiger, 2007</td>
<td>Generalization</td>
<td>Differential reinforcement of single and framed mands forms</td>
<td>Within- Subjects Multiple baseline with Reversal</td>
<td>Y</td>
<td>N</td>
<td>Effective in establishing other framed mands</td>
</tr>
<tr>
<td>Pellecchia &amp; Hineline, 2007</td>
<td>Generalization to peers</td>
<td>Direct instruction</td>
<td>Within- Subjects Reversal</td>
<td>Y</td>
<td>N</td>
<td>• Manding transferred from instructor to parents without direct instruction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Transfer to sibling or peers required explicit training</td>
</tr>
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</table>

Table 2.13. Intervention Characteristics of Mand Operant Focused Interventions
<table>
<thead>
<tr>
<th>Citation</th>
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<th>Design</th>
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<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy, Barnes-Holmes, &amp; Barnes-Holmes (2005)</td>
<td>Generalization</td>
<td>Conditional discrimination training</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>Following conditional discrimination training derived mands and reinforcer functions were established</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple Exemplar Instruction</td>
<td>- Reversal</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Nuzzolo-Gomez &amp; Greer (2004)</td>
<td>Generalization</td>
<td>Multiple exemplar Instruction</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>Effective at establishing untaught mands or tacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple probe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehfeldt &amp; Root (2005)</td>
<td>Generalization</td>
<td>Relational &amp; conditional discrimination training</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>Effective at establishing derived mands</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple probe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosales &amp; Rehfeldt (2007)</td>
<td>Generalization</td>
<td>• Contrived T-CEO</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>Effective in establishing derived mands</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Conditional discrimination training</td>
<td>- Multiple probe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidener, Shabani, Carr, &amp; Roland (2006)</td>
<td>Maintenance</td>
<td>Signaled delayed-to-reinforcement vs. multiple schedules</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>Y</td>
<td>Multiple schedules with 270-s extinction and 30-s reinforcement components was effective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple treatment reversal</td>
<td></td>
<td></td>
<td>Signaled delay-to-reinforcement at 270-s delay was ineffective</td>
</tr>
<tr>
<td>Taylor, Hoch, Potter, Rodriguez, Spinnato, &amp; Kalaigian (2005)</td>
<td>EO’s and generalization to peers</td>
<td>Manipulation of EO</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>When EO was absent, no interactions occurred; when EO was present, participants manded to peers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Reversal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tincani (2004)</td>
<td>Generalization</td>
<td>Training with PECS and Sign</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>Y</td>
<td>Sign language produced a higher percentage of independent mands for one participant, PECS training resulted in a higher percentage of independent mands for the other participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Alternating treatments</td>
<td></td>
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</tr>
<tr>
<td>Wallace, Iwata, &amp; Hanley (2006)</td>
<td>Generalization</td>
<td>Tact training</td>
<td>Within- Subjects</td>
<td>Y</td>
<td>N</td>
<td>Participants manded for highly preferred item over non-preferred item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple baseline</td>
<td></td>
<td></td>
<td>Tact to mand transfer conditions demonstrated</td>
</tr>
</tbody>
</table>

Continued
Table 2.13 continued

<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoon &amp; Feliciano</td>
<td>Skill acquisition &amp; intervention effectiveness</td>
<td>Stimulus-stimulus pairing Direct instruction</td>
<td>Within- Subjects - Reversal</td>
<td>Y</td>
<td>N</td>
<td>Effective for participants high rates of vocal play and low verbal repertoires, ineffective for participants with high verbal repertoires and low vocal play</td>
</tr>
<tr>
<td>(2007)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ziomek &amp; Rehfeldt</td>
<td>PECS vs. Sign</td>
<td>Direct instruction of PECS and Sign</td>
<td>Within- Subjects - Alternating treatments</td>
<td>Y</td>
<td>N</td>
<td>PECS required less training time and fewer learning trials</td>
</tr>
<tr>
<td>(2008)</td>
<td>- Amount of training time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Total number of trial blocks</td>
<td></td>
<td></td>
<td></td>
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</table>

IOA = Inter-observer Agreement  
INT = Procedural Integrity
<table>
<thead>
<tr>
<th>Citation</th>
<th>Focus</th>
<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arntzen &amp; Almas (2002)</td>
<td>Skill acquisition</td>
<td>Mand-tact training vs. Tact only training</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>Y</td>
<td>The combined operant training was effective at establishing mands and tacts, and mand-tact training resulted in faster acquisition of tacts</td>
</tr>
<tr>
<td>Barbera &amp; Kubina (2005)</td>
<td>Skill acquisition</td>
<td>Transfer of stimulus control</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>Effective at teaching 30 tacts</td>
</tr>
<tr>
<td>Delgado &amp; Oblak (2007)</td>
<td>Generalization of pure operants</td>
<td>Intensive tact instruction</td>
<td>Within- Subjects - Delayed Multiple probe</td>
<td>Y</td>
<td>N</td>
<td>Effective for pure tacts; marginal for pure mands</td>
</tr>
<tr>
<td>Pistoljevic &amp; Greer (2006)</td>
<td>Pure operants, Generalization</td>
<td>Daily intensive tact instruction</td>
<td>Within- Subjects - Delayed Multiple probe</td>
<td>Y</td>
<td>Y</td>
<td>Effective at establishing tacts and mands in non-instructional settings</td>
</tr>
<tr>
<td>Schauffler &amp; Greer (2006)</td>
<td>Appropriate tacts and conversational units</td>
<td>Intensive tact instruction</td>
<td>Within- Subjects - Delayed Multiple baseline</td>
<td>Y</td>
<td>Y</td>
<td>Effective at increasing audience-accurate tacts and conversational units</td>
</tr>
<tr>
<td>Sundberg, Endicott, &amp; Eigenheer (2000)</td>
<td>Pure operant with Sign</td>
<td>Verbal prompts (“What is that?”) vs. Intraverbal (“Sign [spoken word]”) prompts</td>
<td>Within- Subjects - Alternating treatments w/ reversal</td>
<td>Y</td>
<td>N</td>
<td>Intraverbal prompts were effective at establishing non-imitative verbal response One participant demonstrated pure tacts</td>
</tr>
<tr>
<td>Williams, Carnerero, &amp; Pérez-González (2006)</td>
<td>Pure operant</td>
<td>Echoic prompts &amp; prompt fading</td>
<td>Within- Subjects - Reversal</td>
<td>Y</td>
<td>N</td>
<td>Effective after learning to tact other actions with and without verbal antecedents</td>
</tr>
</tbody>
</table>

IOA = Inter-observer Agreement  
INT = Procedural Integrity

Table 2.14. Intervention Characteristics of Tact Operant Focused Interventions
<table>
<thead>
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<th>Citation</th>
<th>Focus</th>
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<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carroll &amp; Klatt (2008)</td>
<td>Skill acquisition</td>
<td>• Stimulus-stimulus pairing</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>Y</td>
<td>Effective for one participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Direct reinforcement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drash, High, &amp; Tudor (1999)</td>
<td>Skill acquisition</td>
<td>Mand training</td>
<td>Within- Subjects - Reversal</td>
<td>N</td>
<td>N</td>
<td>Effective at establishing echoic and tact repertoires</td>
</tr>
<tr>
<td>Esch, Carr, &amp; Michael (2005)</td>
<td>Skill acquisition</td>
<td>• Stimulus-stimulus pairing</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>No increase in target sounds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Direct reinforcement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shaping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miguel, Carr, &amp; Michael (2001)</td>
<td>Automatic reinforcement</td>
<td>Stimulus- stimulus pairing</td>
<td>Within- Subjects - Multiple baseline w/ reversal</td>
<td>Y</td>
<td>Y</td>
<td>Effective for one participant, partially effective for a second participant, and no effect for the third participant</td>
</tr>
<tr>
<td>Normand &amp; Knoll (2006)</td>
<td>Automatic reinforcement</td>
<td>Stimulus- stimulus pairing</td>
<td>Within- Subjects - Multiple baseline w/ reversal</td>
<td>Y</td>
<td>N</td>
<td>No increase in target sounds</td>
</tr>
<tr>
<td>Ross &amp; Greer (2003)</td>
<td>Skill acquisition</td>
<td>• Generalized motor imitation</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>Effective at increasing imitative vocal speech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mand training</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock, Schulze, &amp; Mirenda (2008)</td>
<td>Skill acquisition</td>
<td>Comparison of stimulus-stimulus training, echoic training, and control</td>
<td>Within- Subjects - Alternative treatments</td>
<td>Y</td>
<td>Y</td>
<td>No effect for 2 of the 3 participants, an immediate but temporary increase in target sound for 1 participant</td>
</tr>
</tbody>
</table>

Table 2.15. Intervention Characteristics of Echoic Operant Focused Interventions
Table 2.15 continued

<table>
<thead>
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<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsiouri &amp; Greer (2007)</td>
<td>Skill acquisition</td>
<td>Rapid motor imitation</td>
<td>Within- Subjects - Multiple baseline w/ reversal</td>
<td>Y</td>
<td>N</td>
<td>Effective at establishing echoics and independent mands and tacts</td>
</tr>
<tr>
<td>Ward, Osnes, &amp; Partington (2007)</td>
<td>Skill acquisition</td>
<td>Pairing procedure &amp; socially mediated reinforcement</td>
<td>Within- Subjects - Multiple probe</td>
<td>Y</td>
<td>N</td>
<td>Effective at increasing rates of phoneme vocalizations</td>
</tr>
<tr>
<td>Yoon &amp; Bennett (2000)</td>
<td>Skill acquisition</td>
<td>Stimulus- stimulus pairing vs. direct reinforcement (echoic training)</td>
<td>Within- Subjects - Multiple baseline</td>
<td>Y</td>
<td>N</td>
<td>Pairing procedure was shown to be more effective than echoic training</td>
</tr>
</tbody>
</table>

IOA = Inter-observer Agreement  
INT = Procedural Integrity
<table>
<thead>
<tr>
<th>Citation</th>
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<th>Intervention</th>
<th>Design</th>
<th>IOA</th>
<th>INT</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingvarsson, Tiger, Hanley, &amp; Stephenson (2007)</td>
<td>“I don’t know” (IDK) &amp; “I don’t know, please tell me” (IDKPTM) responding</td>
<td>Echoic prompting</td>
<td>Within-Subjects</td>
<td>Y</td>
<td>N</td>
<td>Both responses generalized across questions and teachers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple baseline</td>
<td></td>
<td></td>
<td>• For 3 participants, IDK led to undesirable generalization to known questions</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• IDKPTM, with the addition of a restricted reinforcement contingency, established correct responding to unknown questions</td>
</tr>
<tr>
<td>Finkel &amp; Williams (2001)</td>
<td>Full sentence responding</td>
<td>Textual and echoic prompts</td>
<td>Within-Subjects</td>
<td>Y</td>
<td>N</td>
<td>Both formats were effective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goldsmith, LeBlanc, &amp; Sautter (2007)</td>
<td>Skill acquisition</td>
<td>Transfer of stimulus control</td>
<td>Within-Subjects</td>
<td>Y</td>
<td>Y</td>
<td>Effective for naming items associated with pre-selected categories</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Errorless learning</td>
<td>- Multiple probe</td>
<td></td>
<td></td>
<td>• Limited maintenance and generalization</td>
</tr>
<tr>
<td>Greer, Yaun, &amp; Gautreaux (2005)</td>
<td>Spelling</td>
<td>Multiple exemplar instruction</td>
<td>Within-Subjects</td>
<td>Y</td>
<td>Y</td>
<td>Effective at establishing novel dictation and intraverbal responses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Delayed multiple probe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Multiple baseline</td>
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</tbody>
</table>

IOA = Inter-observer Agreement  
INT = Procedural Integrity

Table 2.16. Intervention Characteristics of Intraverbal Operant Focused Interventions
Overview of Studies, Verbal Behavior Approach

*Mand.* The major theme of the 17 mand studies was generalization. For example, Rehfeldt and Root (2005) used relational and conditional discrimination training to develop derived manding skills with three participants with severe mental retardation (MR-Ser); Pellecchia and Hineline (2007) provided three participants with direct instruction so that their manding skills could generalize to manding to peers. An additional theme was investigation of the mand operant via PECS and manual sign. For example, Chambers and Rehfeldt (2003) taught four participants with MR-Ser to use PECS and sign. Although, Chambers and Rehfeldt found that both forms were effective methods for manding, they reported that participants learned to use PECS with less training and demonstrated generalization of manding across settings.

*Tact.* Skill acquisition and the development of pure operants were major themes of the seven tact studies. Arntzen and Almas (2002) demonstrated that, when compared to a tact only instruction, mand-tact combined training was more effective and resulted in both mand and tact repertoires. Where some tacts are multiply controlled (i.e., the nonverbal stimulus and instructor presented verbal stimulus, “what is this?”), both serve as an antecedent), a pure tact operant is when the controlling antecedent variable is only the nonverbal stimulus. Pistoljevic & Greer, 2006 and Delgado & Oblak, 2007 implemented an intensive tact instruction procedures and successfully developed pure operant repertoires.

*Echoic.* The major theme of the 10 investigations of the echoic operant was increasing free-operant vocalizations. Specifically, investigations of stimulus-stimulus
paring (SSP) and comparisons of direct reinforcement and SSP interventions were conducted. In stimulus-stimulus paring the instructor repeats a target sound repeatedly and contingently pairs the sound with a reinforcing stimulus. The overall hypothesis is that through automatic reinforcement vocalizations and echoic repertoires will develop. With direct reinforcement the instructor models a target sound and a reinforcing stimulus is contingent on the student imitating the sound. For example, in three experiments Esch, Carr, and Michael (2005), compared SSP, direct reinforcement of vocalization, and a shaping procedure; their data indicated that the shaping procedure was most effective in increasing sound frequency.

Intraverbal. The major theme of the five intraverbal investigations was skill enhancement. Goldsmith, LeBlanc, and Sautter (2007) used transfer of stimulus control and errorless learning procedures to teach 3 participants with autism to name items associated with pre-selected categories (e.g., “What are some colors?”). Ingvarsson, Tiger, Hanley, and Stephenson (2007) used echoic prompting to teach two participants with developmental disabilities to respond, “I don’t know” and “I don’t know, please tell me” when presented with unknown questions.

Review Discussion

The Lovaas Method (LøvM) is a behavioral treatment for individuals with developmental disabilities. LøvM is based on four decades of a research and development project in the Psychology Department at the University of California, Los Angeles (UCLA). LøvM primarily begins with home-based treatment that often develops into a combination of home, community, and school-based intervention. The method focuses on
providing fully comprehensive individualized instruction centering on the establishment of receptive language skills (i.e., listener skills) as a foundation for the development of expressive language skills (i.e., elementary verbal operants), implemented in one-on-one (at least initially) training sessions for 35-40 hours per week. This review of the Lovaas Method yielded 13 empirical studies, all published 1999 – 2009. The focus of these studies was outcome effects of 2 – 3 years of LovM and its impact on change in participant IQ, adaptive behavior, and other skill domains; comparison of treatment approaches; instructor skill development and training; and the practicality and efficiency of DTT procedures.

The Lovaas Method is the dominant treatment for autism (Time, 2009). Overall, the studies reviewed here included 297 participants, the majority of which were young male children/preschoolers diagnosed with autism/autism spectrum disorders. Some participants (10%) were diagnosed with Pervasive Developmental Disorder-Not Otherwise Specified, which theoretically could be considered a disorder within the autism spectrum disorder category (see, DSM-IV). Therefore, with only four percent of the identified studies including Other diagnoses (e.g., Cerebral Palsy), the results of this review evoke the question: Is the Lovaas Method effective with developmental disabilities other than autism? In 1997, Smith, Eikeseth, Klevstrand, & Lovaas attempted to address a similar question by reviewing archival records (from Lovaas, 1987 to McEachin, Smith, & Lovaas, 1993) and assessing outcomes achieved by preschoolers with both severe mental retardation and autistic features. Results of this archival data review indicated that intensively treated children with both severe mental retardation and
autistic features achieved clinically meaningful gains relative to the comparison group but remained quite delayed.

This review could not identify any study directly comparing LovM with another behavior-based intervention. However, one study did incorporate aspects of both behavior-based language development models. For example, early intensive instruction in receptive language/listeners skills and mand training. Remington et al. (2007) investigated the effects of two years of early intensive behavior intervention (IBI) with 23 preschool children with autism on measures of intelligence, language, daily living skills, positive social behavior, and a statistical measure of best outcome for individual children. Remington and colleagues implemented treatment, which began in the home during the participant’s 3rd or 4th year and continued for 2 years. This intervention involved 20 to 30 hrs a week of explicit instruction, consisting of LovM and incorporating elements of natural environment training (Sundberg & Partington, 1999) and the verbal behavior approach (Partington & Sundberg, 1998). Remington reported that the IBI treatment mixture resulted in robust significant differences on IQ and increases in the development of receptive and expressive language, acquisition of adaptive daily living skills, and social interaction.

This review of the verbal behavior approach/primary verbal operants yielded 39 empirical studies that included 116 participants with developmental disabilities. Participants were mainly diagnosed with autism and studies were primarily conducted in a school setting. The majority of investigations evaluated treatment effects with some form of multiple baseline design. This review could not identify any investigations of
Sundberg & Partington, 1998, commonly referred as the verbal behavior approach; however, all identified studies examined one or more of the primary verbal operants defined by Skinner (1957) and used one or more of the procedures recommended in Sundberg and Partington’s language training curriculum.

Internet searches for the verbal behavior approach generate a list of service providers and a few books. The position of Carr and Firth (2005) and other researchers (e.g., Eshleman, 1991; McPherson, Bonem, Green, & Osdorne, 1984; Oah & Dickinson, 1989) is that there is not enough research on the verbal behavior approach to support its widespread applied implementation. A research-to-practice gap can prevent a clear and concise scientific methodology (Cooper, Heron, & Heward, 2007). Although the Sundberg and Partington (1998) curriculum is under-researched, this review supports the position of Cautilli (2006). The primary verbal operants and the procedures related to their acquisition have relatively enough research to support their implementation with individuals with developmental disabilities.

Limitations

The Literature. This review identified some discrepancies in the literature. Specifically, Lovaas Method (LovM) empirical investigations with participants with moderate-to-serve mental retardation/intellectual disabilities were few; this search identified only one study, which used a review of archival records to determine treatment effectiveness with the moderate-to-serve mental retardation/intellectual disabilities population. In addition, no comparison research of LovM and other behavior-based intervention could be identified. In regards to the Verbal Behavior Approach (VBA) and
the primary verbal operants, the results of stimulus-stimulus pairing studies are incongruent. Recent research has evaluated how stimulus-stimulus pairing procedures can be used to enhance the language development of typically developing children and individuals with developmental disabilities (Esch, Carr, & Michael, 2005; Miguel, Carr, & Michael, 2002; Normand & Knoll, 2006; Smith, Michael, & Sundberg, 1996; Sundberg, Michael, Partington, & Sundberg, 1996; Yoon & Bennett, 2000; Yoon & Feliciano, 2007). However, where some researchers have reported positive effects (Sundberg et al., 1996; Smith et al., 1996; Yoon & Bennett, 2000) others have not (Stock, Schulze, & Mirenda, 2008). For example, Yoon and Bennett (2000) investigated stimulus-stimulus pairing with three participants with severe developmental delays, no speaker behavior, and limited listener skills. Yoon and Bennett demonstrated an immediate and considerable increase in the target sounds following the pairing condition. However, Miguel, Carr, and Michael (2002) reported mixed results for three children with autism. Miguel et al. demonstrated effectiveness with one participant but partial effectiveness with a second participant, and the pairing procedure had no effect for the third participant. Esch, Carr, and Michael (2005) reported no treatment effect from a stimulus-stimulus pairing procedure employed with three children with a low existing vocal repertoire and autism diagnosis. Eventually, to enhance participants’ language development, Esch, Carr, and Michael concluded with a shaping procedure. Although Normand and Knoll (2006) included only one participant in their investigation of stimulus-stimulus pairing, they modeled the target sound the most number of times per pairing trial (7); Normand and Knoll reported no noteworthy increase in the target.
sounds. The more recent investigations of stimulus-stimulus pairing indicate that the procedure appears to be ineffective with some children in increasing target vocalizations. Given that the earliest investigations of this phenomena produced substantial effects, the answer as to why stimulus-stimulus pairing investigation results are incongruent may lie in the differences between the bodies of research and their variations.

An additional limitation in the literature was, overall, the research was inadequate in its reports of treatment integrity. In Lovaas Method investigations inter-observer agreement was reported only six studies (46%), and procedural integrity was reported in only four studies. Although in the primary verbal operant investigation, 98% of the articles reported the degree of inter-observer agreement, the fidelity of experimenter behavior was reported only 30% of the time. Treatment integrity refers to the degree to which an independent variable is implemented as intended. A goal of behavior analysis is to demonstrate that changes in the target behavior are functionally related to the changes in the environment (Baer, Wolf, & Risley, 1968). In order to do this effectively, dependent and independent variables must be operationally defined and reliably measured. Inadequate assessment of the independent variable may result in faulty conclusions about the functional relationship between dependent and independent variables. In applied behavioral research, control of the independent variable is more difficult than in experimental research. Since independent variables frequently involve human judgments, some assessment of the reliability and accuracy of those judgments are necessary. Researchers are highly motivated to effect changes in behavior and some may inadvertently begin to use additional treatment methods or may alter the current method
to change or hasten results. The implication of this therapist drift is that the lack of independent variable description and verification may result in poor replication of study findings. Experimenters can ensure accurate independent variable application by rigorously training implementers and by conducting periodic informal spot checks on the implementers’ application of the independent variable. A more audacious solution might be to use some measures of the accuracy of independent variable implementation routinely in much the same way the accuracy of dependent variable observation has been routinely examined, either by measuring independent variable reliability with multiple observers or by calibrating the observers against “true values” of the independent variable as specified by the researcher. The presentation of reliable independent variable definitions and implementations would result in large improvements in the quality and generality of experimental data. It is important to note that issues with independent variable description and application do not imply that the experimenter does not retain complete flexibility to alter the treatment strategy; the application of the treatment variable always remains at the discretion of the experimenter. Problems occur when an experimenter believes that the application of the independent variable has certain properties when, in fact, different properties of the independent variable have been applied (Peterson, Homer, & Wonderlich, 1982).

The Review. In addition to the contrasts and flaws in the literature, the reviews themselves present with several limitations. First, the review of VBA/primary verbal operants did not cover studies of the non-verbal operants. A major premise of Verbal Behavior is that the behavior of the speaker and the behavior of the listener, although
they both may originate from the same person, are separate phenomena and each require
analysis (Skinner, 1957). Second, studies concerning autoclitic, textual behavior, or other
aspects of the behavioral account of language (i.e., naming, establishing operations,
operant independence, etc.) were not reviewed. The literature reviewed in this paper and
the four verbal operants they center on make up a small amount of the topics covered
within the verbal behavior arena. Third, studies with typically developing participants
were excluded. The behavioral account of language is relevant for children and adults
with developmental disabilities and typically developing individuals. Particularly for the
intraverbal operant category, eliminating studies with typically developing participants
limited the overall quantity of reviewed studies. Fourth, this review excluded case
studies, A-B designs, and other non-experimental investigations. To be considered
research of the highest quality, single-subject and group designs require certain features
(Gersten et al., 2005; Horner et al., 2005). However, well documented case studies and
other non-experimental research may provide the verbal behavior community with
valuable information by prompting unanswered experimental research questions and
evoking additional empirical research. Fifth, only articles published in peer-reviewed
journals were included. Specifically, this review excluded books (e.g., The Verbal
Behavior Approach, Analysis of Verbal Behavior, etc.) and disregarded investigations
disseminated in presentations and other non-peer reviewed publications. Sixth, social
validity was not addressed. Specifically, the review did not attend to reports of how
participants and other consumers viewed the investigated procedures and experimental
outcomes. Social validity refers to the degree to which consumers find the conducted
research acceptable. Specifically, an assessment of social validity measures how participants, and people that interact with the study participants, feel about the experimental procedures and results. Despite widespread contributions to human endeavors, from special education to national defense (Bjork, 1993); behavioral researchers are frequently frustrated by the lack of acceptance of behavioral approaches and treatment results (Axelrod, Moyer, & Berry, 1990; Greer, 1982). However, if researchers attended to consumer views of investigations and consistently reported social validity data, future researchers may be able to conduct more socially acceptable research. Seventh, the inclusion criteria for the LovM literature review may have been too selective. The LovM literature review excluded studies that, when describing treatment procedures, did not cited Lovaas et al., 1980 and/or Lovaas, 1987. This exclusion may have resulted in neglecting some studies that implemented the LovM but did not cite the 1980 and/or 1987 studies as the foundation of their treatment procedures. Finally, the inclusion criteria of the two reviews were unparallel, resulting in an unequal number of studies reviewed. Specifically, the literature review yielded 13 LovM studies and 39 VBA studies. This disparity occurred because some of terms and/or key words used to modify the literature search were different. For example, the review of the LovM literature employed the key words Lovaas; Lovaas Method; intensive behavior intervention/treatment; and discrete trial training/instruction, and the review of the VBA literature employed the key words verbal behavior; verbal behavior approach; applied verbal behavior; and verbal behavior analysis. In addition, the VBA literature search could not identify any direct investigations of Sundberg and Partington (1998); therefore,
we had to settle on reviewing studies that (a) examined one or more of the primary verbal operants and (b) used one or more of the procedures recommended in Sundberg and Partington’s language training curriculum.

**Recommendations**

There are several recommendations for future researchers. First, investigations of non-verbal operants should be examined. Although the behavior of the speaker was the main focus of Skinner’s (1957) behavioral account of language, listener behaviors make up over six categories of behavior in the verbal behavior approach curriculum. Second, studies of other aspects of the behavioral account of language (i.e., autoclitic, textual behavior, naming, etc.) need review. Particularly, the autoclitic, a secondary verbal operant that manipulates additional verbal behavior, is in need of examination. Additionally, future researchers and reviewers could examine how a behavioral account of language can help enhance reading and writing composition. Third, the behavioral account of language is relevant for all individuals; therefore, studies with typically developing participants should be reviewed so that the overall quantity of analyzed studies can be enhanced. Fourth, to enhance acceptance of behavioral language approaches and verbal behavior approach treatment results, researchers need to focus on social validity. Future reviewers should attend to study reports of social validity and examine what aspects of the Verbal Behavior Approach are considered by consumers to be objectionable.

In conclusion, 52 studies that included a variety of individuals with developmental disabilities were reviewed overall. Although an investigation of Sundberg
and Partington (1998) could not be identified, the data reported in the primary verbal operant studies reviewed here support the applied implementation of the verbal behavior approach. However, the recommendations of Carr and Firth (2005) remain appropriate. For example, long-term outcome data on the intensive application of Sundberg and Partington’s Verbal Behavior Approach (VBA) with individuals with developmental disabilities is required. It is relevant to determine which procedures that make up VBA are most efficient in enhancing language development and human interaction. Additionally, it is imperative to compare the procedures and treatment effects of VBA with other behavioral intervention models to determine optimal practice. Therefore, the third purpose of this paper is to compare the effects of two behavior-based language development models, the Lovaas Method (LovM) and Sundberg and Partington’s language-training protocol (VBA), on the development of tact repertoires of individuals with developmental disabilities. That is, unknown targets from two categories (i.e., school related activities and sight words) were taught receptively to mastery criterion and then expressively to mastery criterion (i.e., LovM) and different unknown targets of the same categories were trained using transfer trials across operants, receptive-to-echoic and echoic-to-tact, in the same trial (i.e., VBA). Both language-development instructional protocols were compared to identify an optimal practice in regards to frequency of operants receptively mastered to criterion, frequency of tact operants mastered to criterion, measures of efficiency, maintenance, and generalization. Specific research questions that were addressed are as follows:
1. When measuring frequency of operants receptively mastered to criterion and the frequency of tact operants mastered to criterion, how do LovM and VBA compare?

2. When measuring efficiency, as defined as: (a) proportion of correct responding; (b) number of training trials to reach mastery criterion; (c) number of sessions to reach mastery criterion; and (d) the amount of instructional time to reach mastery criterion, how do the LovM and VBA instructional protocols compare?

3. When measuring accuracy of responding during maintenance and generalization phases, how do the LovM and VBA compare?
Chapter 3: Method

Participants and Setting

Students between the ages of 9 and 12 with developmental disabilities who exhibited limited language were recruited. Students were included in this study if they met the following inclusion criteria: (a) parental consent was provided; (b) they scored between levels 2 and 3 in the receptive/listener skills category (i.e., copying actions, matching to sample, understanding words or following directions) on the ABBLS-short form; and (c) they scored between levels 1 and 3 in the expressive category (i.e., mand, echoic, tact, and intraverbal) on the ABBLS-short form. Three students met the inclusion criteria and were included as participants in this study. Table 3.1 displays demographic information for Bill, Tim, and John, respectively. Bill was an 11-year-old male with moderate-to-severe mental retardation and quadriplegic cerebral palsy, which manifested in physical impairments that necessitated mobility via a wheelchair. Tim was a 12-year-old male with a diagnosis of moderate-to-severe mental retardation and seizure disorder. John was a 12-year-old male with a diagnosis of moderate-to-severe mental retardation and autism spectrum disorder. The participants’ educational staff reported that each participant frequently displayed challenging behavior when presented with academic tasks and/or when required to work on a task over durations greater than 2 min. All
participants attempted to communicate using symbolic (i.e., vocal-verbal communication with prompting) and nonsymbolic (i.e., pointing, gesturing, etc.) forms of communication, but each demonstrated little spontaneous communication. Prior to intervention, each participant presented with deficits in receptive language and tainting skills yet demonstrated a slight echoic repertoire (i.e., each participant could verbally imitate two to three word phrases). Some educational goals the participants had in common were ‘memory recall’, ‘matching colors/letters’, ‘clearly and appropriately communicating wants/needs’, and ‘using a picture symbol scheduled to transition throughout the day.’ Although IQ scores were not available, participants could be described as having low (Bill and John) to mid-level (Tim) verbal repertoires.

This study was conducted in a small conference room at a local county board of developmental disability school. The room was approximately 10 ft by 10 ft and contained a table, chairs, and all materials necessary for sessions. During treatment implementation, other students receiving services did not use the room. Setting generalization was assessed in an untrained environment: each participant’s general classroom within the school. In the general classroom, there was a teacher, teacher’s assistants, and approximately 6 to 8 other students. The general classroom was approximately 20 ft by 20 ft and contained chairs, desks, audio-visual equipment, and a table where students received academic and daily living skill instruction. The academic instruction in the general classroom typically consisted of three to four students passively participating in a small-group activity. This small-group activity could be described as circle-time, were the teacher and/or teacher assistants interacted with students using
closed and open-ended questions and exposing students to abstract concepts such as letters, numbers, pictures, and songs. Frequently during the small-group activity, other students would be engaged in down time/free play or receiving a diaper change.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>E</th>
<th>Gender</th>
<th>Dx</th>
<th>Add Dx</th>
<th>IQ</th>
<th>VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill</td>
<td>11</td>
<td>C</td>
<td>M</td>
<td>MR (m-s)</td>
<td>• Q─ CP</td>
<td>NA</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hydro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tim</td>
<td>12</td>
<td>CHA</td>
<td>M</td>
<td>MR (m-s)</td>
<td>• SD/E</td>
<td>NA</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John</td>
<td>12</td>
<td>AA</td>
<td>M</td>
<td>MR (m-s)</td>
<td>• ASD</td>
<td>NA</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• SD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Age displayed in years
Dx = Diagnosis
E = Ethnicity
Add Dx = Additional Diagnosis
VR = Verbal repertoire
L / M / H = Low-level / Mid-level / High-level
C = Caucasian
CHA = Caucasian and Hispanic American
AA = African American
MR (m-s) = Moderate – Severe Mental Retardation/Intellectual Disability
Q─ CP = Quadriplegic Cerebral Palsy
Hydro = Hydrocephaly
SD/E = Seizure Disorder / Epilepsy
SD = Sleep disorder
ASD = Autism/Autism Spectrum Disorder

Table 3.1. Participant Demographic Information.

Materials

Instructional materials and tangible reinforcers were used. Instructional materials were based on each participant’s pre-intervention assessment results. The materials were picture/sight word cards (3”x 5”). Tables 3.2 and 3.3 display targets for Lovaas Method (LovM) and Verbal Behavior Approach (VBA), respectively. For each participant, targets consisted of 20 items from two categories: (a) school-related activities (e.g., art,
community, etc.) and (b) school-related sight words (e.g., bathroom, story, etc.). Specific targets were determined during the pre-intervention assessment phase, divided into two sets, and randomly assigned to each treatment condition (i.e., 10 targets per condition). For mand opportunities, participant specific items/activities (i.e., reinforcers) were identified, and included food items (e.g., chips, raisins, etc.), preferred objects (e.g., toy car, bouncy ball, etc.), and activities (e.g., walks, wheelchair wheelies, etc.). Data recording forms were present during sessions, and video recording equipment was used to tape sessions and assist in scoring data following sessions.
<table>
<thead>
<tr>
<th>LovM</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill</td>
<td>Community Activity</td>
<td>1.</td>
<td>Bus</td>
<td>Sight word</td>
</tr>
<tr>
<td></td>
<td>Lunch Activity</td>
<td>2.</td>
<td>Story</td>
<td>Sight word</td>
</tr>
<tr>
<td></td>
<td>Sensory Activity</td>
<td>3.</td>
<td>Boy</td>
<td>Sight word</td>
</tr>
<tr>
<td></td>
<td>Grooming Activity</td>
<td>4.</td>
<td>Blue</td>
<td>Sight word</td>
</tr>
<tr>
<td></td>
<td>Leisure Activity</td>
<td>5.</td>
<td>Play</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tim</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Community Activity</td>
<td>1.</td>
<td>Bus</td>
<td>Sight word</td>
</tr>
<tr>
<td>2.</td>
<td>Lunch Activity</td>
<td>2.</td>
<td>Story</td>
<td>Sight word</td>
</tr>
<tr>
<td>3.</td>
<td>Sensory Activity</td>
<td>3.</td>
<td>Boy</td>
<td>Sight word</td>
</tr>
<tr>
<td>4.</td>
<td>Grooming Activity</td>
<td>4.</td>
<td>Blue</td>
<td>Sight word</td>
</tr>
<tr>
<td>5.</td>
<td>Leisure Activity</td>
<td>5.</td>
<td>Play</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>John</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Art Activity</td>
<td>1.</td>
<td>Bathroom</td>
<td>Sight word</td>
</tr>
<tr>
<td>2.</td>
<td>A.P.E. Activity</td>
<td>2.</td>
<td>All</td>
<td>Sight word</td>
</tr>
<tr>
<td>3.</td>
<td>Music Activity</td>
<td>3.</td>
<td>Red</td>
<td>Sight word</td>
</tr>
<tr>
<td>4.</td>
<td>Special Activity</td>
<td>4.</td>
<td>Green</td>
<td>Sight word</td>
</tr>
<tr>
<td>5.</td>
<td>Library Activity</td>
<td>5.</td>
<td>Good</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

Table. 3.2. Lovaas Method Targets for Bill, Tim, and John, respectively

<table>
<thead>
<tr>
<th>VBA</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill</td>
<td>Art Activity</td>
<td>1.</td>
<td>Bathroom</td>
<td>Sight word</td>
</tr>
<tr>
<td>2.</td>
<td>A.P.E. Activity</td>
<td>2.</td>
<td>All</td>
<td>Sight word</td>
</tr>
<tr>
<td>3.</td>
<td>Music Activity</td>
<td>3.</td>
<td>Red</td>
<td>Sight word</td>
</tr>
<tr>
<td>4.</td>
<td>Special Activity</td>
<td>4.</td>
<td>Green</td>
<td>Sight word</td>
</tr>
<tr>
<td>5.</td>
<td>Library Activity</td>
<td>5.</td>
<td>Good</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tim</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Art Activity</td>
<td>1.</td>
<td>Bathroom</td>
<td>Sight word</td>
</tr>
<tr>
<td>2.</td>
<td>A.P.E. Activity</td>
<td>2.</td>
<td>All</td>
<td>Sight word</td>
</tr>
<tr>
<td>3.</td>
<td>Music Activity</td>
<td>3.</td>
<td>Red</td>
<td>Sight word</td>
</tr>
<tr>
<td>4.</td>
<td>Special Activity</td>
<td>4.</td>
<td>Green</td>
<td>Sight word</td>
</tr>
<tr>
<td>5.</td>
<td>Library Activity</td>
<td>5.</td>
<td>Good</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>John</th>
<th>Targets</th>
<th>Category</th>
<th>Targets</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Community Activity</td>
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<td>Bus</td>
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</tr>
<tr>
<td>2.</td>
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<td>2.</td>
<td>Story</td>
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</tr>
<tr>
<td>3.</td>
<td>Sensory Activity</td>
<td>3.</td>
<td>Boy</td>
<td>Sight word</td>
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<tr>
<td>4.</td>
<td>Grooming Activity</td>
<td>4.</td>
<td>Blue</td>
<td>Sight word</td>
</tr>
<tr>
<td>5.</td>
<td>Leisure Activity</td>
<td>5.</td>
<td>Play</td>
<td>Sight word</td>
</tr>
</tbody>
</table>

Table. 3.3. Verbal Behavior Approach Targets for Bill, Tim, and John, respectively
Dependent Variables and Response Definitions

For each participant, there were several dependent variables. The first dependent variable was the frequency of operants receptively mastered to criterion. Receptive labeling (i.e., listener skills) was defined as a participant touching a specific nonverbal stimulus in response to the presentation of verbal and nonverbal stimuli. Receptively mastered to criterion was defined as a participant touching the targeted picture or sight word with 100% accuracy during three consecutive probe sessions. The second dependent variable was the frequency of tact operants mastered to criterion. A tact was defined as a verbal response (i.e., vocal or sign) evoked by one of the 2-dimensional items from the focus categories (Skinner, 1957). Mastery criterion was defined as a participant tacting the targeted picture or sight word with 100% accuracy during three consecutive probe sessions. The third dependent variable was the accuracy of tacts during the maintenance and generalization phases. Additional dependent variables were the number of training trials per target needed to reach mastery criterion, the number of sessions per target need to reach mastery criterion, the amount of instructional time per target needed to reach mastery criterion, the total number of trials to mastery criterion per protocol, and the total sum of instructional time per protocol.

Data Collection and Measurement

A continuous event recording method was used as the observation and recording procedure. All occurrences and non-occurrences of each target behavior were recorded. The researcher counted the frequency of each target behavior as it occurred (see Appendixes E and F for copies of data sheets). Percentages were calculated by dividing
the number of target behaviors completed correctly by the total number of target behaviors possible, then multiplying by 100%.

**Interobserver Agreement and Treatment Integrity**

Interobserver agreement was calculated using an exact agreement method of calculation in which agreements were divided by the sum of agreements plus disagreements and then multiplied by 100%. For each participant, agreement was defined as both observers scoring the same occurrence (or non-occurrence) of the target behavior. Disagreement was defined as one observer recording an occurrence and the other observer recording a non-occurrence of the target behavior. The primary observer was the first author; secondary observers were graduate students, teacher’s assistants, speech and language pathologists, and the participant’s general classroom teacher. The primary observer trained the secondary observers in intervention procedures and taught them the definitions of the target behaviors. After the initial trainings, the secondary observers were quizzed on intervention procedures and target behavior definitions. Agreement was calculated during 41%, 30%, and 32% of sessions across all phases for Bill, Tim, and John, respectively. Exact agreement for Bill was 100%; for Tim agreement averaged 99.3% (range, 96% to 100%); and for John agreement averaged 99.6% (range, 98% to 100%).

For each participant, the first author and/or a graduate student conducted baseline, training trial, and maintenance and generalization phase sessions. Treatment integrity was assessed by frequent review of the treatment procedures, periodic spot checks, and completion of a treatment integrity checklist (see Appendix G for a copy of data sheet).
On the treatment integrity checklist, primary or secondary observer(s) recorded the presence or absence of critical materials and procedures. Treatment integrity data were recorded to assure that the relevant procedural components were implemented accurately. Treatment integrity checklists were analyzed and integrity was calculated by dividing the number of procedural components implemented correctly by the number of procedural components possible and multiplying by 100%. Treatment integrity (using the treatment integrity checklist) was assessed during 40%, 33%, and 38% of sessions across all phases for Bill, Tim, and John respectively. Integrity data indicate that the relevant procedural components were implemented with 98% integrity across all participants and sessions. Treatment integrity for Bill was 96% (range, 92% to 100%); for Tim integrity averaged 98% (range, 95% to 100%); and for John integrity was 100%.

Experimental Design

To demonstrate experimental control, an alternating treatments with baseline design was implemented (Cooper, Heron, & Heward, 2007). Targets were trained using two instructional protocols: (a) the Lovaas Method and (b) the Verbal Behavior Approach (see below). For example, a participant was taught to tact 10 targets from the focus categories using the Lovaas method and 10 different targets using the Verbal Behavior Approach. Instructional protocol implementation was counter-balanced across study participants.

Procedures

General Procedures. Each day of intervention, the researcher entered the treatment setting and organized the instructional materials to be used during that day’s
probe/training trial session. After organizing the instructional materials, the researcher went to a general classroom to retrieve a participant and, except during the generalization phase, took the participant to the conference room to run sessions. Before initiating probe/training sessions, the researcher established rapport with the participant by associating him/herself with reinforcers. This included going for a walk/pushing around a wheelchair (Bill), social interaction, and providing the participant with noncontingent access to fun activities for a few minutes (e.g. coloring, getting a drink, etc.). After establishing rapport, the intervention session began. Each intervention session consisted of a probe session (see below) which lasted 5 to 10 minutes followed by one to two training trial sessions for the protocol to be trained that day, LovM or VBA (see below). Each training trial session had a maximum duration of 10 minutes. Therefore, each intervention session (i.e., a probe session and one to two training trial sessions) had a maximum duration of 30 min.

Reinforcer Assessment. To identify potential reinforcing stimuli, the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1997) was completed by the first author in collaboration with the participants’ educational staff. The RAISD is a structured interview; its purpose is to provide prompts to caregivers regarding an individual’s preferred stimuli across a variety of categories to facilitate the identification of as many potential reinforcers as possible and to identify the conditions under which those stimuli are preferred (Piazza, Fisher, Hagopian, Bowman, & Toole, 1996).
After identifying potential reinforcers, a multiple stimulus without replacement (MSWO) reinforcer assessment procedure (DeLeon & Iwata, 1996) was implemented to determine which stimuli identified via the RAISD were preferred by each participant. Procedures were similar to those reported by DeLeon and Iwata, except that the MSWO procedure conducted here consisted of three (instead of five) stimulus presentation sessions conducted with each participant. The first author placed a linear array of stimuli in front of the participant. Each participant was verbally instructed to select one stimulus. Attempts to select more than one stimulus at a time were blocked, and the verbal instruction was repeated. If the participant failed to respond, the instruction was repeated; if the participant continued to not make a selection, the trial was ended and the next trial was initiated. After a stimulus was selected, the participant was given 10 s to 30 s to access the selected item before it was removed from the array, and the remaining stimuli were repositioned in a quasi-randomized manner. This process continued until all stimuli were selected, and then was implemented two more times.

**Pre-Intervention Assessment.** For each participant, the mand, echoic, receptive, and tact operants were assessed using an Assessment of Basic Language and Learning Skills, short form (ABLLS-short form, Partington & Sundberg, 1998) to determine present levels of performance and identify experimental targets. The ABLLS is an assessment, curriculum guide, and skills tracking system for children with language delays. This assessment is most frequently used with children with autism or other developmental disabilities (Barbera & Rasmussen, 2007). It is unique in that it is based on Skinner’s behavioral analysis of language (1957). After the ABLLS has been completed, it is intended to guide instructional objectives by providing very specific
information on skills that the student does and does not have. This allows the teacher to choose specific skill deficits and teach those objectives (Partington & Sundberg, 1998).

The ABLLS-short form was operationalized to clarify ambiguous language (e.g., “a couple” was defined as two; “a few targets” was defined as three targets, etc.). The operationalized ABLLS-short form is provided in Appendix D. During assessment sessions, antecedent stimuli were presented. When conducting the ABLLS-short form, if the participant did not respond within 3 s, antecedent stimuli were presented a second time. If there was still no response, it was recorded as an incorrect response. Throughout the assessment, no prompts were provided. To maintain participant engagement throughout the session, mand opportunities were provided contingent upon participation and independent of response accuracy.

To determine if the participants could express needs and wants, the participant’s manding skills were assessed. The first author displayed the reinforcer and presented the discriminative stimulus, “What do you want?” Participants were expected to verbally indicate (i.e., with words or sign) their selection. For responses that specified selection, the manded reinforcer was delivered regardless of response accuracy. For example, the first author held up a ball and presented the verbal stimulus, “What do you want.” If the participant in any way indicated ball, regardless of response accuracy, the ball was delivered.

To determine the participants’ ability to verbally imitate sounds, words, and phrases, each participant’s echoic repertoire was assessed. The first author presented the verbal stimulus, “Say (sound/word/phrase).” Participants were expected to verbally
imitate the sound/word/phrase. For example, the first author said “Say lunch” and the participant was expected to say “Lunch”.

To determine the participants’ ability to label items or actions expressively, each participant’s tact repertoire was assessed. The first author presented a picture of the item and the verbal stimulus, “What is it?” Participants were expected to verbally identify the item in the picture. For example, the first author presented a picture of art and said, “What is it?” and the participant was expected to say, “Art.”

To determine the participants’ ability to label items receptively, each participant’s receptive/listener skill repertoire was assessed. The first author displayed three 2-dimensional items in a linear field and presented the verbal stimulus, “Touch (noun/action).” Participants were expected to make physical contact with only the corresponding item. For example, the first author presented a picture of music, art, and library in a linear field and the verbal stimulus, “Touch music.” The participant was expected to touch the picture of music.

On the ABLLS-short form, Bill presented in the Level 2 range in the expressive category and the Level 2 stage of functioning in the receptive/listener skills category. Tim’s ABLLS score was level 3 range in the expressive category and the level 2 stage of functioning in the receptive/listener skills category. John’s ABLLS score presented in the level 2 range in the expressive category and the level 3 stage of functioning in the receptive/listener skills category. In short, all participants presented with the ability to follow simple one-step instructions (e.g., close the door, sit down, clap hands, etc.) and receptively label non-targeted pictures (e.g., pizza, dog, chair, etc.). Most importantly,
each participant presented with an echoic repertoire in which they could verbally imitate phonetic sounds (e.g., “mmm,” “sss,” etc.); words (“art,” “music,” etc.); and two to three word phrases (e.g., “Candy please,” “I want ball,” etc.).

**Probe Sessions.** Each treatment session began with a probe of the participant’s ability to tact and receptively label the 10 targets associated with the protocol to be trained. For specific probes procedures, see below. Overall, probe sessions consisted of consecutively conducted tact then receptive operant probes. This probe informed the researcher of the required prompting levels to be used during the intervention session and, therefore, was used to make experimental decisions. During probes, the researcher presented antecedent stimuli to the participant. If the participant did not respond within 3 s, the antecedent stimuli were presented a second time. If there was still no response, it was recorded as an incorrect response. During probe sessions, no prompts or corrective feedback were provided; however, opportunities to mand and reinforcers were provided contingent upon the participant’s participation but independent of response accuracy. After a target met mastery criteria for tacts, it was moved to the maintenance phase (see Maintenance section below).

Tact Probe Procedures. During tact probes, the researcher presented one 2-dimensional picture (e.g., Music) and the discriminative stimulus, “What is it?” The participant was given 3 s to tact the picture. If the participant responded correctly, the trial was marked as correct and the next 2-dimensional picture was presented. If they did not respond within 3 s, the verbal stimulus was presented again. If the participant still did
not respond or responded incorrectly, the trial was marked as incorrect and the next 2-dimensional picture was presented.

Receptive Probe Procedures. During receptive probes, the researcher presented three 2-dimensional items in a linear field and provided the verbal stimulus, “Touch (activity/sight word).” The participant was given 3 s to touch the correct activity/sight word. If the participant responded correctly, the trial was marked as correct and the next linear field was presented. If they did not respond within 3 s, the verbal stimulus was presented again. If the participant still did not respond or responded incorrectly, the trial was marked as incorrect and the next linear field was presented.

Baseline. During baseline, data were collected over three sessions. Each session was approximately 10–15 min in duration. Baseline procedures were identical to probe session procedures. Data were collected on each participant’s ability to tact and receptively label school-related activity pictures and sight words; no prompts or corrective feedback were provided. For tacts of targets, the researcher presented one 2-dimensional (2D) item and the verbal stimulus, “What is it?” For receptive identification of targets, the researcher presented three 2D pictures and the verbal stimulus: “Touch (activity/sight word).”

Intervention. For each participant, 20 items from two focus categories (i.e., 10 school-related activities and 10 school-related sight words) were targeted. The 20 targets were randomly divided into two groups and assigned to the two protocols, either the Lovaas Method (LovM) or the Verbal Behavior Approach (VBA). Five school-related activity pictures and five school-related sight words unknown to the participants were
taught using LovM. Ten different unknown targets from the same categories, (i.e., 5 activity pictures and 5 sight words) were trained using VBA.

The Lovaas Method. For each participant, 5 of the 10 targets were initially taught receptively. After receptive mastery criterion was achieved for those five targets, tact training began. After the initial five targets met receptive and tact mastery criteria, receptive instruction began for the final five targets. After receptive mastery criterion had been achieved for the final five targets, tact training began on those five targets. Opportunities to mand for reinforcers were presented following training trials.

Lovaas Method—Receptive Procedures. The researcher presented three nonverbal stimuli and the antecedent stimulus, “Touch (activity/sight word).” For example, a picture of music, lunch, and free play were displayed and the discriminative stimulus (SD), “Touch music” was given. If the participant touched the correct picture, the researcher presented generalized conditioned reinforcement (e.g., verbal praise). If the participant touched the incorrect picture, the researcher said, “No” and presented the SD again. On the second trial, if the participant touched the correct picture, the researcher provided generalized conditioned reinforcement. If the participant did not respond in 3 s or responded incorrectly, the researcher re-presented the antecedent stimuli (for a third time) and a least-to-most prompting stimulus to occasion the correct response.

Lovaas Method—Tact Procedures. The researcher presented the target picture in front of the participant and the SD, “What is this?” For example, a picture of music was displayed and the SD, “What is this?” was given. If the participant correctly labeled the picture (e.g., said “music”), the researcher presented generalized conditioned
reinforcement. If the participant did not respond in 3 s or responded incorrectly, the researcher said, “Try again” and re-presented the antecedent stimuli. If the participant did not respond or responded incorrectly on the second trial, the researcher re-presented the antecedent stimuli (for a third time) with an echoic prompt. For example, a picture of music was displayed and the $S^D$, “What is this?” was given. If the participant incorrectly labeled the picture (e.g., said “ball”) consecutively, the first author repeated the trial and said, “Say music.” Echoic prompting trials were repeated until the participant repeated the correct response or until the session was terminated.

**The Verbal Behavior Approach.** Using the VBA, a target was errorlessly trained using transfer trials across operants, receptive-to-echoic, and echoic-to-tact within one trial. After the participant correctly responded, the researcher presented generalized conditioned reinforcement and labeled the targeted activity or sight word. Following three consecutive independent accurate responses, the receptive and echoic antecedents were faded (see below). Opportunities to mand for reinforcers were continently presented throughout training trials.

**Receptive-to-Echoic Transfer.** The researcher presented three nonverbal stimuli and the discriminative stimulus, “Touch (activity/sight word).” The participant touched the requested picture (receptive). The researcher then presented generalized reinforcement and the $S^D$, “Say (activity/sight word).” The participant responded echoically, “activity/sight word” (echoic). For example, pictures of music, community, and lunch were displayed and the $S^D$, “Touch music?” was presented. The participant touched the picture of music and the researcher presented praise (i.e., generalized
conditioned reinforcement), picked up the picture of music and displayed it to the participant, and then presented the SD, “Say music.” The participant verbally imitated by saying, “Music.” The researcher presented praise (i.e., generalized reinforcement) and proceeded to the tact transfer. For error correction procedures, see below.

Echoic-to-Tact Transfer. Following generalized reinforcement of the participant’s echoic response, the researcher presented the picture of the targeted activity or sight word and the SD, “What is it?” The participant tacted the targeted activity or sight word (tact). For example, after the researcher praised the participant’s echoic response (“Music”), the researcher presented the picture of Music and the SD, “What is it?” Following the momentum of the receptive and echoic transfers, the participant tacted the picture by saying, “Music.” For error correction procedures, see below.

Verbal Behavior Approach—Error Correction. To prevent errors, training was initiated with a 0 s time delay prompting procedure (i.e., errorless learning). During the target-training onset stage, the researcher presented antecedent stimuli and prompted the correct response using a 0 s time delay. Once the participant began to respond correctly when the researcher attempted to provide the prompting stimulus, the acquisition stage was initiated. During the acquisition stage, the researcher presented antecedent stimuli and prompted the correct response using a 3 s time delay procedure. Following one incorrect or two consecutive non-responses, the 0 s time delay prompting procedure was reinstated. During the acquisition stage, the receptive-to-echoic transfer trial was faded after the participant independently receptively labeled the target item correctly three times. Following successful fading of the receptive-to-echoic transfer trial (i.e., three
trials with independent correct responses), the echoic-to-tact transfer trial was faded after the participant had independently tacted the target item correctly three times.

**Booster Sessions.** Due to an extended break in intervention sessions, booster sessions were required for Tim and John. Bill did not require booster sessions. Tim received three booster sessions for training LovM receptive and tact operant targets and VBA receptive and tact operant targets. John received one booster session for training LovM tact operant targets. Booster sessions were identical to intervention session (i.e., booster sessions consisted of a probe session and training trial sessions). However, instead of introducing new targets, booster sessions consisted of reviewing targets that had met mastery criteria prior to the extended break period.

**Maintenance and Generalization**

During the maintenance and generalization phase, targets were probed while instruction and prompts/corrective feedback were withheld. Procedures in the maintenance phase were identical to the receptive and tact probe procedures. Antecedent stimuli were presented, if the participant did not respond within 3 s the antecedent stimuli was presented a second time. If there was still no response it was considered an incorrect response. Opportunities to mand and reinforcers were provided contingent upon participation but independent of response accuracy.

After a target met mastery criteria and progressed to the maintenance phase, generalization of receptive and tact repertoires was assessed in untrained environments and with novel stimuli (i.e., novel trainers). Procedures in the generalization phase were identical to the receptive and tact probe procedures.
Social Validity

Following the completion of the investigation, social validity data were collected by providing voluntary and anonymous questionnaires to the participants’ educational staff. Questionnaires used Likert-type scales (e.g., Not at all, Very little, Neutral, Mostly, or Completely) and open-ended questions (e.g., Any Additional Comments?) to evaluate consumer satisfaction with intervention goals, how the procedures were viewed, and if the results of the study were viewed as acceptable. For example, consumers were asked if they believe that the procedures used in this study were an acceptable way of developing/enhancing language capabilities of students with special needs, if they would like to implement the techniques used in this study with other students, and any additional comments from consumers were solicited (see Appendix H for social validity questionnaire).
Chapter 4: Results

Figures 4.1–4.13, 4.14–4.26, and 4.27–4.40 display the results for Bill, Tim, and John, respectively. Figures 4.1, 4.14, and 4.27 illustrate the frequency of correct responding during receptive operant probe sessions for the Lovaas Method (LovM) and Verbal Behavior Approach (VBA); figures 4.2, 4.15, and 4.28 illustrate the frequency of correct responding during tact operant probe sessions for the LovM and VBA. Figures 4.3, 4.16, and 4.29 illustrate the frequency of correct responding during Lovaas Method specific probes; and figures 4.4, 4.17, and 4.30 illustrate the frequency of correct responding during Verbal Behavior Approach specific probes. Across figures 4.1 to 4.4, 4.14 to 4.17, and 4.27 to 4.30, the horizontal axis represent sessions and the vertical axis represent frequency of correct responses. Figures 4.5, 4.18, and 4.31 illustrate the percent of correct and incorrect responding during LovM training trials, and figures 4.6, 4.19, and 4.32 illustrate the percent of correct and incorrect responding during VBA training trials. Across figures 4.5 to 4.6, 4.18 to 4.19, and 4.30 to 4.32, the horizontal axis represent sessions and the vertical axis represent percent of correct and incorrect responding.

Figures 4.7 to 4.10, 4.20 to 4.23, and 4.33 to 4.36 illustrate Lovaas Method (LovM) and Verbal Behavior Approach (VBA) procedural efficiency data. Figures 4.7, 4.20, and 4.33 illustrate the necessary number of training trials to criterion (per target and
Baseline data were collected on participant’s frequency of correctly labeled receptive and tact operants. For each participant, the figures indicate that none of the participants correctly labeled the targeted receptive and tact operants. Therefore, with all participants demonstrating stable levels of responding, training trials were initiated.

**Bill**

**Lovaas Method Probe Sessions.** During the baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, data were collected over three sessions. Bill did not receptively label or tact any of the 10 LovM targets. Following LovM probe session three, the receptive operant training trial phase commenced for the initial five LovM targets.

During LovM receptive operant probe sessions 4 to 7, Bill accurately labeled an average of 1.3 targets (range, 0 to 2). During LovM receptive operant probe sessions 8 to
11, Bill accurately labeled an average of 4.8 targets (range, 4 to 5). By LovM receptive operant probe session 11, Bill had three consecutive sessions with 100% accuracy, met receptive mastery criteria for the initial five LovM targets, and began tact operant training on the initial five LovM targets. During LovM receptive operant probe sessions 12 to 18, Bill receptively labeled the initial five LovM targets with 100% accuracy while receiving tact training. During LovM receptive operant probe sessions 19 to 22, Bill accurately labeled an average of 8.0 targets (range, 6 to 9). During LovM receptive operant probe sessions 23 to 25, Bill receptively labeled all 10 targets with 100% accuracy, by session 25 he had three consecutive sessions with 100% accuracy, met mastery criteria for all receptive operant LovM targets, and began tact operant training on the final five LovM targets.

During LovM tact operant probe sessions 4 to 7, while receiving receptive operant training for the initial five targets, Bill did not accurately tact any targets. During LovM tact operant probe sessions 8 to 11, Bill accurately tacted an average of .25 targets (range, 0 to 1). However, during LovM receptive operant probe session 11, Bill met criteria to begin explicit tact training on the initial five LovM targets. During LovM tact operant probe sessions 12 to 14, Bill accurately tacted an average of 2.3 targets (range, 2 to 3). During LovM tact operant probe sessions 15 to 18, Bill accurately tacted an average of 4.8 targets (range, 4 to 5). By session 18, Bill had three consecutive sessions with 100% accuracy, met tact mastery criteria for the initial five LovM targets, and began receptive operant training on the final five LovM targets. During LovM tact operant probe sessions 19 to 25, Bill accurately tacted the initial five LovM targets with 100% accuracy. During
LovM tact operant probe sessions 26 to 29, Bill accurately tacted an average of 8.0 targets (range, 7 to 10). During LovM tact operant probe sessions 30 to 33, Bill accurately tacted an average of 9.8 targets (range, 9 to 10). By session 33, Bill had three consecutive sessions with 100% accuracy, met tact mastery criteria for the final five LovM targets, and met mastery criteria for all tact operant LovM targets.

Verbal Behavior Approach Probe Sessions. During baseline phase for Verbal Behavior Approach (VBA) receptive operant probe and tact operant probe sessions, data were collected over three sessions. Bill did not receptively label or tact any of the 10 VBA targets. Therefore, with zero trend and stable responding, the training trial phase was initiated following VBA probe session three.

During VBA receptive operant probe sessions 4 to 7, Bill accurately labeled an average of 1.5 targets (range, 0 to 3). During VBA receptive operant probe sessions 8 to 11, Bill accurately labeled an average of 4.0 targets (range, 3 to 5). During VBA receptive operant probe sessions 12 to 15, Bill accurately labeled an average of 7.0 targets (range, 6 to 8). During VBA receptive operant probe sessions 16 to 19, Bill accurately labeled an average of 9.5 targets (range, 8 to 10). By session 19, Bill had three consecutive sessions with 100% accuracy and met receptive operant mastery criteria for all VBA targets.

During VBA tact operant probe sessions 4 to 9, Bill accurately tacted an average of 2.2 targets (range, 0 to 4). During VBA tact operant probe sessions 10 to 15, Bill accurately tacted an average of 5.7 targets (range, 4 to 8). During VBA tact operant probe sessions 16 to 19, Bill accurately tacted an average of 9.5 targets (range, 8 to 10). During
session 19, Bill had three consecutive sessions with 100% accuracy and met tact operant mastery criteria for all VBA targets.
Figure 4.1. Frequency of Corrects During Lovaas Method and Verbal Behavior Approach Receptive Operant Probe Sessions, for Bill
Figure 4.2. Frequency of Corrects During Lovaas Method and Verbal Behavior Approach Tact Operant Probe Sessions, for Bill
Figure 4.3. Frequency of Corrects During Lovaas Method Specific Probes, for Bill
Figure 4.4. Frequency of Corrects During Verbal Behavior Approach Specific Probes, for Bill
**Lovaas Method Training Trials Sessions.** Following the baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, the training trial phase for the 10 LovM targets began with receptive then tact instruction on the initial five targets followed by receptive then tact instruction on the final five targets. During LovM operant training trial sessions 1 to 10, Bill received an average of 14.5 training trials (range, 10 to 19); he responded with a percent correct average of 64% (range, 27% to 100%) and incorrectly responded or required prompts during an average of 36% (range, 0% to 73%) of trials. During LovM operant training trial sessions 11 to 20, Bill received an average of 14 training trials (range, 12 to 18); he responded with a percent correct average of 69.7% (range, 71% to 100%) and incorrectly responded or required prompts during an average of 14.9% (range, 0% to 29%) of trials. During LovM operant training trial sessions 21 to 30, Bill received an average of 11.6 training trials (range, 7 to 16); he responded with a percent correct average of 82.8% (range, 57% to 100%) and incorrectly responded or required prompts during an average of 17.2% (range, 0% to 43%) of trials. During LovM operant training trial sessions 31 to 40, Bill received an average of 12.9 training trials (range, 8 to 16); he responded with a percent correct average of 84.9% (range, 60% to 100%) and incorrectly responded or required prompts during an average of 14.9% (range, 0% to 40%) of trials. During LovM operant training trial sessions 41 to 51, Bill received an average of 9.8 training trials (range, 4 to 16); he responded with a percent correct average of 86% (range, 73% to 100%) and incorrectly responded or required prompts during an average of 13.7% (range, 0% to 31%) of trials. Following LovM operant
training trial session 51, Bill had three consecutive LovM tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 LovM targets.

Verbal Behavior Approach Training Trials Sessions. Following the baseline phase for Verbal Behavior Approach (VBA) receptive and tact operant probe sessions, the training trial phase for the 10 VBA targets began with same-trial receptive and tact instruction (i.e., transfer trials across operants) for each target. During VBA operant (receptive and tact) training trial sessions 1 to 5, Bill received an average of 14.2 training trials (range, 9 to 20); he responded with a percent correct average of 90.6% (range, 83% to 100%) and incorrectly responded or required prompts (or additional presentation of the antecedent stimuli) during an average of 9.4% (range, 0% to 17%) of trials. During VBA operant training trial sessions 6 to 10, Bill received an average of 14.2 training trials (range, 9 to 20); he responded with a percent correct average of 98.2% (range, 94% to 100%) and incorrectly responded or required prompts during an average of 1.8% (range, 3% to 6%) of trials. During VBA operant training trial sessions 11 to 15, Bill received an average of 16.8 training trials (range, 13 to 20); he responded with a percent correct average of 94.6% (range, 91% to 100%) and incorrectly responded or required prompts during an average of 5.4% (range, 3% to 9%) of trials. During VBA operant training trial sessions 16 to 20, Bill received an average of 14.4 training trials (range, 12 to 17); he responded with a percent correct average of 97.2% (range, 89% to 100%) and incorrectly responded or required prompts during an average of 2.8% (range, 3% to 11%) of trials. During VBA receptive operant training trial sessions 21 to 27, Bill received an average of 10.1 training trials (range, 6 to 14); he responded with a percent correct average of 99.6%
(range, 97% to 100%) and incorrectly responded or required prompts during an average of 0.6% (range, 0% to 3%) of trials. Following VBA operant training trial session 27, Bill had three consecutive VBA tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 VBA targets.
Figure 4.5. Percent of Correct and Incorrect Responding During Lovaas Method Training Trials, for Bill
Figure 4.6. Percent of Correct and Incorrect Responding During Verbal Behavior Approach Training Trials, for Bill
Lovaas Method Efficiency. The data analyzed to determine the efficiency of the Lovaas Method (LovM) are displayed in Table 4.1, and the LovM and Verbal Behavior Approach comparison data are illustrated in Figures 1.6—1.9. To reach mastery criteria for all 10 LovM targets, Bill required 1143 total training trials with an average of 114 training trials per target (range, 75 to 160), and 88 total training trial sessions with an average of 8.8 sessions per target (range, 7 to 12). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 LovM targets required an average percent of total trials of 10% (7% to 14%). For the 10 LovM targets to reach mastery criterion, a maximum amount of total instruction time of 880 minutes were required, with an average of 88 min per target (range, 60 min to 120 min).

<table>
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<tr>
<th>Targets</th>
<th>TT to Cr</th>
<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
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<tbody>
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<td>1. Community</td>
<td>160</td>
<td>12</td>
<td>14</td>
<td>120</td>
</tr>
<tr>
<td>2. Art</td>
<td>124</td>
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<td>11</td>
<td>80</td>
</tr>
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<td>3. Sensory</td>
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<td>100</td>
</tr>
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<td>4. Grooming</td>
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<td>12</td>
<td>100</td>
</tr>
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<td>5. Leisure</td>
<td>75</td>
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<td>12</td>
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<td>6. Bus</td>
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</table>

TT to Cr: Number of training trials to reach mastery criterion
Ses to Cr: Number of training trial sessions to reach mastery criterion
% of Trials: The per target percent of total trials
Time: Amount of instruction time required to criterion reach mastery criterion

Table 4.1. Lovaas Method Efficiency Data, for Bill
Verbal Behavior Approach Efficiency. The data analyzed to determine the efficiency of the Verbal Behavior Approach (VBA) are displayed in Table 4.2, and the Lovaas Method and VBA comparison data are illustrated in Figures 1.6—1.9. To reach mastery criteria for all 10 VBA targets, John required 535 total training trials with an average of 53.5 training trials per target (range, 17 to 131), and 37 total training trial sessions with an average of 3.7 sessions per target (range, 2 to 8). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 VBA targets required an average percent of total trials of 9.8% (range, 3% to 24%). For the 10 VBA targets to reach mastery criterion, a maximum amount of total instruction time of 370 minutes were required, with an average of 37 min per target (range, 20 min to 80 min).

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<thead>
<tr>
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<th>TT to Cr</th>
<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
</tr>
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<td>2. Lunch</td>
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<td>3</td>
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<td>30</td>
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<td>3. Music</td>
<td>72</td>
<td>4</td>
<td>13</td>
<td>40</td>
</tr>
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<td>4. A.P.E</td>
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<td>40</td>
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<td>5. Library</td>
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<td>13</td>
<td>40</td>
</tr>
<tr>
<td>6. Bathroom</td>
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<td>7. Green</td>
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<td>40</td>
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<td>8. All</td>
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<td>7</td>
<td>30</td>
</tr>
<tr>
<td>9. Red</td>
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<td>3</td>
<td>20</td>
</tr>
<tr>
<td>10. Good</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>20</td>
</tr>
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<td>370</td>
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</tr>
</tbody>
</table>

TT to Cr: Number of training trials to reach mastery criterion  
Ses to Cr: Number of training trial sessions to reach mastery criterion  
% of Trials: The per target percent of total trials  
Time: Amount of instruction time required to criterion reach mastery criterion

Table 4.2. Verbal Behavior Approach Efficiency Data, for Bill
Figure 4.7. Number of Training Trials for Lovaas Method and Verbal Behavior Approach, for Bill
Figure 4.8. Number of Sessions for Lovaas Method and Verbal Behavior Approach, for Bill
Figure 4.9. Percent of Total Trials for Lovaas Method and Verbal Behavior Approach, for Bill
Figure 4.10. Amount of Instruction Time for Lovaas Method and Verbal Behavior Approach, for Bill
Maintenance and Generalization. Figures 4.11, 4.12, and 4.13 display the maintenance and generalization results for Lovaas Method (LovM) receptive operant probe sessions, Verbal Behavior Approach (VBA) receptive operant probe sessions, and VBA tact operant probe sessions, respectively. In the maintenance and generalization phase during LovM receptive operant probe sessions 34 to 37, Bill labeled all 10 of the LovM targets with 100% accuracy. During LovM receptive operant probe sessions 38 to 41, Bill accurately labeled an average of 9.8 targets (range, 9 to 10) with setting generalization being assessed during session 39 and stimulus generalization being assessed during session 40.

In the maintenance and generalization phase, during VBA receptive operant probe sessions 34 to 37, Bill labeled all 10 of the VBA targets with 100% accuracy. During VBA receptive operant probe sessions 38 to 41, Bill accurately labeled an average of 9.8 targets (range, 9 to 10) with setting generalization assessed during session 39 and 39 and stimulus generalization assessed during session 40. During Verbal Behavior Approach (VBA) receptive operant probe sessions 20 to 24, Bill accurately labeled an average of 9.6 targets (range, 8 to 10) with stimulus generalization assessed during session 23. During VBA receptive operant probe sessions 25 to 28, Bill labeled all 10 of the VBA targets with 100% accuracy with setting generalization assessed during session 25 and 28. During VBA receptive operant probe sessions 29 to 33, Bill accurately labeled an average of 9.8 targets (range, 9 to 10) with stimulus generalization assessed during session 32.
In the maintenance and generalization phase, during VBA tact operant probe sessions 20 to 24, Bill tacked all 10 of the VBA targets with 100% accuracy with stimulus generalization assessed during session 23. During VBA tact operant probe sessions 25 to 28, Bill accurately tacted an average of 9.8 targets (range, 9 to 10) with setting generalization assessed during session 25 and 28. During VBA tact operant probe sessions 29 to 33, Bill accurately tacted an average of 9.6 targets (range, 8 to 10) with stimulus generalization assessed during session 32.
Figure 4.11. Maintenance and Generalization for Lovaas Method Receptive Operant Probe Sessions, for Bill.
Figure 4.12. Maintenance and Generalization for Verbal Behavior Approach Receptive Operant Probe Sessions, for Bill
Figure 4.13. Maintenance and Generalization for Verbal Behavior Approach Tact Operant Probe Sessions, for Bill
Tim

_Lovaas Method Probe Sessions._ During baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, data were collected over three sessions. Tim did not receptively label or tact any of the 10 LovM targets. Therefore, following LovM probe session three, with zero trend and stable responding, receptive operant training trial phase commenced for the initial five LovM targets.

During LovM receptive operant probe sessions 4 to 8, Tim accurately labeled an average of 1.2 targets (range, 0 to 2). During LovM receptive operant probe sessions 9 to 13, Tim accurately labeled an average of 4.8 targets (range, 4 to 5). By LovM receptive operant probe session 12, Tim had three consecutive sessions with 100% accuracy, met receptive mastery criteria for the initial five LovM targets, and began tact operant training on the initial five LovM targets. However, between session 13 and 14, due to an extended break in his school/treatment calendar, Tim received booster sessions. Booster sessions consisted of providing instruction to get previously trained operants back to pre-break performance levels. During LovM receptive operant probe sessions 14 to 17, Tim receptively labeled the initial five LovM targets with 100% accuracy while receiving tact training. During LovM receptive operant probe sessions 18 to 22, Tim accurately labeled an average of 9.0 targets (range, 7 to 10). During LovM receptive operant probe sessions 22, Tim receptively labeled all 10 targets over three consecutive sessions with 100% accuracy; therefore, he met mastery criteria for all receptive operant LovM targets and began tact operant training on the final five LovM targets.
During LovM tact operant probe sessions 4 to 8, while receiving receptive operant training for the initial five targets, Tim tacted an average of 0.2 targets (range, 0 to 1) without explicit tact instruction. During LovM tact operant probe sessions 9 to 13, Tim accurately tacted an average of 1.2 targets (range, 1 to 2). However, during LovM receptive operant probe session 12, Tim met criteria to begin explicit tact training on the initial five LovM targets. Between session 13 and 14, due to an extended break in his school/treatment calendar, Tim received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During LovM tact operant probe sessions 14 to 19, Tim accurately tacted an average of 4.0 targets (range, 2 to 5). By session 19, Tim had three consecutive sessions with 100% accuracy, met tact mastery criteria for the initial five LovM targets, and began receptive operant training on the final five LovM targets. During LovM tact operant probe sessions 20 to 22, Tim accurately tacted the initial five LovM targets with 100% accuracy. During LovM tact operant probe sessions 23 to 26, Tim accurately tacted an average of 6.3 targets (range, 5 to 8). During LovM tact operant probe sessions 27 to 30, Tim accurately tacted an average of 9.8 targets (range, 9 to 10). By session 30, Tim had three consecutive sessions with 100% accuracy, met tact mastery criteria for the final five LovM targets; and therefore, met mastery criteria for all tact operant LovM targets.

_Please note the logical flow of the following text._

**Verbal Behavior Approach Probe Sessions.** During baseline phase for Verbal Behavior Approach (VBA) receptive operant probe and tact operant probe sessions, data were collected over three sessions. Tim did not receptively label or tact any of the 10
VBA targets. Therefore, with zero trend and stable responding, the training trial phase was initiated following VBA probe session three.

During VBA receptive operant probe sessions 4 to 7, Tim accurately labeled an average of 1.3 targets (range, 1 to 2). During VBA receptive operant probe sessions 8 to 10, Tim accurately labeled an average of 3.7 targets (range, 3 to 5). During VBA receptive operant probe sessions 11 to 13, Tim accurately labeled an average of 5.7 targets (range, 5 to 7). Between session 13 and 14, due to an extended break in his school/treatment calendar, Tim received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During VBA receptive operant probe sessions 14 to 19, Tim accurately labeled an average of 8.8 targets (range, 7 to 10). By session 18, Tim had three consecutive sessions with 100% accuracy and met receptive operant mastery criteria for all VBA targets.

During VBA tact operant probe sessions 4 to 7, Tim accurately tacted an average of 1.7 targets (range, 1 to 2). During VBA tact operant probe sessions 8 to 10, Tim accurately tacted an average of 4.0 targets (range, 3 to 5). During VBA tact operant probe sessions 11 to 13, Tim accurately tacted an average of 5.3 targets (range, 5 to 6). Between session 13 and 14, due to an extended break in his school/treatment calendar, Tim received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During VBA tact operant probe sessions 14 to 19, Tim accurately tacted an average of 8.7 targets (range, 6 to 10). During session 18, Tim had three consecutive sessions with 100% accuracy and met tact operant mastery criteria for all VBA targets.
Figure 4.14. Frequency of Corrects for Lovaas Method and Verbal Behavior Approach Receptive Operant Probe Sessions, for Tim
Figure 4.15. Frequency of Corrects for Lovaas Method and Verbal Behavior Approach Tact Operant Probe Sessions, for Tim
Figure 4.16. Frequency of Corrects for Lovaas Method Specific Probes, for Tim
Figure 4.17. Frequency of Corrects for Verbal Behavior Approach Specific Probes, for Tim
**Lovaas Method Training Trial Sessions.** Following the baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, the training trial phase for the 10 LovM targets began with receptive then tact instruction on the initial five targets followed by receptive then tact instruction on the final five targets. During LovM operant training trial sessions 1 to 9, Tim received an average of 11.4 training trials (range, 6 to 17); he responded with a percent correct average of 58.6% (range, 47% to 77%) and incorrectly responded or required prompts during an average of 41.4% (range, 23% to 53%) of trials. During LovM operant training trial sessions 10 to 20, Tim received an average of 11.5 training trials (range, 6 to 17); he responded with a percent correct average of 78.5% (range, 58% to 100%) and incorrectly responded or required prompts during an average of 21.5% (range, 0% to 42%) of trials. Between session 20 and 21, due to an extended break in his school/treatment calendar, Tim received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During LovM operant training trial sessions 21 to 30, Tim received an average of 13.0 training trials (range, 11 to 17); he responded with a percent correct average of 69.8% (range, 50% to 100%) and incorrectly responded or required prompts during an average of 30.2% (range, 0% to 50%) of trials. During LovM operant training trial sessions 31 to 38, Tim received an average of 11.5 training trials (range, 10 to 14); he responded with a percent correct average of 81.2% (range, 58% to 100%) and incorrectly responded or required prompts during an average of 18.8% (range, 0% to 42%) of trials. Following LovM operant training trial session 38, Tim had three
consecutive LovM tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 LovM targets.

Verbal Behavior Approach Training Trial Sessions. Following the baseline phase for Verbal Behavior Approach (VBA) receptive and tact operant probe sessions, the training trial phase for the 10 VBA targets began with same-trial receptive and tact instruction (i.e., transfer trials across operants) for each target. During VBA operant (receptive and tact) training trial sessions 1 to 5, Tim received an average of 11.8 training trials (range, 9 to 12); he responded with a percent correct average of 84.2% (range, 82% to 97%) and incorrectly responded or required prompts (or additional presentation of the antecedent stimuli) during an average of 15.8% (range, 3% to 31%) of trials. During VBA operant training trial sessions 6 to 10, Tim received an average of 10.2 training trials (range, 6 to 14); he responded with a percent correct average of 84.8% (range, 78% to 90%) and incorrectly responded or required prompts during an average of 15.2% (range, 10% to 22%) of trials. During VBA operant training trial sessions 11 to 15, Tim received an average of 12.0 training trials (range, 11 to 13); he responded with a percent correct average of 88.8% (range, 83% to 94%) and incorrectly responded or required prompts during an average of 12.0% (range, 6% to 17%) of trials. During VBA operant training trial sessions 16 to 19, Tim received an average of 11.8 training trials (range, 9 to 14); he responded with a percent correct average of 95.3% (range, 88% to 100%) and incorrectly responded or required prompts during an average of 5.0% (range, 0% to 13%) of trials. Between session 19 and 20, due to an extended break in his school/treatment calendar, Tim received booster sessions; which consisted of providing instruction to get
previously trained operants back to pre-break performance levels. During VBA receptive operant training trial sessions 20 to 25, Tim received an average of 10.2 training trials (range, 6 to 12); he responded with a percent correct average of 91.8% (range, 83% to 100%) and incorrectly responded or required prompts during an average of 8.2% (range, 0% to 17%) of trials. Following VBA operant training trial session 25, Tim had three consecutive VBA tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 VBA targets.
Figure 4.18. Percent of Correct and Incorrect Responding During Lovaas Method Training Trials, for Tim
Figure 4.19. Percent of Correct and Incorrect Responding During Verbal Behavior Approach Training Trials, for Tim
**Lovaas Method Efficiency.** The data analyzed to determine the efficiency of the Lovaas Method (LovM) are displayed in Table 4.3, and the LovM and Verbal Behavior Approach comparison data are illustrated in Figures 2.6─2.9. To reach mastery criteria for all 10 LovM targets, Tim required 504 total training trials with an average of 50.4 training trials per target (range, 23 to 80), and 42 total training trial sessions with an average of 4.2 sessions per target (range, 2 to 6). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 LovM targets required an average percent of total trials of 10.2% (5% to 16%). For the 10 LovM targets to reach mastery criterion, a maximum amount of total instruction time of 420 minutes were required, with an average of 42 min per target (range, 20 min to 60 min).

<table>
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<th>Targets</th>
<th>TT to Cr</th>
<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
</tr>
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<td>2. Art</td>
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<td>13</td>
<td>60</td>
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<td>3. Sensory</td>
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<td>10</td>
<td>40</td>
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<tr>
<td>4. Grooming</td>
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<td>4</td>
<td>11</td>
<td>40</td>
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<tr>
<td>5. Leisure</td>
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<td>10</td>
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<tr>
<td>6. Bus</td>
<td>80</td>
<td>6</td>
<td>16</td>
<td>60</td>
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<td>7. Story</td>
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<td>8. Boy</td>
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<td>30</td>
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<td>9. Play</td>
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<td>10. Blue</td>
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<td>Totals</td>
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</table>

**TT to Cr:** Number of training trials to reach mastery criterion  
**Ses to Cr:** Number of training trial sessions to reach mastery criterion  
**% of Trials:** The per target percent of total trials  
**Time:** Amount of instruction time required to criterion reach mastery criterion

Table 4.3. Lovaas Method Efficiency Data, for Tim
Verbal Behavior Approach Efficiency. The data analyzed to determine the efficiency of the Verbal Behavior Approach (VBA) are displayed in Table 4.4, and the Lovaas Method and VBA comparison data are illustrated in Figures 2.6—2.9. To reach mastery criteria for all 10 VBA targets, Tim required 328 total training trials with an average of 32.8 training trials per target (range, 6 to 50), and 29 total training trial sessions with an average of 2.7 sessions per target (range, 1 to 4). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 VBA targets required an average percent of total trials of 10.1% (range, 2% to 15%). For the 10 VBA targets to reach mastery criterion, a maximum amount of total instruction time of 290 minutes were required, with an average of 29 min per target (range, 10 min to 40 min).

<table>
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<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
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<td>1. Music</td>
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<td>41</td>
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<td>40</td>
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<td>4. A.P.E</td>
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<td>40</td>
</tr>
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<td>5. Library</td>
<td>45</td>
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<td>6. Bathroom</td>
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<td>7. All</td>
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<td>6</td>
<td>20</td>
</tr>
<tr>
<td>8. Green</td>
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<td>20</td>
</tr>
<tr>
<td>9. Red</td>
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<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>10. Good</td>
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<td>10</td>
</tr>
<tr>
<td>Totals</td>
<td>328</td>
<td>29</td>
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<td>290</td>
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</table>

TT to Cr: Number of training trials to reach mastery criterion  
Ses to Cr: Number of training trial sessions to reach mastery criterion  
% of Trials: The per target percent of total trials  
Time: Amount of instruction time required to criterion reach mastery criterion

Table 4.4. Verbal Behavior Approach Efficiency Data, for Tim
Figure 4.20. Number of Training Trials for Lovaas Method and Verbal Behavior Approach, for Tim
Figure 4.21. Number of Sessions for Lovaas Method and Verbal Behavior Approach, for Tim
Figure 4.22. Percent of Total Trials for Lovaas Method and Verbal Behavior Approach, for Tim
Figure 4.23. Amount of Instruction Time for Lovaas Method and Verbal Behavior Approach, for Tim
Maintenance and Generalization. Figures 4.24, 4.25, and 4.26 display the maintenance and generalization results for Lovaas Method (LovM) receptive operant probe sessions, Verbal Behavior Approach (VBA) receptive operant probe sessions, and VBA tact operant probe sessions, respectively. In the maintenance and generalization phase during LovM receptive operant probe sessions 31 to 35, Tim accurately labeled an average of 9.8 targets (range, 9 to 10) with setting generalization assessed during session 34. During LovM receptive operant probe sessions 36 to 39, Tim accurately labeled an average of 9.5 targets (range, 9 to 10) with stimulus generalization assessed during session 37 and setting generalization assessed during session 39. During LovM tact operant probe sessions 31, Tim accurately tacted 9 of the 10 LovM targets with 100% accuracy while setting generalization was assessed.

In the maintenance and generalization phase, during VBA receptive operant probe sessions 20 to 25, Tim accurately labeled an average of 9.7 targets (range, 9 to 10) with setting generalization assessed during session 22 and 25 and stimulus generalization assessed during session 23 and 24. During VBA receptive operant probe sessions 26 to 31, Tim accurately labeled an average of 9.2 targets (range, 7 to 10) with setting generalization assessed during session 31.

In the maintenance and generalization phase, during VBA tact operant probe sessions 20 to 25, Tim accurately tacted an average of 9.7 targets (range, 9 to 10) with setting generalization assessed during session 22 and 25 and stimulus generalization assessed during session 23 and 24. During VBA tact operant probe sessions 26 to 31, Tim
accurately tacted an average of 9.8 targets (range, 9 to 10) with setting generalization assessed during session 31.
Figure 4.24. Maintenance and Generalization for Lovaas Method Receptive Operant Probe Sessions, for Tim
Figure 4.25. Maintenance and Generalization for Verbal Behavior Approach Receptive Operant Probe Sessions, for Tim
Figure 4.26. Maintenance and Generalization for Verbal Behavior Approach Tact Operant Probe Sessions, for Tim
John

*Lovaas Method Probe Sessions.* During baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, data were collected over three sessions. John did not receptively label or tact any of the 10 LovM targets. Therefore, following LovM probe session three, with zero trend and stable responding, receptive operant training trial phase commenced for the initial five LovM targets.

During LovM receptive operant probe sessions 4 to 6, John accurately labeled an average of 1.3 targets (range, 0 to 3). During LovM receptive operant probe sessions 7 to 10, John accurately labeled an average of 4.8 targets (range, 4 to 5). By LovM receptive operant probe session 10, John had three consecutive sessions with 100% accuracy, met receptive mastery criteria for the initial five LovM targets, and began tact operant training on the initial five LovM targets. During LovM receptive operant probe sessions 11 to 15, John receptively labeled the initial five LovM targets with 100% accuracy while receiving tact training. During LovM receptive operant probe sessions 16 to 19, John accurately labeled an average of 9.3 targets (range, 7 to 10). During LovM receptive operant probe sessions 19, John receptively labeled all 10 targets over three consecutive sessions with 100% accuracy; therefore, he met mastery criteria for all receptive operant LovM targets and began tact operant training on the final five LovM targets.

During LovM tact operant probe sessions 4 to 10, while receiving receptive operant training for the initial five targets, John did not accurately tact any targets; however, during LovM receptive operant probe session 10, John met criteria to begin explicit tact training on the initial five LovM targets. Therefore, during LovM tact
operant probe sessions 11 to 15, John accurately tacted an average of 4.2 targets (range, 2 to 5). By session 15, John had three consecutive sessions with 100% accuracy, met tact mastery criteria for the initial five LovM targets, and began receptive operant training on the final five LovM targets. During LovM tact operant probe sessions 16 to 19, John accurately tacted the initial five LovM targets plus one of the final five LovM targets (i.e., 6 targets) with 100% accuracy. During LovM receptive operant probe session 19, John met criteria to begin explicit tact training on the initial five LovM targets. During LovM tact operant probe sessions 20 to 21, John accurately tacted an average of 9.0 targets (range, 8 to 10). However, between session 21 and 22, due to an extended break in his school/treatment calendar, John received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During LovM tact operant probe sessions 22 to 23, John accurately tacted all LovM targets with 100% accuracy; in addition, by session 23, John had three consecutive sessions with 100% accuracy, met tact mastery criteria for the final five LovM targets and mastery criteria for all tact operant LovM targets.

*Verbal Behavior Approach Probe Sessions.* During baseline phase for Verbal Behavior Approach (VBA) receptive operant probe and tact operant probe sessions, data were collected over three sessions. John did not receptively label or tact any of the 10 VBA targets. Therefore, with zero trend and stable responding, the training trial phase was initiated following VBA probe session three.

During VBA receptive operant probe sessions 4 to 6, John accurately labeled an average of 1.3 targets (range, 0 to 3). During VBA receptive operant probe sessions 7 to
10, John accurately labeled an average of 4.8 targets (range, 4 to 5). During VBA receptive operant probe sessions 11 to 13, John accurately labeled an average of 5.7 targets (range, 5 to 7). Between session 13 and 14, due to an extended break in his school/treatment calendar, John received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During VBA receptive operant probe sessions 14 to 19, John accurately labeled an average of 8.8 targets (range, 7 to 10). By session 18, John had three consecutive sessions with 100% accuracy and met receptive operant mastery criteria for all VBA targets.

During VBA tact operant probe sessions 4 to 7, John accurately tacted an average of 1.7 targets (range, 1 to 2). During VBA tact operant probe sessions 8 to 10, John accurately tacted an average of 4.0 targets (range, 3 to 5). During VBA tact operant probe sessions 11 to 13, John accurately tacted an average of 5.3 targets (range, 5 to 6). Between session 13 and 14, due to an extended break in his school/treatment calendar, John received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During VBA tact operant probe sessions 14 to 19, John accurately tacted an average of 8.7 targets (range, 6 to 10). During session 18, John had three consecutive sessions with 100% accuracy and met tact operant mastery criteria for all VBA targets.
Figure 4.27. Frequency of Corrects for Lovaas Method and Verbal Behavior Approach Receptive Operant Probe Sessions, for John
Figure 4.28. Frequency of Corrects for Lovaas Method and Verbal Behavior Approach Tact Operant Probe Sessions, for John
Figure 4.29. Frequency of Corrects for Lovaas Method Specific Probes, for John
Figure 4.30. Frequency of Corrects for Verbal Behavior Approach Specific Probes, for John
**Lovaas Method Training Trials Sessions.** Following the baseline phase for Lovaas Method (LovM) receptive and tact operant probe sessions, the training trial phase for the 10 LovM targets began with receptive then tact instruction on the initial five targets followed by receptive then tact instruction on the final five targets. During LovM operant training trial sessions 1 to 10, John received an average of 12.7 training trials (range, 8 to 17); he responded with a percent correct average of 75.6% (range, 31% to 100%) and incorrectly responded or required prompts during an average of 24.6% (range, 0% to 69%) of trials. During LovM operant training trial sessions 11 to 20, John received an average of 11.5 training trials (range, 7 to 15); he responded with a percent correct average of 78.1% (range, 64% to 100%) and incorrectly responded or required prompts during an average of 21.8% (range, 0% to 36%) of trials. During LovM operant training trial sessions 21 to 27, John received an average of 8.7 training trials (range, 6 to 13); he responded with a percent correct average of 87.9% (range, 56% to 100%) and incorrectly responded or required prompts during an average of 12.1% (range, 0% to 44%) of trials. Between session 27 and 28, due to an extended break in his school/treatment calendar, John received booster sessions; which consisted of providing instruction to get previously trained operants back to pre-break performance levels. During LovM operant training trial sessions 28 to 30, John received an average of 14.7 training trials (range, 13 to 16); he responded with a percent correct average of 71.7% (range, 60% to 92%) and incorrectly responded or required prompts during an average of 28.7% (range, 8% to 40%) of trials. Following LovM operant training trial session 30, John had three
consecutive LovM tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 LovM targets.

**Verbal Behavior Approach Training Trial Sessions.** Following the baseline phase for Verbal Behavior Approach (VBA) receptive and tact operant probe sessions, the training trial phase for the 10 VBA targets began with same-trial receptive and tact instruction (i.e., transfer trials across operants) for each target. During VBA operant (receptive and tact) training trial sessions 1 to 5, John received an average of 13.8 training trials (range, 13 to 15); he responded with a percent correct average of 95.8% (range, 94% to 100%) and incorrectly responded or required prompts (or additional presentation of the antecedent stimuli) during an average of 4.2% (range, 0% to 6%) of trials. During VBA operant training trial sessions 6 to 10, John received an average of 12.8 training trials (range, 11 to 15); he responded with a percent correct average of 95.4% (range, 89% to 100%) and incorrectly responded or required prompts during an average of 4.6% (range, 0% to 11%) of trials. During VBA operant training trial sessions 11 to 15, John received an average of 10.0 training trials (range, 6 to 14); he responded with a percent correct average of 98.0% (range, 90% to 100%) and incorrectly responded or required prompts during an average of 2.0% (range, 0% to 10%) of trials. During VBA operant training trial sessions 16 to 18, John received an average of 13.3 training trials (range, 12 to 15); he responded with a percent correct average of 98.0% (range, 94% to 100%) and incorrectly responded or required prompts during an average of 2.0% (range, 0% to 6%) of trials. Following VBA operant training trial session 18, John had three
consecutive VBA tact operant probes sessions with 100% accuracy and met mastery criteria for all 10 VBA targets.
Figure 4.31. Percent of Correct and Incorrect Responding During Lovaas Method Training Trials, for John
Figure 4.32. Percent of Correct and Incorrect Responding During Verbal Behavior Approach Training Trials, for John
Lovaas Method Efficiency. The data analyzed to determine the efficiency of the Lovaas Method (LovM) are displayed in Table 4.5, and the LovM and Verbal Behavior Approach comparison data are illustrated in Figures 3.6—3.9. To reach mastery criteria for all 10 LovM targets, John required 420 total training trials with an average of 42 training trials per target (range, 17 to 73), and 38 total training trial sessions with an average of 3.8 sessions per target (range, 2 to 6). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 LovM targets required an average percent of total trials of 9.9% (range, 4% to 17%). For the 10 LovM targets to reach mastery criterion, a maximum amount of total instruction time of 380 minutes were required, with an average of 38 min per target (range, 20 min to 60 min).

<table>
<thead>
<tr>
<th>Targets</th>
<th>TT to Cr</th>
<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Art</td>
<td>44</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>2. APE</td>
<td>46</td>
<td>3</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>3. Music</td>
<td>57</td>
<td>5</td>
<td>14</td>
<td>50</td>
</tr>
<tr>
<td>4. Special</td>
<td>31</td>
<td>3</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td>5. Library</td>
<td>47</td>
<td>5</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>6. bathroom</td>
<td>62</td>
<td>6</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>7. all</td>
<td>17</td>
<td>2</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>8. green</td>
<td>26</td>
<td>3</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>9. red</td>
<td>17</td>
<td>2</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>10. good</td>
<td>73</td>
<td>6</td>
<td>17</td>
<td>60</td>
</tr>
<tr>
<td>Totals</td>
<td>420</td>
<td>38</td>
<td></td>
<td>380</td>
</tr>
</tbody>
</table>

TT to Cr: Number of training trials to reach mastery criterion  
Ses to Cr: Number of training trial sessions to reach mastery criterion  
% of Trials: The per target percent of total trials

Table 4.5. Lovaas Method Efficiency Data, for John
Verbal Behavior Approach Efficiency. The data analyzed to determine the efficiency of the Verbal Behavior Approach (VBA) are displayed in Table 4.6, and the Lovaas Method and VBA comparison data are illustrated in Figures 3.6—3.9. To reach mastery criteria for all 10 VBA targets, John required 236 total training trials with an average of 23.6 training trials per target (range, 12 to 54), and 19 total training trial sessions with an average of 1.9 sessions per target (range, 1 to 5). The percent of trials was identified by dividing the number of training trials to criterion by the total number of training trials to criterion and multiplying by 100%. The 10 VBA targets required an average percent of total trials of 10.1% (range, 5% to 23%). For the 10 VBA targets to reach mastery criterion, a maximum amount of total instruction time of 190 minutes were required, with an average of 19 min per target (range, 10 min to 50 min).

<table>
<thead>
<tr>
<th>Targets</th>
<th>TT to Cr</th>
<th>Ses to Cr</th>
<th>% of Trials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Community</td>
<td>27</td>
<td>2</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2. Lunch</td>
<td>14</td>
<td>1</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>3. Sensory</td>
<td>13</td>
<td>1</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>4. Grooming</td>
<td>30</td>
<td>2</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>5. Leisure</td>
<td>12</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6. Bus</td>
<td>13</td>
<td>1</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>7. Story</td>
<td>13</td>
<td>1</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>8. Boy</td>
<td>24</td>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>9. Play</td>
<td>36</td>
<td>3</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>10. Blue</td>
<td>54</td>
<td>5</td>
<td>23</td>
<td>50</td>
</tr>
<tr>
<td>Totals</td>
<td>236</td>
<td>19</td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>

TT to Cr: Number of training trials to reach mastery criterion  
Ses to Cr: Number of training trial sessions to reach mastery criterion  
% of Trials: The per target percent of total trials  
Time: Amount of instruction time required to criterion reach mastery criterion

Table 4.6. Verbal Behavior Approach Efficiency Data, for John
Figure 4.33. Number of Training Trials for Lovaas Method and Verbal Behavior Approach, for John
Figure 4.34. Number of Sessions for Lovaas Method and Verbal Behavior Approach, for John
Figure 4.35. Percent of Total Trials for Lovaas Method and Verbal Behavior Approach, for John
Figure 4.36. Amount of Instruction Time for Lovaas Method and Verbal Behavior Approach, for John
Maintenance and Generalization. Figures 4.37, 4.38, 4.39, and 4.40 display the maintenance and generalization results for Lovaas Method (LovM) receptive operant probe sessions, LovM tact operant probe sessions, Verbal Behavior Approach (VBA) receptive operant probe sessions, and VBA tact operant probe sessions, respectively. In the maintenance and generalization phase, during Lovaas Method (LovM) receptive operant probe sessions 20 to 21, John accurately labeled all 10 of the LovM targets with 100% accuracy with setting generalization assessed during session 21. During Lovaas Method (LovM) tact operant probe session 24, John accurately tacted all 10 LovM targets with 100% accuracy while setting generalization was assessed.

In the maintenance and generalization phase, during Verbal Behavior Approach (VBA) receptive operant probe sessions 14 to 17, accurately labeled all 10 VBA targets with 100% accuracy with setting generalization assessed during session 17. During VBA receptive operant probe sessions 18 to 20, John accurately labeled an average of 8.7 targets (range, 7 to 10). In the maintenance and generalization phase, during Verbal Behavior Approach (VBA) tact operant probe sessions 14 to 20, John accurately tacted all 10 VBA targets with 100% accuracy with setting generalization assessed during session 17.
Figure 4.37. Maintenance and Generalization of Lovaas Method Receptive Operant Probe Sessions, for John
Figure 4.38. Maintenance and Generalization of Lovaas Method Tact Operant Probe Sessions, for John
Figure 4.39. Maintenance and Generalization of Verbal Behavior Approach Receptive Operant Probe Sessions, for John
Figure 4.40. Maintenance and Generalization of Verbal Behavior Approach Tact Operant Probe Sessions, for John
Social Validity

Following the completion of the investigation, questionnaires using a 5-point Likert scale were given to participants’ educational staff to measure the social validity of the goals, procedures, and effects of the intervention. See Table 4.7 for a summary of the social validity data. Analysis of the eight completed questionnaires indicated that six (75%) consumers surveyed identified the intervention’s goals, procedures, and results as completely satisfactory and the remaining two (25%) identified the intervention’s goals, procedures, and results as mostly satisfactory. Although, two (25%) respondents indicated that they had very little confidence and two (25%) respondents indicated that they had neutral confidence in being able to independently implement the procedures for the Verbal behavior Approach (VBA), all respondents (100%) recommended the intervention for other students and indicated anecdotally a willingness to learn the VBA protocol.

<table>
<thead>
<tr>
<th>Summarized Questions</th>
<th>Not at All</th>
<th>Very Little</th>
<th>Neutral</th>
<th>Mostly</th>
<th>Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with the goals</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Satisfaction with the procedures</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Satisfaction with the results</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Overall, satisfaction</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Procedures viewed as acceptable</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>Confidence in implementing</td>
<td>13%</td>
<td>25%</td>
<td>25%</td>
<td>38%</td>
<td>0%</td>
</tr>
<tr>
<td>Implement with other students</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Recommend the techniques</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>13%</td>
<td>88%</td>
</tr>
</tbody>
</table>

Table 4.7. Summary of Social Validity Data
Although each participant was described by educational staff as a student that frequently display challenging behavior, the participants displayed little to no challenging behavior during intervention sessions. On occasion, when retrieving a participant to run sessions, a participant that was not retrieved would engage in challenging behaviors. For example, if the researcher went to the general classroom to work with Tim, John would indicate that he wanted to go, and after being told that it was not his turn, he would protest (e.g., attempting to leave the room, yelling, ripping worksheets, etc.). The most frequent challenging behavior displayed during intervention sessions was refusing to go back to the general classroom after the intervention session had concluded.
Chapter 5: Discussion

This investigation focused on two behavior-based language development models: the Lovaas Method (LovM) and the Verbal Behavior Approach (VBA). Both models build meaningful repertoires and reduce challenging behaviors by addressing all areas of deficit and progressively building skills and teaching socially appropriate repertoires. Both models promote active learning by providing multiple opportunities to respond, and they both make use of data to plan and evaluate student progress toward skill mastery with an aim of skill maintenance and generalization. Both models are widely implemented, as an intervention for children with autism in particular. Both models share some similarities; however, there are some important differences. The purpose of this dissertation was to (a) review experimental studies implementing the LovM, (b) review experimental studies employing VBA and/or studies focusing on the primary verbal operants, and (c) conduct an empirical investigation comparing the effects of these two behavior-based language development models on the frequency of operants receptively mastered to criterion and the frequency of tact operants mastered to criterion, measures of efficiency, and the accuracy of responding during maintenance and generalization.
LovM is a fully comprehensive behavioral treatment for individuals with developmental disabilities. LovM suggests that language is first acquired receptively, and that receptive language repertoires (i.e., listener skills) should be used as a foundation for the development of expressive language skills (i.e., elementary verbal operants). Initial treatment sessions focus on setting up a structured teaching environment and establishing compliance, with early programming/instruction consisting of toy play, non-verbal imitation, matching, receptive labeling, and teaching learners to follow simple one-step instructions. LovM is based on over 40 years of research and development; in fact, mainstream media view LovM as the dominant treatment for autism spectrum disorder.

The review of LovM yielded 13 empirical studies, all published between 1999 and 2009. The 13 studies included 297 participants with developmental disabilities, the majority of whom were young male children/preschoolers diagnosed with autism spectrum disorders. The focus of these studies was (a) outcome effects of 2 to 3 years of LovM and its impact on change in participant IQ, adaptive behavior, and other skill domains; (b) comparison of treatment approaches; (c) instructor skill development and training; (d) and the practicality and efficiency of DTT procedures.

VBA is a fully comprehensive behavioral language-training curriculum for individuals with autism and other developmental disabilities that supplies educators with protocols, assessments, and progress-monitoring tools that can be used to develop individualized education programs. VBA can be described as an alternative to other behavior-based intervention models, namely the LovM (Carr & Firth, 2005). VBA focuses on the development of expressive language skills with early programming
centering on establishing rapport with a student through mand training and providing instruction on elementary verbal operants (i.e., mands, echoics, tacts, and intraverbals).

The review of VBA and the primary verbal operants yielded 39 empirical studies that included 116 participants with developmental disabilities. Although, all identified studies examined one or more of the primary verbal operants defined by Skinner (1957) and used one or more of the procedures recommended in Sundberg and Partington’s language training curriculum (1998), no studies empirically investigating the VBA could be identified.

In this investigation, targets from two categories were taught receptively to mastery criterion and then expressively to mastery criterion using LovM and different targets from the same two categories were trained using VBA, which included transfer trials across operants. The research questions addressed were (a) when measuring frequency of operants mastered to criterion, (b) when measuring efficiency, and (c) when measuring accuracy of responding during maintenance and generalization phases, how do the LovM and VBA compare?

This investigation compared the effects of LovM and VBA protocols on the frequency of operants receptively mastered to criterion and the frequency of tact operants mastered to criterion. The effect of LovM on Bill’s responding was that he required 25 probe sessions to reach mastery criterion for receptive operants and 33 probe sessions to met mastery criterion for tact operants. The effect of LovM on Tim’s responding was that he required 22 probe sessions to reach mastery criterion for receptive operants and 31 probe sessions to met mastery criterion for tact operants. The effect of LovM on John’s
responding was that he required 19 probe sessions to reach mastery criterion for receptive
operants and 23 probe sessions to met mastery criterion for tact operants. The effect of
VBA on Bill’s responding was that he required 19 probe sessions to reach mastery
criterion for receptive and tact operants. The effect of VBA on Tim’s responding was that
he required 19 probe sessions to reach mastery criterion for receptive and tact operants.
The effect of VBA on John’s responding was that he required 13 probe sessions to reach
mastery criterion for receptive and tact operants. In short, when compared to the LovM,
the VBA was 20%, 15%, and 16% more efficient in teaching these receptive and tact
operants for Bill, Tim, and John, respectively.

To compare the effects of the LovM and VBA instructional protocols on measure
of efficiency, we examined the difference between the total number of training trials, the
total number session, and the total amount of instructional time to reach mastery
criterion. To reach mastery criteria for all 10 LovM targets, Bill required 1143 training
trials, 88 training trial sessions, and 880 minutes of instruction time. To reach the mastery
criteria for all 10 LovM targets, Tim required 504 training trials, 42 training trial
sessions, and 420 minutes of instruction time. To reach mastery criteria for all 10 LovM
targets, John required 420 training trials, 38 training trial sessions, and 380 minutes of
instruction time. To reach mastery criteria for all 10 VBA targets, Bill required 535
training trials, 37 training trial sessions, and 370 minutes of instruction time. To reach
mastery criteria for all 10 VBA targets, Tim required 328 training trials, 29 training trial
sessions, and 290 minutes of instruction time. To reach mastery criteria for all 10 VBA
targets, John required 236 training trials, 19 training trial sessions, and 190 minutes of
instruction time. When compared with VBA, the LovM required 608 more training trials, 51 more training trial sessions, and 510 more minutes of instruction time for Bill; 176 more training trials, 13 more training trial sessions, and 130 more minutes of instruction time for Tim; and 184 more training trials, 19 more training trial sessions, and 190 more minutes of instruction time for John. In short, overall, the LovM required 968 more training trials, 83 more training trial sessions, and 830 more minutes of instruction time than VBA.

As previously mentioned, once a target met mastery criteria, explicit instruction on that particular target was terminated and it was placed into the maintenance and generalization phase. This study investigated how the two protocols compared in promotion of maintenance and generalization. In this investigation, the LovM and VBA were equally effective in maintaining skills over the relatively small period of this investigation. In addition, generalization (to a novel setting and trainer) probes of targets taught by either protocol demonstrated the LovM and VBA are similarly effective at facilitating skill generalization.

Implications

In this investigation, the LovM and VBA were each effective in teaching the receptive and tact operant targets. However, the results of this investigation suggest that VBA was the more efficient instructional protocol, particularly more efficient for teaching tact operants. To teach Bill, Tim, and John the 20 operant targets (receptive and tact), with all participants’ responding combined, the VBA required 968 less training trials, 83 less training trial sessions, and 830 less minutes of instruction time than the
LovM. Roughly speaking, this essentially means that with the VBA participants learned the receptive and tact operant targets a full month faster than they did when receiving instruction via the LovM. Just imagine what educators could do with an extra month worth of instruction time. In addition to enhanced efficiency, the VBA evoked more accurate responding, and resulted in fewer incorrect responses. Overall, when compared to LovM, VBA training trials resulted in 15.2%, 16.5%, and 17.9% less incorrect responding for Bill, Tim, and John, respectively.

In this investigation, VBA was found to be more effective, more efficient, and more likely to promote accurate responding. These results are due to significant differences between the two protocols investigated in this study. One difference between the two protocols is that VBA incorporates transfer trials across operants, and LovM employs a receptive-language first and expressive-language (i.e., verbal operants) second approach. Although both methods are effective, instruction that uses transfer trials across operants is more efficient. Barbera and Kubina (2005) used transfer trials across operants to quickly teach 30 tacts to a child with autism spectrum disorder (ASD). Arntzen and Almas (2002) used a transfer trials across operants procedure (i.e., a mand to tact transfer) to teach tacts of objects and letters to students with and without developmental disabilities. The Arntzen and Almas study demonstrated that transfer trials across operants procedure led to more rapid acquisition of tacts for all participants, regardless of diagnostic label. In addition, Drash, High, and Tudor (1999) used transfer trials across operants to produce mand, echoic, and tact repertoires in three children with ASD, aged 2
to 3 years old. Within 10 sessions, the participants developed echoic and tact repertoires and the authors reported a subsequent decrease in inappropriate vocalizations.

Another significant difference between the two protocols is that VBA incorporates errorless learning techniques, and LovM provides multiple opportunities to respond before a prompting stimulus is provided (i.e., a no-no-prompting sequence). Errorless learning, a procedure introduced by Terrace (1963), is a type of discrimination learning that decreases or eliminates the opportunity for incorrect responding and maximizes the possibility of a correct response. Specifically, errorless learning allows for learning to occur with few or no incorrect responses. Errorless learning is effective for several reasons. Errorless learning (a) minimizes the number of errors, (b) increases the overall time available for instruction, (c) reduces the likelihood that errors will be repeated in future trials, and (d) reduces frustration and the occurrence of inappropriate emotional behaviors by increasing opportunities for reinforcement (Barbera & Rasmussen, 2007; Cooper, Heron, & Heward, 2007; Greer & Ross, 2008; Heckaman, Alber, Hooper, & Heward, 1998; Touchette, & Howard, 1984; Sundberg & Partington, 1998). In errorless learning, children primarily learn the correct skill. That is, students make very few mistakes, and as a result, the students learn more efficiently because they do not learn an incorrect skill that will have to be corrected or re-taught later.

VBA training trials initiate with an immediate prompting stimulus, which facilitates accurate responding. On the other hand, LovM training trials provide students with opportunities to respond before providing a prompting stimulus, which may facilitate inaccurate responding, patterns of incorrect responding, and a thin schedule of
reinforcement that may result in the learning process being associated with aversive stimulation. For example, if a student is presented with 100 trials during a LovM session, each antecedent might be presented three times before the student’s responding is reinforced. If the student is responding incorrectly, this might result in responses contacting reinforcement during only 30% of the session. This means that the student could spend 70% of the LovM session incorrectly responding and being told “No.”

Often, practitioners work with students with developmental disabilities who present with language deficits; and in those learning environments, limitations in verbal abilities typically result in problematic and challenging behaviors. In learning environments, the challenging behavior displayed by students with developmental disabilities is often a function of escape from tasks; these tasks can be aversive due to their complexity and/or duration. With the errorless component of the VBA, however, tasks (i.e., learning receptive and tact operant targets) are simplified for students; in this investigation, VBA resulted in 85% more accurate responding, overall, than the LovM. Hypothetically, this means that the enhanced accuracy and decreased rates of failure associated with VBA could reduce student frustration with educational tasks, and therefore, lead to less challenging behavior within learning environments.

This investigation expanded the literature base in a few ways. First, the LovM investigations identified and reviewed in this study overwhelmingly included young/preschool male children diagnosed with autism spectrum disorder, evoking the question: Is the Lovaas Method effective for individuals of elementary age or older with developmental disabilities other than autism? The results of this investigation suggest that
the LovM is highly effective for young adolescent students with moderate-to-severe mental retardation/intellectual disabilities and other disorders. Second, the literature search conducted here could not identify any studies directly comparing LovM with another behavior-based intervention. This investigation directly compared the LovM with the VBA to determine which protocol was more efficient, thereby shedding light on an optimal practice for service providers. Finally, this investigation reported data regarding inter-observer agreement and the fidelity of experimenter behavior. Of the 52 studies identified and reviewed in this dissertation, less than 31% reported treatment integrity data. In fact, a 13-year-old quote still holds true, “few studies have reported any data about the competence of therapists, teachers, or trainers, or objectively verified information about what they actually did during sessions” (Lovaas, 1996, p.42).

Limitations

This project presents with several limitations. First, the results of this study represent the performance of only three participants. For a greater degree of external validity, systematic replications and empirical investigations with larger groups of participants are necessary. Second, due to the nature of the participants’ academic calendar, this investigation was conducted under intense time constraints. Time limitations combined with participant schedules mandated an extended break in intervention sessions, which resulted in the need for booster sessions. These booster sessions hinder the conclusions regarding maintenance of skills meeting mastery criteria. Third, as a measure of procedural efficiency, this investigation reported data regarding the amount of time (total and per target) needed to reach mastery criterion. This was
possible because intervention sessions had a 10 min cap. However, not all sessions actually lasted a full 10 min; during a few sessions, a schedule change and/or participant performance mandated that the session terminate prior to the 10 min mark. In addition, active student responding did not occur throughout the entire 10 min interval. Therefore, data regarding efficiency as it relates to time should be viewed as the maximum amount of instruction time required to meet mastery criteria. Finally, LovM and VBA are each fully comprehensive behavior-based curriculums. The protocols implemented in this investigation represent only components of each intervention. Therefore, the conclusions drawn from the results of this investigation should be limited to the precise components investigated.

Future Research

It is the recommendation of this author that future researchers address the aforementioned limitations by replicating this and similar investigations. Specifically, future research could systematically replicate this study with a larger group of participants. In addition, future researchers could compare the LovM and VBA protocols over longer investigative periods.

Future researchers could also investigate the protocols studied here and their effects on other operants. This investigation focused primarily on the development of tact repertoires; however, future researchers could study the effects of the LovM and VBA protocols on the development of intraverbal operants, or perhaps investigate an optimal practice for the development of autoclitic repertoires. Additionally, future researchers could examine what effects LovM and VBA have on participants’ in session off-task and
challenging behavior. It would be interesting to determine from the participant’s perspective which model/method is preferred.

In this investigation, mastery criterion was defined as a participant tacting the targeted picture or sight word with 100% accuracy during three consecutive probe sessions. Often, in applied settings the treatment team idiosyncratically determines the mastery criterion. If the established criterion is too weak, student performance will dissipate over time and skill maintenance and generalization checks will reveal that the skill needs to be re-taught. With the strenuous mastery criterion implemented in this investigation, participant responding maintained and generalized. LovM focused literature typically defines mastery criterion as the participant demonstrating a skill with 80% to 100% accuracy over two consecutive sessions (Lovaas et al., 1980; Lovaas, O. I., 2003; Maurice, Green, & Luce, 1996; Wynn, 2000). VBA focused literature typically defines mastery criterion as the participant demonstrating a skill with 90% to 100% accuracy over two consecutive sessions (Barbera & Rasmussen, 2007; Greer & Ross, 2008; Sundberg & Partington, 1998). Future researchers could investigate how the mastery criterion used during a study effects student performance during maintenance and generalization. For example, a mastery criterion of 100% accuracy during three consecutive probe sessions could be compared with a mastery criterion of 80% to 100% accuracy over two consecutive sessions and/or 90% to 100% accuracy over two consecutive sessions to investigate what effects the different criterions have on skill maintenance over extended periods (e.g., 1 and 6-month follow up) and skill generalization.
Following the completion of this investigation, the first author explained and demonstrated the LovM and VBA procedures to the participants’ educational staff. However, when subsequently responding to social validity questionnaires the educational staff indicated limited confidence in being able to implement the procedures used in this study. The social validity data indicating educational staff’s limited confidence in their ability to independently implement the protocols (VBA, in particular) suggest that future researchers need to identify an optimal practice for teaching educators to implement these procedures.

**Conclusion**

In conclusion, this investigation focused on two behavior-based language development models: the Lovaas Method and the Verbal Behavior Approach, and the effects of these protocols on the development of tact operant repertoires of students with moderate-to-severe mental retardation. Both protocols were examined to determined optimal practice in regards to frequency of tact operants mastered to criterion, frequency of operants receptively mastered to criterion, total trials to criterion, efficacy measures, maintenance, and generalization. The data suggest that LovM and VBA are each effective in teaching the targeted receptive and tact operants. However, the results of this investigation suggest that VBA was more efficient in that it taught the same number of targets as the LovM, but in less time and with fewer participant response errors. Although the results of this investigation are exciting, more replication is necessary and conclusions drawn should be tentative and limited to the precise components investigated. Furthermore, the call of Carr and Firth (2005) is still very valid: More VBA
specific investigations are required, and empirical evidence of VBA treatment effects collected over a longitudinal period is in need.


Finkel, A., Weber, K., & Derby, K. (2004). Use of a braille exchange communication system to improve articulation and acquire mands with a legally blind and


Appendixes
Appendix A: Endorsement Letter
1 December 2008

Members of The Ohio State University Institutional Review Board,

I am writing this letter to indicate that the project “Examination of the Effects of Two Behavioral Intervention Models on the Tact Repertoires of Individuals with Developmental Disabilities” has the full support of the Franklin County Board of Mental Retardation and Developmental Disabilities, and we welcome this project.

Our schools serve students with severe to profound developmental disabilities, many of whom engage in challenging behaviors to communicate their wants and needs. We believe that many of our students could benefit from interventions focused on teaching communication skills that might lead to the acquisition of literacy skills. The study will examine the effects of behavior-based language development models on the overall communication of our students, including requesting, labeling, receptive identification, following instructions, conversation, and motor and verbal imitation. The effects of this training program on other behaviors, such as engagement and challenging behavior, will also be evaluated. Since an integral part of a child’s development focuses on communication, this project is a good fit for our program.

I am looking forward to collaborating with Dr. Helen Malone and her doctoral students on this project, which I believe will greatly assist us in meeting the needs of the students who receive services in our schools. When ethical clearance is obtained from your IRB, I will assist with recruitment by sending out the consent forms to families.

Sincerely,

Jack Brownley
Director of Schools
Franklin County Board of Mental Retardation and Developmental Disabilities
Appendix B: Recruitment Letter
Dear Parents,

We are conducting a study at The Ohio State University to examine the effectiveness of a comprehensive communication training package. This study will examine the effects of two behavior-based language development models, the Lovaas method and Sundberg and Partington’s language-training protocol (the VB approach). Both protocols will be used to teach expressive labeling skills, and the protocols will be examined to determine an optimal practice for service delivery. We will also evaluate the effects of this training program on other behaviors, such as challenging behavior and engagement. This study will be conducted in your child’s classroom and will involve research on special education instructional strategies.

During this study, graduate students from the Special Education section in the School of Physical Activity and Educational Services will work with your child three to five days a week, for approximately 45 minutes per session. Initially, we will conduct an assessment to ascertain your child’s current level of communication. Once we have identified your child’s current level of communication, we will develop an individualized plan that will focus on teaching your child to label, acquire higher level receptive skills, request, as well as begin teaching early conversation skills. Training will include both individual sessions (done at a desk with your child and a graduate student) and sessions conducted in the naturalistic setting (your child working with the graduate student in the context of regular classroom activities).

This project will be led by Dr. Helen Malone. The graduate students who will be working on this project are Edward Parker, Abby Basbagill, and Geoff Wheeler. We have the full support of Franklin County Board of Mental Retardation and Developmental Disabilities to complete this project in your child’s classroom.

If you would like more information, please feel free to contact me at the phone number or email address below. If you would like for your child to participate in this study, please sign the attached consent form and return it to Dr. Helen Malone.

Thank you for your time and attention.

Helen I. Malone, Ph.D.
Assistant Professor
The Ohio State University
Appendix C: Parent Permission Letter
The Ohio State University Parental Permission
For Child’s Participation in Research

Study Title: Examination of the Effects of Two Behavioral Intervention Models on the Tact Repertoires of Individuals with Developmental Disabilities

Researcher: Helen I Malone

Sponsor: FCBMRDD

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.
Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this study is to determine if the effects of two behavior-based language development models, the Lovaas method and Sundberg and Partington’s language-training protocol (VB approach), on the development of expressive labeling ability of individuals with developmental disabilities. Both language-development instructional protocols will be used to teach expressive labeling skills, and the protocols will be examined to determine an optimal practice for service delivery.

Procedures/Tasks:
If you allow your child to participate in this study, s/he will participate in assessment, intervention, and maintenance phases. In the assessment phase, we will administer the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD) to identify preferred items/activities. An assessment procedure will then be conducted to determine which RAISD identified items/activities your child likes most and would want to use during sessions. Additionally, we will administer The Assessment of Basic Language and Learning Skills to determine your child’s current level of performance. This assessment consists of multiple parts. In the first part of the assessment, we will verify if your child can verbally imitate our words/phrases. For example, if we say “Ball” would your child also say “ball” (or at least a close approximation). In the second part of the assessment, we will display three pictures of items and verify if your child, after hearing the name of the picture, can touch the correct corresponding picture. For example, we will present a picture of a dog, cup, and a ball and ask your child to touch ball. In the final part of this assessment, we will verify if your child can verbally (either vocally with words or with sign language) identify the presented pictures. For example, we will show your child a picture of a ball and ask him/her “what is it?” We will repeat this process with at least 20 items. Doing these several times will allow us to determine your child’s current level of performance with repeating words/phrases, identifying items by touching, and labeling items with his/her words or sign language.

In the intervention phase of the study, we will implement two behavior-based language development models, the Lovaas method and VB approach, using a single-subject research design to examine learning and determine an optimal practice. With the Lovaas method protocol, 10 unknown items from a focus category (e.g., objects, school related activities, actions, numbers, or letters) will be taught by having your child label five pictures (one picture at a time) by touching. After your child has learned to label all
five pictures by touching, we will begin working on having your child label those same five pictures (one picture at a time) with his/her words or sign language. After your child has learned to label the five pictures by touching and by using his/her words or sign language, we will repeat the process with the other five unknown items from the focus category. With the VB approach protocol, 10 unknown items from a focus category will be taught using transfer trials. When using transfer trials, we will teach your child to label by touching the requested item, then we will give your child the name of the item and ask him/her to repeat the name, and finally we will ask your child to name (using his/her words or sign language) the item. For example, we will present a picture of a ball and ask your child to “Touch ball.” After your child touches the picture of the ball, we will ask him/her to “Say ball.” After your child has repeated the word ball (either vocally or with sign language), we will say to him/her, “What is it?” and assist your child in saying “Ball”. Therefore, in each trial, your child will learn to label an item across skills (i.e., by touching, by repeating the item name, and by stating the name of the item.) Both protocols will incorporate prompts and rewards to minimize errors and facilitate success.

In the maintenance phase of the study, we will probe your child’s ability to correctly label previously taught items without direct instruction. After your child has learned to label an item using the Lovaas method or VB approach, we will fade the protocols and continue to track your child’s ability to correctly label items.

Both language-development instructional protocols will be examined to determined optimal practice in regards to the total number of items labeled with words or sign language, the total number of items labeled by touching, the total number of trials required to learn the skill, and in the maintenance phase the number of items labeled correctly without instruction.

Duration:
This study will last approximately 6 months (until the end of this school year). During this study, we expect to work with each student three to five days per week for thirty to forty-five minutes per day.

Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
As a result of your child participating in this study, we do not anticipate any significant risks. However, due to the fact that a person other than your child’s typical teacher/aides (i.e., the PI and/or key OSU student personnel) will be implementing the intervention, there is a slight possibility that your child might be a little anxious when the study begins. In addition, with 30+ minutes of intervention we expect some response fatigue. To minimize anxiety, we will work diligently to build rapport with your child so that they are not anxious when working with us. To eliminate fatigue during the 30+ minutes of intervention, we will be incorporating tangible rewards, praise, and providing numerous breaks. During breaks, your child will have access to preferred activities and items.

The main anticipated benefit of this study is that your child will learn to label unknown items. Your child will learn to label items with language, label by touching, and your child will learn to repeat words/phrases. An additional benefit of this study is that the results may help educators identify an optimal practice for teaching labeling skills to students with special needs.

Confidentiality:
Efforts will be made to keep your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

**Incentives:**
There are no incentives for participating in this study.

**Participant Rights:**
You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

**Contacts and Questions:**
For questions, concerns, or complaints about the study you may contact Helen Malone at 614-247-8710 or malone.175@osu.edu.

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is injured as a result of participating in this study or for questions about a study-related injury, you may contact Helen Malone at 614-247-8710 or malone.175@osu.edu.
Signing the parental permission form

I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

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<th>Printed name of subject</th>
<th>Printed name of person authorized to provide permission for subject</th>
<th>Signature of person authorized to provide permission for subject</th>
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<td>Relationship to the subject</td>
<td>Date and time</td>
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**Investigator/Research Staff**

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

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<th>Printed name of person obtaining consent</th>
<th>Signature of person obtaining consent</th>
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<td>Date and time</td>
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Appendix D: ABLLS-short form
For the following questions, indicate the level of performance that best matches (but does not exceed) the learner’s current level of performance.

1. **COOPERATION WITH ADULTS**
   How easy is it to work with the child?
   
   1. Always uncooperative, avoids work, engages in negative behavior
   2. When given a task(s), will do only 1 response for a tangible reward
   3. When given a task(s), will complete 5 responses without engaging in escape or avoidance behaviors
   4. When given a task(s), will work for 5 minutes without engaging in escape or avoidance behaviors
   5. When given a task(s), works for 10 or more minutes without engaging in escape or avoidance behaviors

2. **MANDS**
   How does the learner lets his needs and wants be known?
   
   1. Without prompting, does not ask for reinforcers; or engages in negative behaviors
   2. Independently pulls people, points, or stands by reinforcing item
   3. Independently uses 1 – 5 words, signs, or pictures to ask for reinforcers
   4. Independently uses 6 – 10 words, signs, or pictures to ask for reinforcers
   5. Independently daily requests using 11 or more words, signs, or pictures
3. MOTOR DUPLICS
Does the learner copy actions?

1. Does not imitate motor movements
2. Imitates 3 gross motor movements modeled by others on request
3. Imitates 5 gross motor movements modeled by others on request
4. Imitates 5 fine and gross motor movements modeled by others on request
5. Imitates any fine or gross motor movements without request

4. VOCAL PLAY
Without request, does the learner say sounds and words?

1. Does not make any sounds (mute)
2. Vocalizes up to 3 separate speech sounds per minute
3. Vocalizes 8 separate speech sounds with varied intonations
4. Vocalizes 10 separate speech sounds with varied intonation and says at least 3 words
5. Vocalizes 10 separate speech sounds and says at least 8 understandable words

5. ECHOICS
Will the learner repeat sounds or words?

1. Does not repeat any sounds or words
2. Will repeat up to 3 specific sounds or words
3. Will repeat or approximate 5 sounds or words
4. Will repeat or approximate 8 different words
5. Will repeat any word, even simple phrases

6. MATCHING-TO-SAMPLE
Will the learner match objects, pictures, and designs to presented samples?

1. Does not match any objects or pictures to corresponding sample
2. Can match 2 objects or pictures to corresponding sample
3. Can match 5 to 10 objects or pictures to corresponding sample
4. Can match 5 to 10 colors, shapes, or designs to corresponding sample
5. Can match 20+ items and match 2 to 4 block designs
7. RECEPTIVE
   Does the learner understand any words or follow directions?
   
   1. Does not understand any words
   2. Will follow 3 instructions related to daily routines
   3. Will follow 3 instructions to do actions or touch items
   4. Can follow 8 instructions and point to at least 25 items
   5. Can point to at least 100 items, actions, persons, or adjectives

8. TACTS
   Does the learner label/verbally identify any items or actions?
   
   1. Does not label or verbally identify any items or actions
   2. Verbally identifies only 1 to 5 items or actions
   3. Verbally identifies 6 to 15 items or actions
   4. Verbally identifies 16 to 50 items or actions
   5. Verbally identifies over 100 items or actions and emits short sentences (e.g., “It’s a ball”)

9. RECEPTIVE BY FUNCTION, FEATURE, & CLASS
   Does the learner identify items when given information about those items?
   
   1. Does not identify by touching items based on function, feature, or class information about them
   2. Will identify by touching 3 items given synonyms or functions
   3. Will identify by touching 10 items given 1 or 3 functions or features
   4. Will identify by touching 25 items given 4 functions, features, or classes
   5. Will identify by touching 100 items given 5 functions, features, or classes

10. INTRAVERBALS
    Can the learner fill-in missing words or answers questions?
    
    1. Cannot fill-in missing words or parts of songs
    2. Can fill-in 3 missing words or provide animal sounds
    3. Can fill-in 10 non-reinforcing phrases or answer at least 10 simple questions
    4. Can fill-in 20 phrases or can answer 20 questions with variation
    5. Can answer at least 30 questions with variation
11. LETTERS & NUMBERS
Does the learner know any letters, numbers, or written words?

1. Cannot identify any letters, numbers, or written words
2. Can identify at least 3 letters or numbers
3. Can identify at least 15 letters or numbers
4. Can read at least 5 words and identify 5 numbers
5. Can read at least 25 words and identify 10 numbers

12. SOCIAL INTERACTION
Does the learner intimate and sustain interactions with others?

1. Does not initiate interaction with others
2. Physically approaches others to initiate an interaction
3. 3 out of 4 times asks adults for reinforcers
4. Verbally interacts with peers with prompts
5. 8 out of 10 times intimates and sustains verbal interactions with peers
Appendix E: LovM Data Sheet
### Lovaas Method

**Participant Initial:**

| 1. Community | 6. bus |
| 2. Art | 7. story |
| 3. Sensory | 8. boy |
| 4. Grooming | 9. play |
| 5. Leisure | 10. blue |

**Probe Targets:**

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**Probe Session #**

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**Session II**

**Length: 10 min.**

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**Lovaas Method**

**Receptive / Expressive**

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<th># of C:</th>
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**T: __ = Target #**  
**T = Tact**  
**R = Receptive Labeling**  
**C = Correct Trial**  
**P = Prompted Trial**  
**I/NR = Incorrect or No Response Trial**
Appendix F: VBA Data Sheet
### VB Approach

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### Session II

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**VB Approach**

- T: __ = Target #  
- + = Correct Trial  
- - = Incorrect/Prompted Trial  
- T = Tact  
- E = Echoic  
- R = Receptive  

**Labeling**

- # of Plus:  
- # of Minus:  
- # of Trials:  
- TT Session #:
Appendix G: Treatment Integrity
VB Study

Treatment Integrity

Procedures

I. Probe Sessions.
   a. Every treatment session will begin with a tact and a receptive labeling probe of the targets
      Y / N / NA
         i. During probes, we will present the antecedent stimulus.
            Y / N / NA
         ii. If the participant does not respond within 3 sec, we will re-present the antecedent stimulus a second time (i.e., with non-responses, the student will get a second opportunity to respond). Y / N / NA
            i. If there is still no response it will be considered an incorrect response.
               Y / N / NA
         iii. During probe sessions, no prompts/corrective feedback will be provided; however, opportunities to mand and reinforcers will be provided contingent upon participation and independent of response accuracy. Y / N / NA

b. Tact Probe Procedures.
   i. The experimenter will present one 2/3-dimensional item and the verbal stimulus, “What is it?” The participant will tact the object by verbally (i.e., vocal/sign) identifying the corresponding picture.
      Y / N / NA

c. Receptive Probe Procedures. The experimenter will present three 2/3-dimensional items, displayed in a linear field of three, and the verbal stimulus, “Touch (noun/verb/phoneme).” The participant will label by touching the corresponding picture.
      Y / N / NA
II. Intervention
   a. For each participant, 20 items from a focus category will be targeted.
      i. Ten unknown targets will be taught using the Lovaas approach and 10 different unknown targets from the same category will be trained using the VB approach.
      ii. Lovaas Method vs. VB Approach

III. THE LOVAAS METHOD
   a. For each participant, five of the 10 targets will be initially taught receptively.
      i. After receptive mastery criterion has been met, tact training will begin.
         Y / N / NA
   b. After the initial five targets have met receptive and tact mastery criteria, receptive instruction will begin for the final five targets.
   c. After receptive mastery criterion has been met for the final five targets, tact training will begin.
      Y / N / NA

IV. Lovaas Method — Receptive Procedures.
   a. The experimenter will present three linear displayed nonverbal stimuli and the antecedent stimulus, “Touch (noun/verb/phoneme).”
      i. If the participant receptively labels the correct picture/object, the experimenter will present generalized reinforcement (e.g., verbal praise).
         Y / N / NA
      ii. If the participant receptively labels a non-target picture/object, the experimenter will present the verbal stimulus “No” and represent the antecedent stimuli.
         1. On the second trial, if the participant receptively labels the correct picture/object, the experimenter will present generalized reinforcement.
      2. On the second trial, if the participant continues to respond incorrectly, the experimenter will represent the antecedent stimuli and a prompting stimulus to occasion the correct response.
         Y / N / NA
   b. Training trials will be followed by mand opportunities.
      Y / N / NA
V. Lovaas Method — Tact Procedures.  
   a. The experimenter will place the target picture/object in the front of the participant and present the discriminative stimulus, “What is this?” 
      Y / N / NA
   
   i. If the participant correctly tacts the picture/object, the experimenter will present generalized reinforcement. 
      Y / N / NA
   
   ii. If the participant does not respond/responds incorrectly, the experimenter will say, “Try again” and represent the antecedent stimuli. 
      1. If the participant does not respond/responds incorrectly on the second trial, the experimenter will present the antecedent stimuli with an echoic prompt. 
      Y / N / NA
   
   b. Training trials will be followed by mand opportunities. Y / N / NA

VI. THE VB APPROACH  
   a. In one trial, a target will be errorlessly trained using transfer trials across operants, receptive-to-echoic and echoic-to-tact. Following independent accurate tacts, the receptive and echoic antecedents will be faded. 
      Y / N / NA
b. **Receptive-to-Echoic Transfer.**
   i. The experimenter will present three linear displayed nonverbal stimuli and the discriminative stimulus, “Touch (noun/verb/phoneme).”
   ii. The participant will touch the targeted picture/object (receptive).
   iii. The experimenter will present generalized reinforcement and then present the discriminative stimulus, “Say dog.” The participant will respond echoically, “Dog” (echoic).

   Y / N / NA

c. **Echoic-to-Tact Transfer.**
   i. Following the participant’s echoic response, the experimenter will present the targeted picture/object and the discriminative stimulus, “What is it?” The participant will tact the targeted picture/object (tact).

   Y / N / NA

VII. **VB Approach — Error Correction.**

a. To prevent errors, training will be initiated with a 0-sec. time delay prompting procedure (i.e., Errorless Learning).

b. In the target-training onset stage, the experimenter will present antecedent stimuli and prompt the correct response using a 0-second time delay.

   Y / N / NA

   i. After the participant correctly responds, the experimenter will present generalized reinforcement and label the targeted picture/object.

   Y / N / NA

   ii. Once the participant begins to initiate the response at the same time the experimenter is attempting to provide the prompting stimulus, we will proceed to the acquisition stage.
c. During the acquisition stage, the experimenter will present antecedent stimuli and prompt the correct response using a 3-second time delay procedure. 
   
   i. After the participant correctly responds, the experimenter will present generalized reinforcement and label the targeted picture/object. 
   
   ii. After the participant correctly responds, the experimenter will present generalized reinforcement and label the targeted picture/object. Following an incorrect or two consecutive non-responses, the 0-sec. time delay prompting procedure will be used. 
   
   iii. During the acquisition stage, the receptive and echoic antecedents (i.e., transfer trials) will be faded after the participant has independently tacted the target item correctly three or more times. 

VIII. Maintenance 

   a. In the maintenance phase, targets will be fully probed; no instruction or prompts/corrective feedback will be provided. 
   
   b. During the maintenance phase, we will present the antecedent stimuli. If the participant does not respond within 3 sec, we will re-present the antecedent stimuli a second time. If there is still no response it will be considered an incorrect response. 
   
   c. Opportunities to mand and reinforcers will be provided contingent upon participation and independent of response accuracy. 

Y’s / Total Possible Ys:   /
Appendix H: Social Validity
Voluntary & Anonymous
Questionnaire for Educators and Parents
Effects of Two Behavioral Intervention Models
Social Validity Scale

Directions: Please read the following questions and circle one of the five choices that best describes how you feel about the Effects of Two Behavioral Intervention Models Study

1. How satisfied were you with the goals of this study?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

2. How satisfied were you with the procedures implemented during this study?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

3. How satisfied were you with the results of this study?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

4. Overall, how satisfied were you with this study?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

5. How much do you believe the procedures used in this study were an acceptable way of developing/enhancing language capabilities of students with special needs?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

6. How well do you think you could independently implement the intervention preformed during this study?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely

7. In the future, would you like to implement the techniques used in this study with other students?
   - Not at all
   - Very little
   - Neutral
   - Mostly
   - Completely
8. Would you recommend the techniques used in this study to other teachers?

Not at all   Very little   Neutral   Mostly   Completely

9. Were there any un-described effects associated with participation in this study? If so, would you describe them? If un-described effects occurred, do you feel that theses effects were positive or negative?

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

10. After participating in this study, did the student’s ability to label improve, if so how?

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

11. Any Additional Comments:

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Thank you for your participation

Please return to the researcher
Appendix I: Parent Follow-up Letter
Dear Parent,

With your consent, your child, XYZ, participated in a study over the course of this school year. During this study, graduate students from the Special Education section in the School of Physical Activity and Educational Services at The Ohio State University worked with your child three to five days a week, for approximately 30 - 40 minutes per session. Training included both individual sessions (done at a desk with your child and a graduate student) and sessions conducted in the naturalistic setting (your child working with the graduate student in the context of regular classroom activities). This study was conducted in your child’s classroom and involved research on special education instructional strategies.

In this study, we examined the effects of two behavior-based language development models, the Lovaas method and Sundberg and Partington’s language-training protocol (VB approach), on the development of expressive labeling ability of individuals with developmental disabilities. Both language-development instructional protocols were used to teach expressive labeling skills, and the protocols were examined to determine an optimal practice for service delivery. In this study, we were comparing the effectiveness of two language-training models. Using these models, XXX learned to label 10 school-related activity pictures (pictures of his schedule routine) and 10 school-related sight words (i.e., story, bathroom, etc.). Both models were effective; however, the VB approach was more efficient as it resulted in more behavior and correct patterns of responding. Attached is a handout copy of the presentation given at the conference. XXX is referred to as “Bill.” The results of this study were disseminated in a paper presentation at the annual Association of Behavior Analysis International Conference in Phoenix, AZ. This study also functioned as my dissertation topic.

Thank you for allowing us to get to know XXX. Working with XXX over these two years has truly been a treat. He is very bright and was always enthusiastic about working/playing with us; his smile and excited attitude made my day many times. I think we learned just as much for him as he learned from us. Please feel free to contact me about XXX’s performance in these projects.

Thank you,

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