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Content Validity of ABA Language Assessments in the Totality of Skinner's Verbal Operant Theory

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**CONTENT VALIDITY OF ABA LANGUAGE ASSESSMENTS IN THE TOTALITY OF
SKINNER'S VERBAL OPERANT THEORY**

A Master's Thesis

Presented to

The Graduate College of
Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Applied Behavior Analysis

By

Taylor Marie Lauer

May 2021

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CONTENT VALIDITY OF ABA LANGUAGE ASSESSMENTS IN THE TOTALITY OF SKINNER'S VERBAL OPERANT THEORY

Psychology

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Master of Science

Taylor Marie Lauer

ABSTRACT

Content validity describes the degree of which a measure represents all the components of the overall construct being measured. Behavior analytic language assessments are largely based on Skinner's verbal operant theory (1957). Three behavior analytic language assessments were utilized to measure the coverage of Skinner's verbal behavior theory: the VB-MAPP, ABLLS-R, and PEAK. The purpose of the current study was to examine the content validity of each of these assessments coverage on the totality of Skinner's verbal operant theory. Expressive items on each of the three assessments were compared to definitions of Skinner's verbal operants and were coded as the corresponding verbal operant. The results of this analysis indicated that all three assessments used all of the primary verbal operants, however PEAK utilized the largest number of the extended versions of the verbal operants. The assessment that utilized the lowest number of extended verbal operants was the VB-MAPP. The results of this study indicated that the top three assessments utilized by behavior analysts cover less than 25% of the totality of Skinner's verbal operant theory. Implications of this study demonstrate the lack of coverage on all of Skinner's verbal operants, and further proposes that the complexity of language may not be accounted for in totality by Skinner's theory; future research should be conducted using newer accounts of language learning such as relational frame theory to provide a more robust account of human language learning.

KEYWORDS: ABLLS-R, autism spectrum disorder, language, language assessment, PEAK, VB-MAPP, verbal behavior, verbal operants

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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INTRODUCTION

Autism spectrum disorder is a neurodevelopmental disorder that includes difficulties with social interaction, social communication, and repetitive and restrictive behaviors (ASD; American Psychological Association, 2013). Social communication impacts more than just building relationships; it can affect learning and adaptability. Impairments in social communication such as language deficits may lead to larger problems associated with general learning and engaging in challenging behaviors as a form of communication. Restrictive and repetitive behaviors may also be a problem with general learning because of interference with other preferred activities.

Language deficits can be a symptom of autism spectrum disorder (Mody & Belliveau, 2013). Language is an integral part of social interaction and may contribute to complex problem solving and adaptability (Yow & Lim, 2019). Language learning is a crucial skill to teach children with autism due to underlying general learning abilities coming from language (Sundberg & Michael, 2001). There is vast literature that supports language barriers may also lead to an increase in maladaptive behaviors (Chow & Wehby, 2018). Language learning and strengthening communication skills may lead to greater independence and contribute to the social significance of teaching these skills (Gillespie-Lynch et al., 2012).

Structuralism and Functionalism as Divergent Approaches

Theories to explain human language vary greatly (Harris, 1993). The process by which people communicate is undoubtedly a complex system (Steels, 2000) and different views rooted in the philosophical underpinnings of structuralism and functionalism have contributed to varied

explanations accounting for human language and human language learning (Bates & MacWhinney, 1989). Structuralism “seeks to identify causation in terms of underlying structures or mechanical devices that may or may not be physically present” (Dixon et al., in prep). Structuralism functioned in psychology to explain observable behavior caused by unobservable or mental structures (Moore, 2013a). An emphasis is placed in structural theories not on the behavior itself as indicative of an underlying cause, where real or non-real structures (physical or non-physical) may operate on behavior (Sturmey, 2008).

Structural approaches to language, such as the use of syntax, semantics, and morphemes suggests that there is a fundamental system, a pattern of speech sounds and units, that constitute a systemic coherence of languages (Stewart, 2019). Chomsky (1959) reasoned that “we recognize a new item as a sentence not because it matches some familiar item in any simple way, but because it is generated by the grammar that each individual has somehow and in some form internalized.” Functionalism in language contradicts what is proposed by structuralism and suggests that “the forms of natural languages are created, governed, constrained, acquired, and used in the service of communicative function” (Bates & MacWhinney, 1989). These points posit that language exists to provide communication between others rather than language existing due to an underlying structure. Linguistics is a discipline which studies human language (Widdowson, 1996). General linguistics may concern how “languages share some features in common, whether in pronunciations, grammatical organization, or expressive power, one may speak of human language as an abstract set of characteristics, perhaps reflection part of the biologically inherited structure of the human mind or brain” (Robins, 2013).

There are notable challenges with operating from a purely structural account (Sturmey, 2007). According to Skinner (1953), there a circular fallacy in this approach that makes

generating usable technologies difficult without consideration of context. That is, structuralist explanations commit to circularity when “the presence of unobservable structures is inferred from behavior, yet these structures are then used to explain that same behavior” (Sturmey, 2007). There is no clear mechanism that can be manipulated (i.e. if behavior causes itself, then there is no external way to change it). An alternative to structuralism emerged as practical considerations for this approach faltered, functionalism grew as a result (Moore, 2011). Functionalism in psychology is distinguished from structuralism in different ways; some distinguishing features include that functionalists view unobservable events as an adaptive process contributing to an organism’s functioning, there is an interest in motivation within organisms, and an interest in observable events as well as unobservable events (Sturmey, 2008). Radical behaviorism represents an attempt to apply a purely functional analytic strategy to account for simple and complex behavior, including human language learning (Moore, 2013b; O’Donohue, 1998). Radical behaviorism can be described as “a complete, or thoroughgoing behaviorism in that all human behavior, public and private, is explained in terms of its functional relations with environmental events” (Heward & Cooper, 1992). Radical behaviorism is a functional approach in that consequences of a response are categorized by how it functions for the response, such as a reinforcer functions to increase the future probability of a response (Moore, 2011). Radical behaviorists are not interested with explanations of behavior from a structural standpoint, but instead are interested in the functional explanations of behavior (Heward & Cooper, 1992).

Two subfields extended from a science of behavior consistent with radical behaviorism have emerged (Malott & Shane, 2016). The experimental analysis of behavior (EAB) is the study of behavior within a laboratory setting. Applied behavior analysis (ABA) is the study of utilizing behavioral principles in applied settings and is used to solve problems of social significance.

Behavior analytic technologies are used in a variety of settings and is applicable to anything that regards behavior. Applications of behavior analytic technologies have been largely effective within interventions for autism spectrum disorder (ASD; Simpson, 2001). ABA can be used to target behaviors associated with ASD such as social communication, social interaction, and restrictive and repetitive behaviors. These treatments seek to improve maladaptive behaviors to increase functioning in these individual's lives. Communication is largely targeted for improvement when conducting an intervention for children with autism. The process of teaching communication is founded on a theoretical approach, Verbal Behavior (VB), proposed by Skinner in 1957 describing language learning as verbal operant behavior, serving as a bedrock for several contemporary approaches used by behavior analysts today (Padilla, 2020).

Verbal Behavior

The publication of *Verbal Behavior* by B.F. Skinner (1957) provided the framework for a behavioral account of speaker and listener behavior regarding language and communication. A behavioral account of language maintains that verbal behavior is an operant, just like any other behavior and is under the control of the environment (Skinner, 1957). The principles of behavior can be applied to language, and can be brought under control by contingencies of reinforcement and punishment. The definition of verbal behavior was proposed by Skinner as “behavior reinforced through the mediation of other persons” (Skinner, 1957). For language to be considered verbal behavior, reinforcement must be the delivered by another person, but does not necessarily mean that this it must be vocal (Skinner, 1957). For example, a child pointing to something out of reach while an adult is in the room and receiving that item from the adult would be considered verbal behavior because the consequence was contingent on another person.

Skinner described six primary verbal operants that serve different functions of language: the mand, tact, intraverbal, echoic textual, and transcription (Tincani et al., 2020).

The first verbal operant that Skinner proposed was the mand. A mand is defined broadly as "...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). Mands may be considered one of the most important verbal operants and may be taught first (Sundberg & Michael, 2001; Drash et al., 1999) because mands directly produce access to desired reinforcers. The colloquial term for mand may be "demand" "request" or "command." A mand may serve as the spoken statement "I want a cookie," but may also be displayed as a point towards a cookie jar. A structuralist approach for a mand would suggest that the child pointed or spoke because they "wanted" the cookie and because of the word's structure or operation as a noun; a functionalistic approach would suggest that because of the presence of another person, there is likely a history of reinforcement for when the child performs this behavior, they receive what they requested. The consequence of receiving the cookie is the causal variable for communicating in this way the next time they are in a state of deprivation where hunger is the motivating operation for requesting a cookie. The functionalistic approach relies on an observable event for prediction and control over the future probability of verbal behavior.

The tact is a verbal operant "in which a response of given form is evoked (or at least strengthened) by a particular object or event or property of an object or event" (Skinner, 1957). The importance of a tact is building a repertoire of language that leads to more complex verbal behavior as both a speaker and a listener, such as "the salt is behind the cup," "hand me the scissors," "where is the lightswitch?"; all of these statements require a label that matches an object to fulfill the task and enables the speaker or listener to interact with the environment.

Recognizing what things are in the environment also affects the functionality of these items; for example, you must learn to tact a sign that is red in the shape of an octagon as a “stop sign” to be able to transfer the function of stopping a car while at a four-way.

Skinner referred to the intraverbal as “...verbal responses show no point-to-point correspondence with the verbal stimuli which evoke them” (Skinner, 1957). The intraverbal in lay terms is simply the back-and-forth conversation between people. An intraverbal can be used to inquire further about something in different forms such as asking questions, or casual conversation. The intraverbal requires a response from a listener to the original speaker’s statement.

An echoic is referred to as “responses in the listener showing a point-to-point correspondence between the sound of the stimulus and the sound of the response” (Skinner, 1957). The echoic is imitation of a model’s spoken statement. It is important to determine the echoic within an individual’s skillset when teaching language. Much of language begins with a model from others; for example, a young toddler babbling “mama” as a result of their mother saying “say mama!” followed by positive social reinforcement when the child imitates them. This interaction demonstrates building a repertoire of speech sounds when presented with a novel statement from a model and also builds the framework towards more complex verbal behavior.

Reading is also a form of verbal behavior, and is categorized as a verbal operant as textual. As Skinner (1957) described, “when a child learns to read, many verbal operants are set up in which specific responses come under the control of visual (or, as in Braille, tactual) stimuli.” Skinner maintains that textual verbal operants can be in many different forms, including pictures, formalized pictographs, hieroglyphs, characters, or the letters or symbols of a phonetic

alphabet. Textual verbal behavior affects the process of learning language in that it provides a visual stimulus that changes the response of the reader.

Transcription is another form of verbal behavior. Skinner (1957) maintains that “a response that creates a visual stimulus having a similar effect is also verbal according to our definition. Since verbal behavior may consist of writing rather than speaking, other correspondences between the dimensions of stimulus and response need to be considered.” Writing as a form of communication is an essential skill for independence and builds towards a repertoire of complex responding.

In addition to what will be referred to in the present paper as the primary verbal operants (the broad sense of the term), Skinner also described extensions of his verbal operants that suggested certain specifications to each. The important distinction between the primary and extended forms of the verbal operants leads to the surmounting complexity of verbal behavior. The utility in targeting the extended forms of the verbal operants is addressed below.

Empirical Support for Verbal Behavior

As noted in the opening section, language and communication are deficits associated with autism; therefore, verbal operant training could provide an avenue for comprehensive instruction. Language deficits are important to address early on in order to prevent potential problems with adaptive skills, challenging behaviors as a result of impaired communication and to avoid extensive interventions that aim to replace maladaptive behaviors with functional communication (Kelley et al., 2007). As stated above, Skinner’s verbal operant approach utilizes the functionality of responses from the speaker, which is why it is crucial in teaching language. Practitioners can contrive situations in which motivation can be established and verbal operants

will be used as the basis for the client's verbal behavior. Practitioners can also reinforce the response making the future probability of the response being emitted higher. Verbal operants may be functionally independent from each other, meaning that a client may be able to engage in one form of a verbal operant (such as tacting "doll" when it is laying on the table) but that does not mean it can be reasonably assumed they can engage in using another verbal operant (such as manding to play with the doll) (Ward & Shukla Mehta, 2019). However, there is literature that supports that the verbal operants may also be functionally interdependent; the verbal operants may function together in varying levels of complexity rather than as independent operants (Belisle, Dixon, Malkin, et al., 2021).

Teaching mands has been extensively researched (Coleman et al., 2020). Mands are quite often the first verbal operant that is targeted in language training programs (Sundberg & Michael, 2001). Mands are important because "they begin to establish the speaker and listener roles that are essential to further verbal development" (Sundberg & Michael, 2001). A study by Hall & Sundberg (1987) revealed that children with autism can be taught to mand for missing objects by contriving establishing operations. There have been many studies that support that children with autism can be taught to mand (Albert et al., 2012; Lechago et al., 2013; Sweeny-Kerwin et al., 2007).

Methods of teaching tacts have also been empirically validated within the population of children with autism (Barbera & Kubina, 2005; Marchese et al., 2012). Tacts play a vital role in language development; tacts are maintained by generalized social reinforcement in that labeling thoughts, feelings, and objects can spark conversation with other people and lead to a variety of consequences. Delfs and colleagues (2014) examined bidirectional relations between tact and listener training; their results proposed that tact training has a greater likelihood of producing

emergent listener responding than vice versa. Clinical implications from studies such as these suggest that programming should be designed based on findings such as these for greater success in both tact and listener responding.

The echoic is an integral part of learning language. Imitating vocal sounds, either overtly or covertly contributes to speaking and understanding language. Research in this area has shown that echoic training can transfer to the success in the acquisition of other verbal operants (Kodak et al., 2009). Eikeseth & Nasset (2003) found that echoic training can be useful in teaching children with phonological disorders with articulation and translates to natural speech. The efficacy of varying echoic procedures may differ depending on a child's abilities; Cividini-Motta and colleagues (2017) identified an assessment procedure that identified which echoic training best served the needs of the child.

Intraverbal responses in individuals with autism can be a complex skill to teach; because a hallmark of autism symptomology is rote responses, teaching and conversing using intraverbals may suffer as a result (Stauch et al., 2017). However, children with autism can be taught to use intraverbals by a variety of different methods (Braam & Poling, 1983; Kisamore et al., 2016). Goldsmith and colleagues (2007) used a transfer-of-stimulus-control method from tacts to intraverbals to teach intraverbals to children with autism. Ingvarsson and colleagues (2010) taught children with autism how to respond to an unfamiliar question with "I don't know, please tell me" which generalized to novel questions, which is an important skill to contribute to being able to learn and acquire more information.

Textual verbal behavior can be incorporated in teaching other language skills. In a study by Krantz & McClannahan (1998) textual prompts were used to promote the use of scripts which eventually led to the children making increased unscripted verbal interactions. Roche and

colleagues (2019) used a textual prompt to teach multiple word sentences to children with autism. Yamamoto & Isawa (2019) also used textual prompts to promote the use of niceties with adolescents with autism. The clinical implications of studies such as these indicate is that using textual prompts to promote the use of other verbal operants may assist in acquiring these language skills. As well, the use of scripts can be used to teach social situations that may generalize to real life settings.

Similarly, transcription, or writing as a verbal behavior can be incorporated in teaching other language skills. Transcription can be used to supplement teaching other verbal operants (Greer et al., 2005). Eby and colleagues (2010) conducted a study of multiple exemplar instruction (MEI) for transfer of stimulus function of writing and vocally spelling (an intraverbal response) and found that when direct instruction of spelling and writing using different sets transferred the function to the previously unmastered probes. The clinical utility in approaches such as these allows the verbal operants to be used to aid in the emergence of other verbal skills.

Teaching children with autism functional communication utilizing the verbal operants can reduce challenging behaviors that may emerge. Carr & Durand (1985) coined the term “functional communication training” (FCT) in which their study reduced challenging behaviors by altering the stimulus conditions that were maintaining the behaviors. The clinical implications from studies such as these that focus on the function of challenging behavior due to a deficit in language as a root of the problem provide a solution for change. A functional approach to language provides children with autism a way to communicate their wants and needs without evoking challenging behaviors to access these same things. The verbal operant largely associated with treatment of challenging behavior is the mand; by giving a child with autism a way to

communicate, problem behaviors can be decreased (Cornelius Habarad, 2015; Torres-Viso et al., 2018).

Deficits in language skills in children with autism may be associated with lower cognition and adaptability. Measures of intelligence are not usually the focus of ABA interventions, but is a widely accepted measure in collaborating fields as a measure of a student's abilities. Dixon, Paliliunas and colleagues (2019) compared verbal behavior techniques developed by Skinner (1957), comprehensive techniques that expanded on Skinner's theory, and a control group; the results indicated that both groups showed increased skill acquisition, but the comprehensive group had the highest gains on IQ. The clinical implications from this study indicate that targeting the verbal operants using the PEAK curriculum can not only increase skill acquisition, but also "cognition."

Social behaviors rely on the use of language with others. The verbal operants that are largely associated social behaviors due to socially mediated reinforcement may be the mand and intraverbal. Practitioners can contrive social situations in which the verbal operants will be utilized to communicate with others. The above studies contribute to the growing literature to support that the verbal operants can be taught and can be used to teach language skills to children with autism. It is critical however that language training is guided by functional analytic assessments to ensure that targets are appropriate and build on prior language learning-- and as noted by Ackley and colleagues (2019), multiple assessments are available for behavior analysts grounded in a Skinnerian verbal operant approach.

Verbal Operant Language Training Assessments

The literature supports a variety of assessment tools for parents and professionals to utilize when interaction with children with ASD (Ackley et al., 2019). Unfortunately, according to Ackley and colleagues (2019) and as noted in Padilla (2020), several of these assessments cover a variety of skill deficits but are not empirically supported. The Board for Behavior Analysts, as well as varying state and federal laws maintain that interventions for populations that are served should be based on the literature for best practice. In lieu of direct empirical research for most assessments, authors claim assessments are evidence-based because they are grounded in a currently supported theory of language learning (i.e. the verbal operants). However, no research to date has evaluated alignment of the various assessments with Skinner's verbal operant theory as a measure of validity of the content.

The assessment with the most empirical support according to Ackley and colleagues (2019) is *Promoting the Emergence of Advanced Knowledge (PEAK)*; Dixon, 2014a, 2014b, 2015, 2016), an assessment tool and curriculum guide that is comprised of four modules (Direct Training, Generalization, Equivalence and Transformation) assessing a variety of primarily language skills and cognitive deficits that was composed using Skinner's (1957) theory of verbal behavior in the Direct Training and Generalization modules (Dixon, 2014a; Dixon, 2014b). The PEAK system has building levels of complexity; the Direct Training module uses a contingency-based model of teaching basic verbal operants, the Generalization module incorporates programming where skills that are directly taught are tested for generalization. The Equivalence module utilizes stimulus equivalence (Sidman, 1971) and the Transformation utilizes Relational Frame Theory (Hayes et al., 2001). The PEAK system has the most empirical support within the

assessment tools discussed in the current paper and is becoming more widely used and recognized as a common tool for teaching language repertoires to children with autism.

Several studies have been conducted that consider the psychometric properties of PEAK. For example, studies of convergent validity have been conducted with PEAK and other widely known assessments that are aimed to teach learners with autism or other developmental disabilities (Dixon, Carman, et al., 2014; Malkin et al., 2017; McKeel, Rowsey, Dixon et al., 2015). The relative importance of comparing PEAK to other established assessment and curriculum tools is to gain validity that these assessments are covering the same skill deficits indicating that they are desired target behaviors for increase. PEAK also has been shown to have high inter-rater reliability (Dixon, Stanley, et al., 2016; Malkin et al., 2017; Rowsey et al., 2014). Studies have also shown the different components of the PEAK system yield high correlations with each other, such as the PEAK-DT indirect assessment and the PEAK-DT preassessment (Moore, Rizer, et al., 2020) and the PEAK preassessment and the PEAK comprehensive assessment (Moore, Yi, et al., 2020).

The literature has also supported the effectiveness of the PEAK-DT module for directly trained target skills (Dixon, Wiggins, et al., 2018; Dixon, Belisle, Munoz, et al., 2017; McKeel, Rowsey, Belisle, et al., 2015). Dixon, Peach, and colleagues (2017) examined the effectiveness of using the PEAK Generalization module to train and test complex verbal skills (creative pathfinding, distorted tacts, and vocal autoclitic mands) and found structured training using the PEAK-G module resulted in skills being generalized without being directly taught. Stanley and colleagues (2018) utilized the PEAK Equivalence module to teach academic skills to adolescents with autism; this study contributes to the literature for the PEAK-E curriculum to teach language based on stimulus equivalence (Dixon, Belisle, Stanley, Munoz, et al., 2017; Dixon, Belisle,

Rowsey, et al., 2017; Dixon, Belisle, Stanley, Speelman, et al., 2017). The literature also supports skills taught utilizing the PEAK Transformation module; Belisle and colleagues (2016) utilized a PEAK-T program to teach basic perspective taking to children with autism. Barron and colleagues (2019) utilized the PEAK-T module to teach here-there and then-later relations to children with autism.

Intelligence measures are not generally utilized by behavior analysts but are recognized as a measure used by collaborating fields; four studies have been conducted that support that using the PEAK system may contribute to increasing IQ scores (Dixon, Whiting, et al., 2014; Dixon, Paliliunas, et al., 2019; Kimzey, 2020; Schneider, 2020). The clinical implications of these studies such as these contribute to the literature that using ABA procedures may aid in increasing the IQ gains of children with autism and more specifically that using small dosages of the PEAK curriculum may aid in these increases as well. The PEAK system goes beyond typical curricula that utilize Skinner's verbal operants, each module surmounts in complexity and utilizes novel complex theories of language. Support from the literature may be indicative of the utility of this tool in assessing and teaching complex language to children with autism. For the purposes of this current paper, I will focus exclusively on the PEAK-DT and PEAK-G modules, as these modules are based solely on a Skinnerian model of verbal operant development.

The Assessment of Basic Language and Learning Skills-Revised (ABLLS-R; Partington, 2010) is a criterion-referenced assessment that assesses 25 different skill areas. The ABLLS-R assessment contains 544 questions related to language, social interaction, self-help, academic and motor skills. The ABLLS-R was developed using Skinner's (1957) theory of verbal behavior.

Few studies exist that support the psychometric properties of the ABLLS-R; Partington and colleagues (2016) found that the ABLLS-R had good internal consistency reliability for 18

of the 25 domains and found it to also have high test-retest reliability. Similarly, Usry and colleagues (2018) utilized an expert panel composed of practitioners with experience in the field of autism to examine the content validity of the ABLLS-R as well as the inter-rater reliability; results showed that a high percentage of skills were rated as “essential” by the expert panel, and inter-rater reliability was also high across implementors who had little or no exposure previously to the ABLLS-R. Malkin and colleagues (2017) examined the convergent validity of the PEAK-DT module with the ABLLS-R and found that the two assessments had convergent validity when compared with other psychometrically sound assessments, providing initial indirect support of the validity of the ABLLS-R. The most recent review of the literature by Belisle, Dixon, Munoz, and colleagues (2021) extended on the previous study measuring the convergent validity between PEAK and the ABLLS-R (Malkin et al., 2017); Belisle and colleagues did not find as high of a correlation between the PEAK-E-PA and the ABLLS-R as Malkin and colleagues found between PEAK-DT and the ABLLS-R. This may be indicative of a potential clinical limitation for the ABLLS-R due to the findings of the current study in that the ABLLS-R targets the basics of language learning (as also targeted in PEAK-DT) but once language skills become more complex (as in PEAK-E which is based on stimulus equivalence), the relationship between these two assessments falter indicating that the ABLLS-R may only serve as an appropriate tool for assessing basic language skills.

The *Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP;* Sundberg, 2008) is a criterion-referenced assessment based on developmental milestones that was created based on Skinner’s (1957) verbal operants. The VB-MAPP was designed to track skills for children with autism or children who demonstrate other language delays. The VB-MAPP is organized into 3 levels based on age (0-18, 18-30, and 30-48 months).

The VB-MAPP has been used extensively as a measurement tool in empirical studies (e.g., Brodhead et al., 2016; Carnett & Ingvarsson, 2016; Byrne et al., 2014), yet does not have a sound basis in the tool itself as far as outcome measures and real-world progress is concerned. Research that has been completed on the VB-MAPP is slim; Dixon, Belisle, and colleagues (2015) found that the VB-MAPP and PEAK-DT assess similar skills, however PEAK-DT assesses more robust language repertoires. Important clinical implications from this study indicated a ceiling effect, concluding that language skills on the VB-MAPP plateau at 60 out of 184 questions on PEAK-DT, meaning that the VB-MAPP may not provide as robust of a repertoire. As well, the VB-MAPP in comparison with PEAK-G suggests that the VB-MAPP does not support a generalized language repertoire and that once children display generalized responding, that the VB-MAPP may no longer be an appropriate means of assessment.

A study by Sundberg & Sundberg (2011) used a sample of the VB-MAPP (80 intraverbal questions) to examine the effects of teaching intraverbals to children with autism. This study did not contribute to outcome studies for the entire VB-MAPP as a whole, but contributed to the construct validity and reliability of the intraverbal section. The authors noted a significant consideration/limitation of this study is that most of the participants had previous training on intraverbal repertoires and that should be considered before determining the success of this study. The current state of the literature does not support the VB-MAPP as an appropriate method of assessing language repertoires based on the lack of outcome studies alone; however, the VB-MAPP is considered to be reliable with more thoroughly researched methods to a certain degree and is best used up to the age of a typically developing 4-year-old (Sundberg, 2008).

The Present Study

The construct of verbal behavior is composed of Skinner's verbal operants. Content validity assesses the extent of which a measure represents the construct. There are many assessments that target the construct of verbal behavior, three common tools are the VB-MAPP, ABLIS-R, and PEAK. These assessments were analyzed to measure the content validity of the coverage of Skinner's verbal operants, meaning the coverage constitutes the totality in which the construct was utilized (i.e. were all parts covered by all the assessments?). However, there is no research to date to evaluate the alignment of the various assessments with Skinner's verbal operant theory as a measure of the validity of the content. The utility of ensuring that all these assessments target the same facets of the construct of verbal behavior contributes to the content validity of these assessment tools, thus measuring which assessment, if any, is actually measuring everything Skinner proposed in his theory of verbal behavior. The purpose of the current study is to assess the extent of which these three assessment tools utilize the totality of the verbal operants proposed by Skinner (1957) and assesses the content validity of each of these assessments as the first study to do so utilizing these assessments.

METHODS

Procedure

The current study was conducted in three phrases, including (1) identification of primary and extended verbal operants in Skinner's verbal behavior theory (i.e., VO categories), (2) sorting of content items from PEAK, VB-MAPP, and ABLLS-R into VO categories, and (3) analyzing trends in coverage of Skinner's theory within each of the assessments. VO categories were developed independently by two PhD level behavior analysts independently utilizing a PDF of *Verbal Behavior* with pre-existing knowledge of Skinner's operant theory. Both evaluators have published over 10 research studies evaluating verbal operant training in children with autism. The researchers first generated a list of the primary verbal operants and IOA was calculated for this initial list by dividing the total number of agreements by the total number of items found, multiplied by 100. IOA for this initial search was 90%. Once the primary verbal operants were identified, the researchers utilized a find function (ctrl + f) within the PDF document by search all instances of the operant word (e.g., tact). All instances where extensions of the operant were recorded (i.e., an extension preceded the operant, e.g., "metonymical tact") to serve as VO categories. IOA was also calculated for this strategy of locating all potential VOs that could be included in any assessment that claims to be based on Skinner's verbal behavior theory. IOA was calculated by dividing the total number of agreements by the total number of items, and IOA was 83.3%. To arrive at the final number of operants, the researchers discussed all disagreements and made a decision regarding inclusion or exclusion. A total of 63 VO categories were located, including 6 primary VOs and 57 extended VOs.

Once the VO categories were established, two graduate students in behavior analytic programs at two universities located the definitions for each of the verbal operants (both primary and “extensions”) as described by Skinner (1957). 6 verbal operants were defined as “primary”—mand, tact, echoics, intraverbal, textual, or transcription, and fifty-seven “extensions” were also defined (more complex forms—see Table 1). The definitions generated by the graduate students are shown in Table 1. Items for assessment were taken from the ABLLS-R protocol, the VB-MAPP protocol, and the PEAK-DT and PEAK-G assessments. Items were cross-referenced against Skinner’s definition and coded as the corresponding verbal operant. Items that could have fallen into more than one category were coded based on best fit. Items that indicated a receptive skill were excluded due to an interest specifically in expressive language and speaker rather than listener behavior. Each of the verbal operants were counted for the ABA protocols—PEAK-DT and PEAK-G scores were combined because the first two modules of the PEAK system utilized Skinner’s VB approach. IOA was collected for each assessment and was 96% for the ABLLS-R; 99% for the VB-MAPP; 96% for PEAK-DT; and 95% for PEAK-G. IOA was collected in a range dependent on the assessment (25-55%) due to the varying lengths of the assessments. IOA was collected on each “section” of verbal operants in these protocols; the VB-MAPP and ABLLS-R had clear sections, whereas the PEAK-DT and PEAK-G protocols were not organized by section, in which raters went through and randomly selected items; this was done to capture the scope of the assessment to make sure IOA was representative of PEAK’s representation of the verbal operants.

Dependent Variables and Data Analysis

There were two primary dependent variables that we analyzed in the current study. The first variable was the frequency distribution of items from each assessment contained within each VO category. The general distribution scores indicated how many of the different verbal operants the assessment utilized (see Figure 1); these scores were computed by dividing the amount of times (items) the primary and extended verbal operants were used divided by the amount of verbal operants (primary: 6, extended, 57) and multiplied by 100. Distribution by assessment scores indicate which verbal operants are covered within the different assessments. A graph was generated by assigning a number to each verbal operant (see Table 1) and listing the number of items for each assessment that correspond with the verbal operant.

The second variable was the totality of Skinner's VO theory by each assessment, or the spread (i.e., extent of coverage) within each assessment expressed as a percentage of VO categories assessed in each assessment (see Figure 2); these scores were computed by dividing the number of items considered as either a primary or extended verbal operant that was used by the total number of items on the assessment (VB-MAPP: 170, ABLLS-R: 544, PEAK: 386). Due to the exclusion of receptive items, the same method of calculation was used for items that were included as well (Figure 3; VB-MAPP: 106, ABLLS-R: 240, PEAK: 216).

A chi-square test of independence was performed to examine the relations between the number of verbal operants used that were either primary or extended with each assessment. A second chi-square test of independence was performed to examine the relationship between the number of items dedicated between the primary and extended versions of the verbal operants based on each assessment. A chi-square assesses the assumption of the relative equal distribution

or spread of items across each VO category. This would theoretically represent a balanced assessment.

RESULTS

The results of this study are shown in Figure 1, Figure 2, Figure 3, and Figure 4. Figure 1 represents the general distribution scores are indicative of the amount of verbal operants that were utilized with each assessment in the primary and extended forms; all three assessments used 100% of the primary verbal operants meaning that each assessment presents items for all 6 of the primary verbal operants, while PEAK used 21% of the extended versions, ABLLS-R used 15.7% and the VB-MAPP used 3.5%. This suggests that PEAK contains the greatest distribution or covers the greatest percentage of the totality of Skinner's theory; however, none of the assessments evaluated covered greater than 25% of the extended operants or 50% of the total VO categories.

Figure 2 demonstrates the protocol that dedicated the highest percentage of the entire assessment to the primary verbal operants was the VB-MAPP at 60%, followed by PEAK at 47.41%, and ABLLS-R at 32.35%. The protocol that dedicated the lowest percentage of the assessment to the extended verbal operants was the VB-MAPP at 2.35%, followed by PEAK at 8.55%, and ABLLS-R at 11.76%. These scores indicate what percentage of the assessment is dedicated towards the verbal operants, both primary and extended for all items on the assessment.

Figure 3 illustrates the protocol that dedicated the highest percentage of the included items of each assessment (i.e. expressive items) to the primary verbal operants was the VB-MAPP at 96.2%, followed by PEAK at 84.7% and ABLLS-R at 73.3%. The protocol that dedicated the lowest percentage of the assessment to the extended verbal operants was the VB-MAPP at 3.7%, followed by PEAK at 15.2% and the ABLLS-R at 26.6%. These scores measure

how much of the included items from each assessment are dedicated towards the verbal operant categories.

The distribution by assessment of the extent of which each assessment covers each verbal operant is demonstrated in Figure 4; all assessments showed clusters in the same areas for the primary versions of the verbal operants and the amount of questions dedicated towards them, the extended versions are much more spread out for each assessment. All three of the assessments cluster around mand (primary) with a close range of items from 15-27. A rise in tact items (primary) was noted in PEAK with 75 items, compared to 29 on the VB-MAPP and 27 on the ABLLS-R. A cluster of items with a similar range also was noted with abstract tacts (extension), ABLLS-R with 4 and PEAK with 8. The ABLLS-R had a noticeable spike with 21 questions dedicated to extended tacts (extension) in comparison with the VB-MAPP at 2. Echoics (primary) had a similar cluster of items for all three assessments from 12-23, as well as with transcription from 2-13. Intraverbal (primary) scores clustered for all three assessments, however the VB-MAPP only had 21 items compared to 63 (ABLLS-R) and 55 (PEAK). The ABLLS-R had 13 items dedicated to fragmentary intraverbals (extension). The utility in this graph eliminates the bias from summing the items all together for the extended versions such that one assessment may score higher for extended versions if it tests the same verbal operant several times such as in Figure 2.

The results indicate that the assessment that dedicates the most items to the primary verbal operants is VB-MAPP, and the most extended verbal operants is ABLLS-R. The results of the general distribution scores indicated that all of the assessments use all of the primary verbal operants, and PEAK utilizes the most extended verbal operants. Figure 3 extends on Figure 2 and found the same results regarding which assessments contribute the least and most to the spread

of the assessments. Figure 4 illustrates how many questions were dedicated to each of the verbal operants.

The chi-square analysis in Table 2 represents the number of verbal operants utilized by each assessment. The results suggested that these variables were not significant $\chi^2 (2, N = 41) = 4.0505, p \leq 0.05$. These results indicate that the number of verbal operants used by each assessment were not balanced within the general distribution of the assessment. The chi-square analysis in Table 3 represents the items dedicated to the primary and extended versions of the verbal operant for each assessment. The results indicated that these variables were significant $\chi^2 (2, N = 562) = 27.8666, p \leq 0.05$. These results indicated that the number of items dedicated to the primary verbal operants differed significantly from the extended version, suggesting that there is an imbalance within the assessment which differs from the assumption that the VO categories should be equally covered.

DISCUSSION

This study examined the coverage of the verbal operants in their primary and extended forms in three common behavior analytic assessments used with children with autism. The results of this study indicated that the assessment that dedicates the majority of the assessment to the primary verbal operants is the VB-MAPP, and the assessment that dedicates the least amount of the assessment to the primary operants is the ABLLS-R. The assessment that had the highest percentage of the assessment dedicated to the extended versions of the verbal operants was the ABLLS-R, and the least amount of the assessment dedicated to the extended versions was the VB-MAPP. The number of questions on these assessments in total vary greatly, so these scores may not accurately reflect the true usage of the verbal operants. One consideration is the overall coverage of the verbal operants. All three assessments covered all of the primary verbal operants. PEAK utilized the highest percentage of all verbal operants, and the VB-MAPP utilized the lowest percentage. Perhaps the most representative result of this study can be found in Figure 4, which illustrates the general distribution of the number of questions covered on every verbal operant by each assessment. This figure is important because it demonstrates that although the ABLLS-R utilized the highest percentage of assessment dedicated to extended verbal operants, this figure illustrates that this may be due to the same verbal operant being assessed in several questions. PEAK appears to be the most comprehensive assessment reviewed in that it covers the most amount of verbal operants of these three assessments.

The implications of this study are of utility for practitioners working with children with autism to assess complex verbal behavior. A verbal behavior approach utilizes the function behind language and improves social communication in teaching language, especially for

children with autism. The methods used to teach children with autism greatly improve their adaptability and likely give them a much greater quality of life. Skinner's verbal operant theory (1957) is the framework in which many behavior analysts teach language (Padilla, 2020). The assessments utilized in the present study are based on Skinner's approach. Two common assessments used by behavior analysts (VB-MAPP and ABLLS-R) are lacking in empirical research and the implications of this are partially outlined in the current paper. Rather than obtaining experts to provide subjective ratings of the utility of various items, we attempted to describe the content validity of the assessments as a percentage of the totality of Skinner's operant theory represented in the assessment items. That is, all three assessments claim to be developed from Skinner's VO theory; however, these results suggest that the greatest coverage is given to only the most simple forms of VO behavior described by Skinner. Conversely, the complex verbal operants have received little coverage in the assessments, mirroring a dearth of literature on complex forms of VO behavior (Carnett et al., 2019). This paper also outlines the content within these assessments where coverage is lacking. Practitioners will be better able to choose an assessment which utilizes the most coverage of the VO's and also be better able to select an assessment protocol which fits best practice, such as an empirically based assessment. The assessments discussed above focus exclusively on Skinner's approach to assess language, the current paper discusses in detail the focus on the totality of usage of VB within these assessments. That is, these assessments may be appropriate in directing behavior analysts in the early stages of language training programs but may fall short at the level of complex behavior.

One implication of this study also highlights weaknesses within the assessments that are commonly used by behavior analysts (Padilla, 2020). These weaknesses are related to the content validity of these assessment's coverage of the verbal operants. The current study suggests that

any of the three assessments could be used to assess the primary verbal operants; it also reveals where primary areas of emphasis may be of interest such as using Figure 4 to target specific primary VO's (for example, PEAK emphasizing tacts more than the other assessments). This study further asserts assessments that claim to be evidence-based because they are based on Skinner's theory to be threatened because of the scope of coverage revealed in this study.

Assessments such as the VB-MAPP which are utilized based on the assumption of coverage on the verbal operants has resulted in a breakdown which revealed that the simplest forms of these operants is being used and does not account for the full account of verbal behavior. Because this is an assessment protocol utilized by 80% of behavior analysts (Padilla, 2020) it may be necessary to redefine the goals of the field when assessing language (i.e. is an account of primarily the primary verbal operants the focus, rather than a robust account including the extended versions?). If a practitioner chooses to solely operate using Skinner's analysis, the current paper provides a description for each assessment's coverage of the theory, and provides evidence of each assessment's coverage of not only the primary verbal operants but also the extended versions.

The largest implication of this study reveals evidence provided for each assessment for the extended verbal operants, such that teaching this VO category contributes to much more complex language. Providers may be interested in that although the VB-MAPP is very commonly used within the field of behavior analysis (Padilla, 2020), it covers the least amount of extended verbal operants and the assessments is composed of less than 5% dedicated to this category. Similarly, the ABLLS-R is a lengthy assessment which only contributes 15% of the extended category. Practitioners that are interested in assessing complex verbal behavior may find that the most comprehensive curriculum is the *PEAK Relational Training System*; this paper

supports that PEAK utilizes the most amount of extended verbal operants, it also indicates that PEAK utilizes the primary verbal operants as well. However, only a small percentage of the assessment was actually dedicated to the extended VOs. This outcome begs the question, why are only the elementary verbal operants covered in these assessments and in the research literature to date? This is indicative of the need for a more robust account of language; the verbal behavior theory alone cannot account for language learning as demonstrated with the lack of empirical support for complex language skills. Newer technologies with extensive research such as relational frame theory supplement the initial theory and allows for a greater understanding of the formation of language.

An important implication related to the lack of coverage that has been demonstrated within these assessments is that assessments guide what is verbal behavior is targeted for increase; if the assessment lacks in scope, the intervention is limited in scope as well. Contextual behavior science seeks to “allow analytic goals to be accomplished with precision, scope, and depth” (Hayes et al., 2012). This paper may contribute to a larger conversation which should have behavior analysts carefully consider the tools that are being used to assess these skills and reevaluate the goals that more closely identify with the origins of contextual behavior science. The results of the current paper indicate that these origins are being invalidated; the goals which are being guided by these assessments do not address the scope or depth of the content in which they assess, which in turn means that interventions are not being based on best practice. However, there is potentially considerable precision within the primary verbal operants, which is an avenue for future research to explore how to bring the goals from Skinner’s analysis to a closer approximation of contextual behavior science.

An implication of this study may also provide a future avenue of research into Skinner's analysis with commonly used assessment protocols. Studies may be conducted in this same manner with other existing protocols to examine the coverage of the verbal operants and may contribute to a larger conversation on the best fit of assessment protocols for language learning and create a hierarchy of best practice based on the utilization of the full verbal operant theory. However, the conversation does not end with Skinner's analysis and further research should utilize newer technologies in combination with Skinner's approach for the most robust account of language. This may lead to yet another implication of this study, it may indicate that more is needed than just Skinner's account of language.

A limitation of the current study is that each of the assessments are based on Skinner's definitions of the VO categories and have been attempted to be translated into measurable variables; qualitative data and "reverse translating" into measurable, manipulable variables for quantitative data may be difficult to capture (Critchfield & Reed, 2009). The terms Skinner provided may not translate easily into an equation that is commonly utilized within laboratory settings or applied settings. Because the field operates based on quantitative data, translating such a large part of what we assess (i.e. verbal behavior) by means of a description from qualitative into quantitative data may be difficult. These assessments attempt to do so, and because of this, interpretations on what is "most important" and how the definitions are translated may be skewed and as a result coverage of these items differs.

Another limitation is the assumption that each assessment should have an equal spread of VO categories, the assessments were not balanced so the assumption was not reflected in the data. This is a limitation because the assumption that each of the assessments should have an equal spread of coverage of the VO categories is not a fair comparison between these

assessments due to the fact that they had varying coverage within each one. The totality of the assessments can be assessed, however a true comparison should measure which assessment covers the VO categories “best” but a comparison cannot be made on the content if the content does not exist within every assessment.

Future avenues of research should address the limitations presented within this paper. The first limitation presented is due to the issue with “reverse translating” qualitative data into quantitative data (i.e. Skinner’s definitions of the VO categories into measurable variables). The challenge of translation leads to future research in that an equation does not exist for the verbal operants, and this could be explored further. According to Critchfield & Reed (2009), an equation could be applied to any sort of behavior if it can be measured “across a range of situations that vary in terms of environmental events that appear to reflect the equations predictor values.” Functional relations are required for an equation and functional relations between VO categories and their outcomes could result in an equation which could provide a better explanation and usage of the VO categories. A study which establishes an equation for the VO categories could highlight the utility in teaching this method and give a concrete way of assessing the categories rather than an interpretation of them.

One avenue for future research should address the limitation based on the assumption that each assessment has an equal spread of VO categories. Balance may be determined based not on the assumption of equal spread of the VO categories, but instead by calculating the amount of text that Skinner dedicated to each VO. It can be reasonably assumed that there would be more text coverage of the primary verbal operants because they have a more central role in the base theory. The number generated could be used as the percentage for assumed item distribution and spread of each assessment and may more closely represent a balanced assessment based on

coverage. This avenue is important because it may highlight why certain VO's are targeted more than others and also reveal if it is necessary to target VO categories differently.

Another avenue for future research that addresses the above concern of assumption of coverage would be to utilize the literature based on each verbal operant. This would generate an accurate picture of what is frequently used within the field and extend the focus to the most "important" verbal operants that play a central role in language development. This could be done by calculating the amount of available research within each VO category and utilizing that as a basis for balance. For example, it is reasonably assumed that more mand (primary) items should be expected because this is the most frequently used research in the literature.

The current paper focused exclusively on Skinner's theory of language, however, this theory is not the totality of language learning and more current theories based on derived relational responding and relational frame theory may extend Skinner's account and contribute to more complex language learning. The remaining two PEAK modules (Equivalence and Transformation; Dixon, 2015; Dixon, 2016) utilize these theories and provide a more comprehensive assessment and guide to language learning. The methods utilized in this paper could be extended using not only Skinner's account of language, but in combination of newer theories of language.

The present paper could be extended by using the next two modules of PEAK to account for a more robust representation of language learning by incorporating derived relational responding and RFT. Future research could examine the utility in these modules contributing to more complex language skills. Barnes-Holmes and colleagues (2000) proposed a synthesis of RFT and Skinner's VB. An example of the synthesis between these two theories can be demonstrated with the extended verbal operant abstract tact. A Skinnerian account would

propose that seeing the property of redness evokes the vocal response “red” when presented with a red ball, red book, red light, etc. An RFT account proposes that property must participate in a coordination frame to produce differential responding that cannot be from specific reinforcement and must control the response; it could not be reasonably assumed that by being able to vocally label red objects that a person could then point to a red object when presented “find red” because the trained vocal response does not form a bidirectional relation from seeing red to vocally saying “red” and between hearing the word “red” and producing a point. Combining Skinner’s approach with RFT allows for a more robust explanation of language. Future research could also contribute to the literature by testing the synthesis between these two theoretical approaches as an account of language learning, as well as the utility in understanding how these two approaches can be combined and of use.

Language learning is undoubtedly a complex process which involves a variety of variables which influence it. Skinner’s analysis provided one avenue for an account of verbal behavior. Several curriculums were developed based on this analysis, yet a large majority of them have not been empirically validated, and a study such as the present one has not been completed yet. The implications of this paper indicate that assessments that are currently being used are not addressing all parts of the analysis that Skinner composed. When assessments are limited in scope as this paper suggests, this means that our interventions in turn will also be limited. This may indicate a concern with using Skinner’s theory as the exclusive method of assessing language skills to children with autism if three of the most common assessments utilize less than half of what makes up the entire theory. This could be indicative that the extended verbal operants may not be considered an integral part of language learning, and may also signal that Skinner’s analysis should not be the exclusive theory which defines language and verbal

behavior. This may indicate that Skinner's analysis may need to be supplemented with other newer technologies that can account for more language than Skinner originally proposed. Further studies on RFT in conjunction with Skinner's analysis may lead to a more robust account of language.

In summary, the totality of the construct of verbal behavior described by Skinner (1957) differs vastly within the three assessments evaluated, and close evaluation of the content validity of these assessments revealed discrepancies associated with the content amongst commonly used assessment protocols. Skinner's analysis is not completely represented within the content of these assessments, while some assessments cover more of the VO categories than others, the total content validity in these assessments that compose the construct of verbal behavior are lacking. The assessments examined are commonly used tools within the field of behavior analysis and this paper proposes that the totality of Skinner's theory of language is not being covered within these assessments. This paper revealed that practitioners who are interested in the most comprehensive review of Skinner's analysis based on the VB-MAPP, ABLLS-R and PEAK may find that PEAK covers the widest variety of verbal operants and may be the best protocol to use to assess the VO categories. However, as it has been noted above, none of the assessments reviewed covered the entirety of what Skinner originally proposed. This may be indicative that Skinner's total analysis may not be as influential on language as it was originally believed to be and may be better supplemented with current technologies such as RFT. The current paper is may be one of the first steps in evaluating the exclusive focus on Skinner's theory and may lead to exploration of newer technologies of language learning to account for a more complex account of verbal behavior in children with autism. The current paper may also

be indicative of a greater need than just Skinner's analysis to account for language learning with children with autism and has provided future avenues of research to extend this view.

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Table 1. Skinner's Definitions of the Verbal Operants from *Verbal Behavior* with Accompanying Examples.

Verbal Operant	Definition	Primary or Extension	Example
1. Mand	"...the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (p. 35)	Primary	Saying "cookie" to mom and receiving a cookie
2. Extended mand	"Extension of a practical response through stimulus induction to a situation in which normal reinforcement is impossible" (p. 47)	Extension	"A lone man dying of thirst calling 'water!'" (p. 46)
3. Superstitious mand	"There are mands which cannot be explained by arguing that responses of the same form have been reinforced under similar circumstances" (p. 47)	Extension	A dice player saying "come seven!" (p. 47)
4. Magical mand	"Mands which cannot be accounted for by showing that they have ever had the effect specified or any similar effect upon similar occasions." (p. 48)	Extension	"Having effectively manded bread and butter, he goes on to mand the jam, even though he has never obtained jam before in this way." (p. 48)
5. Generalized mand	"...intensifying the mand function of what follows." (p. 321)	Extension	"please" "may" "would" (p. 49)
6. Disguised mand	"A disguised form of the mand is exemplified by 'call for Philip Morris', which may function as a mand although it is disguised as the response of a paging bellhop." (p. 257)	Extension	"Mmmm those cookies look good"

Table 1 continued.

	“We learn not to mention certain topics or certain events. With some listeners we come to avoid mands or use disguised mands instead.” (p. 179)		
7. Softened mand	“Some listeners are accustomed to taking orders - they have felt the unconditioned aversive consequences of not doing so - and respond appropriately to simple mands. Others are more likely to react to softened forms.” (p. 42)	Extension	“I wish you would tell me what you want” (p. 316)
8. Concealed mand	“...producing a special effect, in which some functions in lieu of a sharper specification of amount.” (p. 329)	Extension	“May I have some butter?” (p. 329)
9. Conditional mand	“The behavior manded is brought under the control of a future stimulus.” (p. 359)	Extension	“When the fire burns out, close the damper.” (p. 359)
10. Self-mand	“The verbal response comes first because it has less aversive consequences than the behavior manded.” (p. 440)	Extension	“‘Get up!’ is easier to execute than getting out of bed and less likely to be followed by a cold shock.” (p. 440)
11. Explicit mand	“Explicit mands not only provide a supplementary stimulus for the name of a product but arrange some of the conditions which elsewhere in the life of the speaker are associated with the reinforcement of echoic behavior.” (p. 257)	Extension	“Wait a minute, I haven’t finished!” (p. 200)

Table 1 continued.

12. Tact	“...a response of given form is evoked (or at least strengthened) by a particular object or event or property of an object or event.” (p. 82)	Primary	Seeing a plant and saying “plant”
13. Extended tact	“If a response is reinforced upon a given occasion or class of occasions, any feature of that occasion or common to that class appears to gain some measure of control. A novel stimulus possessing one such feature may evoke a response.” (p. 91)	Extension	Calling all different kinds of chairs a “chair”
14. Metaphorical tact	“A second type of extension takes place because of the control exercised by properties of the stimulus, which though presentation at reinforcement, do not enter into the contingency respected by the verbal community.” (p. 92)	Extension	Comparing drinking a soda to the feeling of a foot falling asleep (p. 92)
15. Metonymical tact	“An extension of a tact occurs when a stimulus acquires control over the response because it frequently accompanies the stimulus upon which reinforcement is normally contingent.” (p. 100)	Extension	The White House denied the rumor although it was the President who spoke (p. 100)
16. Solecistic tact	“...the property which gains control of the response is only distantly related to the defining property upon which standard reinforcements are contingent or is similar to that property for irrelevant reasons.” (p. 102)	Extension	“We may not be seriously disturbed when someone says dilemma although a situation is merely difficult.” (p. 102)
17. Nomination	“Before what we call “nomination” takes place, the only available responses are the common nouns and adjectives evoked by miscellaneous properties which	Extension	“The-new-baby-at-our-house” (p. 103)

Table 1 continued.

	the new object shares with previous objects for which tacts have already been acquired.” (p. 103)		
18. Abstract tact	“The procedure through which an abstract tact is set up does not create the control exerted by the stimulus; it simply sharpens and intensifies it. The property specified by the restricted contingency is the same.” (p. 108)	Extension	“To evoke a response which is under the control of a single property of an object it is necessary not only to present the object but to “specify the property to be reacted to.” Thus, to get the response red, one must present a red object as well as a verbal occasion on which color responses are especially reinforced...” (p. 113)
19. Proper tact	“A proper noun is a tact in which the response is under the control of a specific person or thing.” (p. 113)	Extension	Saying a person’s name
20. Self-tact	“The self-tact has an immediate effect in helping the speaker identify or clarify the situation to which it is a response.” (p. 441)	Extension	“I am opening the window” (p. 139)
21. Distorted tact	“Stimulus control is not only “stretched” but “invented.” A response which has received a special measure of reinforcement is emitted in the absence of the circumstances under which it is characteristically reinforced.” (p. 149)	Extension	A lie, or stretching the truth

Table 1 continued.

22. Pure tact	"... [a response] is characteristically reinforced only when it corresponds to a particular state of affairs." (p. 151)	Extension	"Dinner is ready!" when there is not a hungry person who is coming to eat, but is said as a general statement (p. 151)
23. Impure tact	"...a mixture of controlling relations characteristic of both tact and mand." (p. 151)	Extension	"Dinner is ready!" when there is a hungry person in the house to summon them to eat (p. 151)
24. Fragmentary tact	"A situation which does not adequately evoke a whole response in the form of a tact may evoke part of the response, perhaps in combination with other fragments." (p. 250)	Extension	A child calling noodles "Yankee doodles" (p. 250)
25. Conventional tact	"...emphasized onomatopoetic response" (p. 297)	Extension	"Sizzling" can sound similar to the actual sound of sizzling (p. 297)
26. Conditional tact	"...affects the listener by bringing behavior appropriate to ['a response] under the control of...a discriminative stimulus." (p. 361)	Extension	"When the light is on, the door is unlocked" (p. 361)
27. Hypostatical tact	"Emitting a response having the form of a statement as an echoic response" (p. 451)	Extension	"...not to be confused with emitting the same form of a response under the kinds of

Table 1 continued.

			circumstances which permit us to call it a statement.” (p. 451)
28. Audience control	“...certain forms of response are differentially reinforced by listeners belonging to different social classes or by listeners standing in different relations to the speaker. Each class or relationship thus defines a special audience controlling such forms.” (p. 173)	Extension	Talk differentially dependent on the audience; small children, co-workers, animals, etc.
29. Distant audience	“...discriminative stimulus associated with a deferred reinforcement” (p. 177)	Extension	Sending a letter (p. 177)
30. Positive audience	“The presence of a negative audience can be detected only in combination with a positive audience, since its effect is felt as a reduction in the strength of behavior appropriate to the latter.” (p. 230)	Extension	Obscene responses reinforced by a child’s playmates, for example, are punished by his family. (p. 230)
31. Negative audience	“The presence of a negative audience can be detected only in combination with a positive audience, since its effect is felt as a reduction in the strength of behavior appropriate to the latter.” (p. 230)	Extension	Obscene responses reinforced by a child’s playmates, for example, are punished by his family. (p. 230)
32. Self-audience	“...the speaker reacts as a listener to his own behavior. Insofar as he automatically reinforces himself, he must be regarded as an audience affecting the strength of relevant parts of his behavior.” (p. 179)	Extension	Covert thoughts
33. Unseen audience	“Unseen audiences encourage repetition—in letter writing, or in speaking impromptu on television, or in	Extension	Writing a book

Table 1 continued.

	writing a book for which there is no way of predicting the reaction of the reader.” (p. 221)		
34. Atypical audience	“Small babies, dogs, dolls, and so on, which may evoke behavior through stimulus generalization, show no sign of an effect, and the behavior is characteristically repetitious.” (p. 221)	Extension	“Baby” talk with an infant
35. Multiple audiences	“...two or more audiences have the same effect upon the same response.” (p. 230)	Extension	A growing crowd increases the stage fright of the speaker (p. 230)
36. Restricted audience	“Verbal behavior usually occurs only in the presence of a listener. When the speaker is talking to himself, of course, a listener is almost always present.” (p. 172) “The overt behavior may be restricted to the writer as the only audience by being put in coded form.” (p. 376)	Extension	“Between you and me” (p. 318)
37. Changing the audience	“The speaker or writer may strengthen his verbal behavior by finding an audience appropriate to a given repertoire or subject matter.” (p. 408)	Extension	Talking to fellow scientists about a theory rather than a family member
38. Echoic	“...responses in the listener showing a point-to-point correspondence between the sound of the stimulus and the sound of the response” (p. 55)	Primary	Telling a child say “Ball” and they say “ball”
39. Fragmentary echoic	“...responses which are alliterative or rhyming or otherwise similar to the stimulus word” (p. 56)	Extension	The sentence “dog log on a frog”

Table 1 continued.

40. Fragmentary self-echoic	"...may be shown in reduplicative forms..." (p. 56)	Extension	"Razzle-dazzle" "Willy-nilly" (p. 56)
41. Pathological echoic	"Pathological echoic behavior is seen in "echolalia," in which a bit of speech heard by the patient is repeated possibly many times." (p. 56)	Extension	Repeating "read read read"
42. Self-echoic: Overt- Covert	"Since a speaker usually hears himself and thus stimulates himself verbally, he can also echo himself." (p. 64) "however, it will be useful to appeal to the possibility of self-echoism. In all kinds of self-echoic behavior we have to consider the possibility that the verbal stimulus may be covert." (p. 65)	Extension	Overt: repeating oneself outloud—"I can't do it, I can't do it, I can't do it" Covert: a thought repeatedly running through someone's mind
43. Textual	"When a child learns to read, many verbal operants are set up in which specific responses come under the control of visual (or, as in Braille, tactual) stimuli." Skinner maintains that textual verbal operants can be in many different forms, including pictures, formalized pictographs, hieroglyphs, characters, or the letters or symbols of a phonetic alphabet." (p.65)	Primary	Words on a page
44. Self-textual	"We frequently create a text ("make a note") to control our own behavior at a later date." (p. 69)	Extension	Reminding ourselves to "do" something later (p. 69)
45. Audible textual	"The process of learning to point is sometimes quite explicit. We learn to "point" by pressing the doorbell button opposite the name of a friend in the vestibule of	Extension	Dialing a phone number (p. 194)

Table 1 continued.

	<p>an apartment house. We “point” to the name of a piece of music we want to hear by pushing the button opposite that name on a “jukebox.” We point to numbers in serial order in dialing a telephone. An audible textual response may often be detected in such cases, but an autonomous pointing response could be set up.” (p. 194)</p>		
46. Transcription	<p>“A response that creates a visual stimulus having a similar effect is also verbal according to our definition. Since verbal behavior may consist of writing rather than speaking, other correspondences between the dimensions of stimulus and response need to be considered” (p. 69)</p>	Primary	Writing a word
47. Phonetic transcription	<p>“...phonetic transcription which permits the reader to reconstruct relevant properties of the original behavior.” (p. 17)</p>	Extension	Writing a direct quotation
48. Intraverbal	<p>“...verbal responses show no point-to-point correspondence with the verbal stimuli which evoke them” (p. 71)</p>	Primary	“How are you?” “I am good”
49. Intraverbal chain	<p>“Common examples of intraverbal chaining are described by the term “literary borrowing.” All verbal behavior is, of course, borrowed in the sense of being acquired from other people. Much of it begins as echoic or textual behavior, but it does not continue as such when the echoic or textual stimulus is no longer present.” (p. 73)</p>	Extension	“The singer who cannot produce notes at the proper pitch may “loose the melody” in either sight-reading or singing by ear or from notes.” (p. 73)

Table 1 continued.

50. Trivial intraverbal	“Trivial intraverbal connections may disturb the chaining of responses. When a simple tact cannot be emitted, the generalized pressure from silence as an aversive condition may bring out a series of related responses. The first term in such a series (and perhaps others) cannot be an intraverbal if there has been no (at least covert) verbal stimulus.” (p. 219)	Extension	The alphabet being recited incorrectly (p. 219)
51. Mixed intraverbals	“Mixed intraverbals are exemplified by a telephone number or a car registration number containing the sequence 1, 2, 3, 4. One can learn such a number more easily because of earlier contingencies establishing the same response.” (p. 237)	Extension	Memorizing a phone number (p. 237)
52. Fragmentary intraverbal	“The speaker responds to a common property of the situation and gives it a tag. This alters the status of, and the available grammatical practices with respect to, the responses which remain. If the first response has been tagged as a noun, a fragmentary intraverbal pattern will supply the appropriate tag for, say, the verb to follow.” (p. 337)	Extension	“It has been pointed out that, although we usually say the horse neighs, we could as well say the neigh horses. Ultimately the distinction is meaningless.” (p. 337)
53. Self-intraverbal	“The events available to him as stimuli consist of the products of his own behavior as speaker. He may hear himself or react to private stimuli associated with vocal behavior, possibly of a covert or even incipient form. In a more obvious case, he may read what he has written. Self-stimulation has already been appealed to in discussing self-echoic, self-textual, and self-intraverbal behavior, as well as	Extension	Reading a note you have wrote and thinking “Why did I write that?” (p. 314)

Table 1 continued.

	certain effects of the speaker acting as his own listener and audience.” (p. 314)		
54. Intraverbal frames (recombination)	“...the practice represents a blend of fragmentary responses from two sources—the literary source of the intraverbal frames or sequences and the variables controlling possibly original verbal behavior in the writer.” (p. 308)	Extension	Using an original statement and altering it—“ The sound of horns and motors, which shall bring Sweeney to Mrs. Porter in the spring...” “A noise of horns and hunting, which shall bring Actaeon to Diana in the spring.” (p. 307)
55. Extended intraverbal frames	“...several local themes and standard intraverbal sequences are combined with the intraverbal frame....” (p. 308)	Extension	“Hadn’t he seven dams to wive him, and every dam had her seven crutches, and every crutch had its seven hues, and each hue had a differing cry” (p. 308)
56. Skeletal intraverbal	“In engaging in verbal behavior which is logical and scientific the speaker slowly acquires skeletal intraverbal sequences which combine with responses appropriate to a given occasion.” (p. 422)	Extension	“ <i>The wages of sin is death</i> finds the intraverbal connection between <i>sin</i> and <i>is</i> overcoming the more remote relation

Table 1 continued.

			between <i>wages</i> and <i>are</i> .” (p. 339)
57. Translation	“Simple paraphrase is in this sense translation. As in intraverbal behavior in general, either stimulus or response may be written or spoken without altering the basic process.” (p. 77)	Extension	A doctor using layman’s terms to explain something to a patient
58. Autoclitic	“The term “autoclitic” is intended to suggest behavior which is based upon or depends upon other verbal behavior.” (p. 315)	Extension	“I think” “I guess” “I assure you” (p. 315)
59. Descriptive autoclitic	“...descriptive of the speaker’s behavior (at the moment or at some other time) or even of the verbal behavior of someone else, but the immediate effect upon the listener in modifying his reaction to the behavior they accompany establishes a distinctive pattern.” (p. 315)	Extension	“I said ‘Heads’ or ‘I now say ‘Heads’ or ‘I will say “Heads.”’ (p. 313)
60. Qualifying autoclitics	<p>“Somewhat more explicit mands upon the listener are concerned with the practical problem of making a response effective upon him although they do not alter the nature of his reaction. He may react more positively or more hesitantly, but the action he takes is unchanged because the autoclitics do not qualify the relation between the accompanying response and a given state of affairs.” (p. 322)</p> <p>“The distinction is whether the effect on the listener is related to the speaker’s inclinations or to the properties of the stimuli responsible for these inclinations.” (p. 328)</p>	Extension	“The response no, as an example of a qualifying autoclitic, has the force of a mand. It may be roughly translated Don’t act upon this response as an unextended tact.” (p. 324)

Table 1 continued.

61. Quantifying autoclitics	“...function to narrow the reaction of the listener by indicating the relation between a response and the controlling stimulus. The circumstances under which we say book are different” (p. 329)	Extension	“a” or “the” (p. 329)
62. Relational autoclitics	“...“agreement” in number between the verb and the noun which serves as its subject.” (p. 333)	Extension	“The boy runs...”.. the -s indicates that the object described as the boy possesses the property of running. The fact that the boy and the running go together and that these are not isolated responses occurring together accidentally is made clear to the listener by the grammatical device.” (p. 333)
63. Manipulative autoclitic	“Vocal verbal behavior has only one important dimension: time. Within this dimension the speaker must describe multidimensional scenes or episodes and present complex arguments. For this purpose he may use special manipulative autoclitics which connect remote responses, signal temporary digressions, pick up dangling threads, and so on.” (p. 353)	Extension	“‘Sam rented a leaky boat.’ The “raw” responses are rent, boat, leak, and Sam. The important relations may be carried in broken English by autoclitic ordering and grouping: Sam rent

Table 1 continued.

boat—boat leak.” (p.
347)

Table 2. Chi-square Analysis for Verbal Operants Used Within Each Assessment.

	Primary	Extended	Total
VB-MAPP	6 (3.51) [1.76]	2 (4.49) [1.38]	8
ABLRS-R	6 (6.59) [0.05]	9 (8.41) [0.04]	15
PEAK	6 (7.90) [0.46]	12 (10.10) [0.36]	18
Total	18	23	41

Table 3. Chi-square Analysis for Number of Items Dedicated to the Verbal Operants.

	Primary	Extended	Total
VB-MAPP	102 (86.95) [2.60]	4 (19.05) [11.89]	106
ABLBS-R	176 (196.87) [2.21]	64 (43.13) [10.10]	240
PEAK	183 (177.18) [0.19]	33 (38.82) [0.87]	216
Total	461	101	562

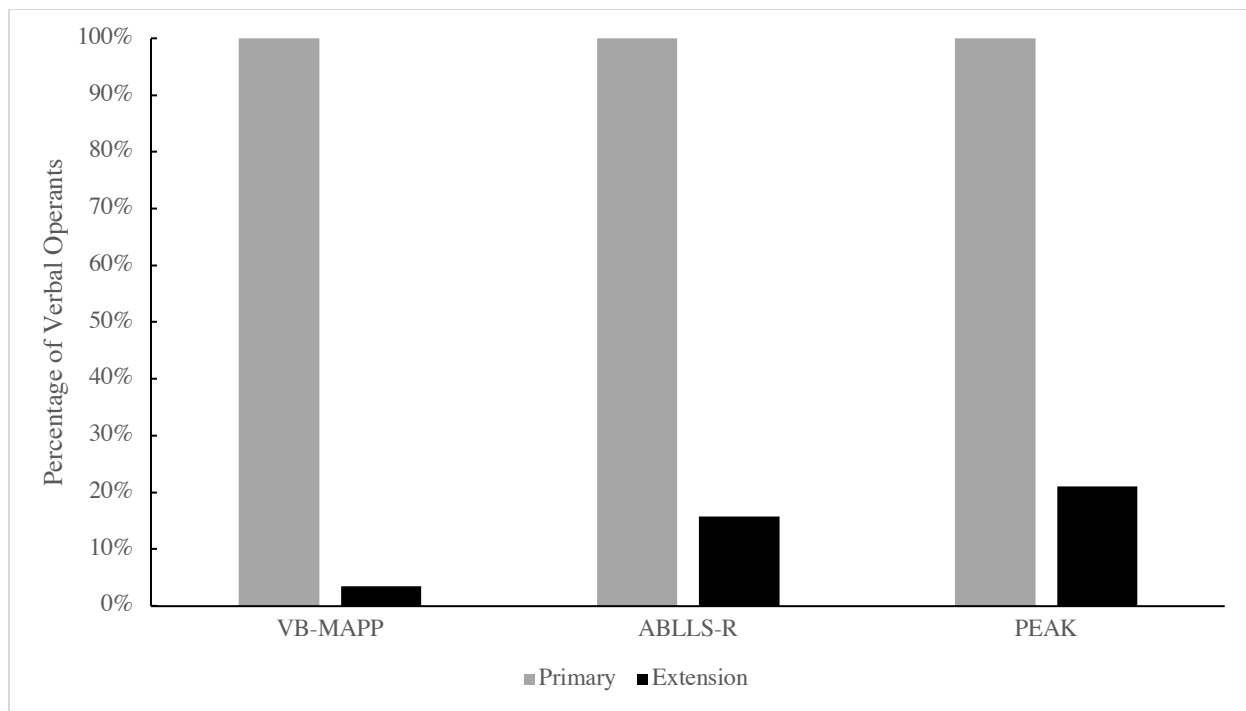


Figure 1. Percentage of verbal operants used within each protocol.

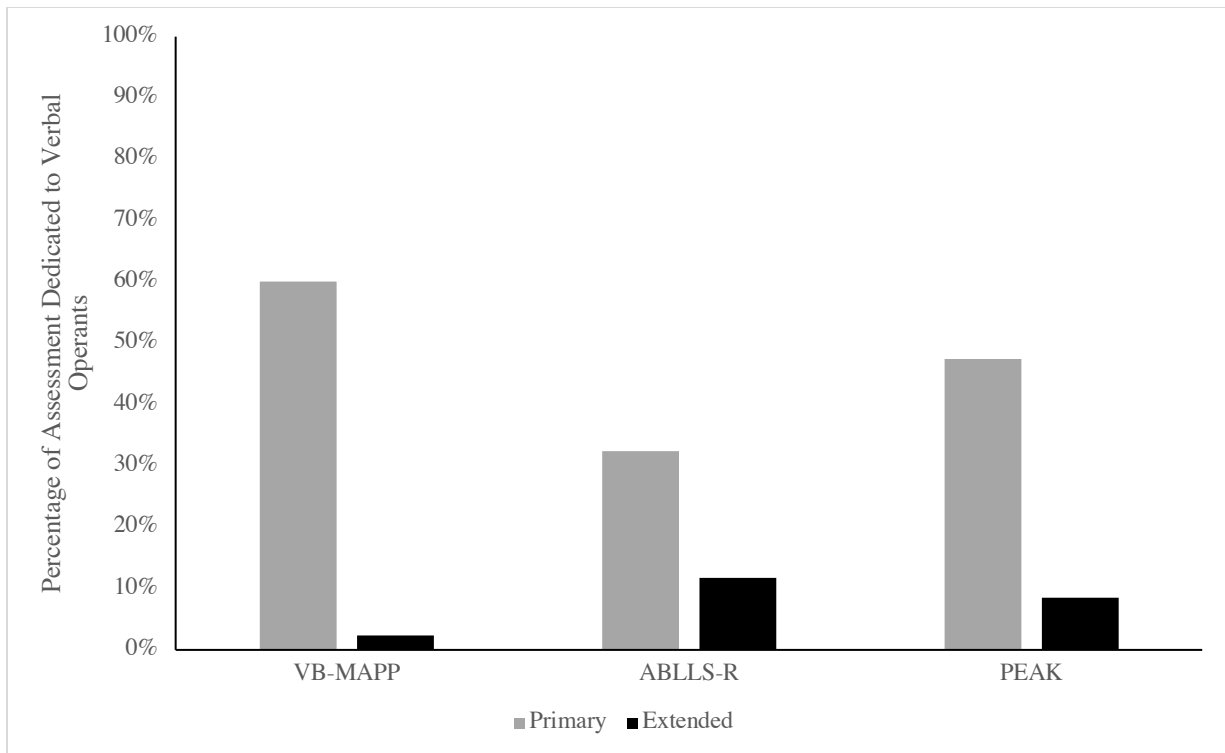


Figure 2. Percentage of each assessment dedicated to either the primary or extended verbal operants based on the entire assessment.

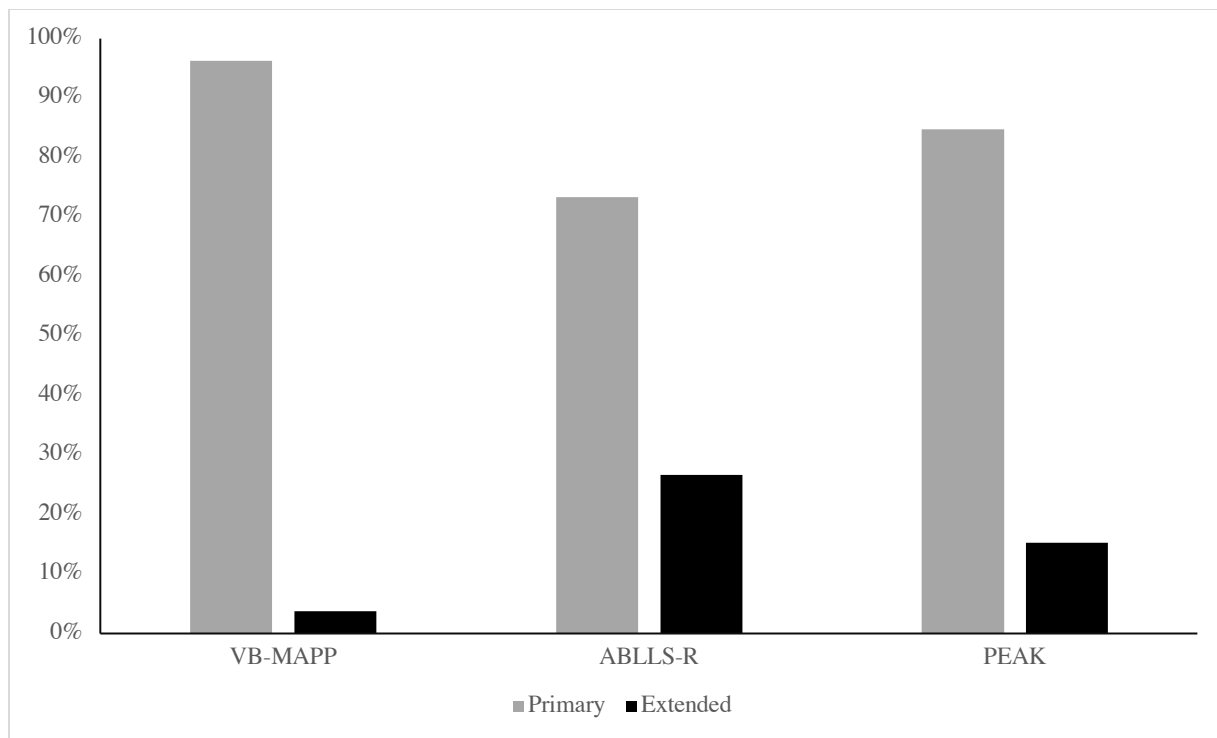


Figure 3. Percentage of each assessment dedicated to either the primary or extended verbal operants based on included items (i.e. expressive items).

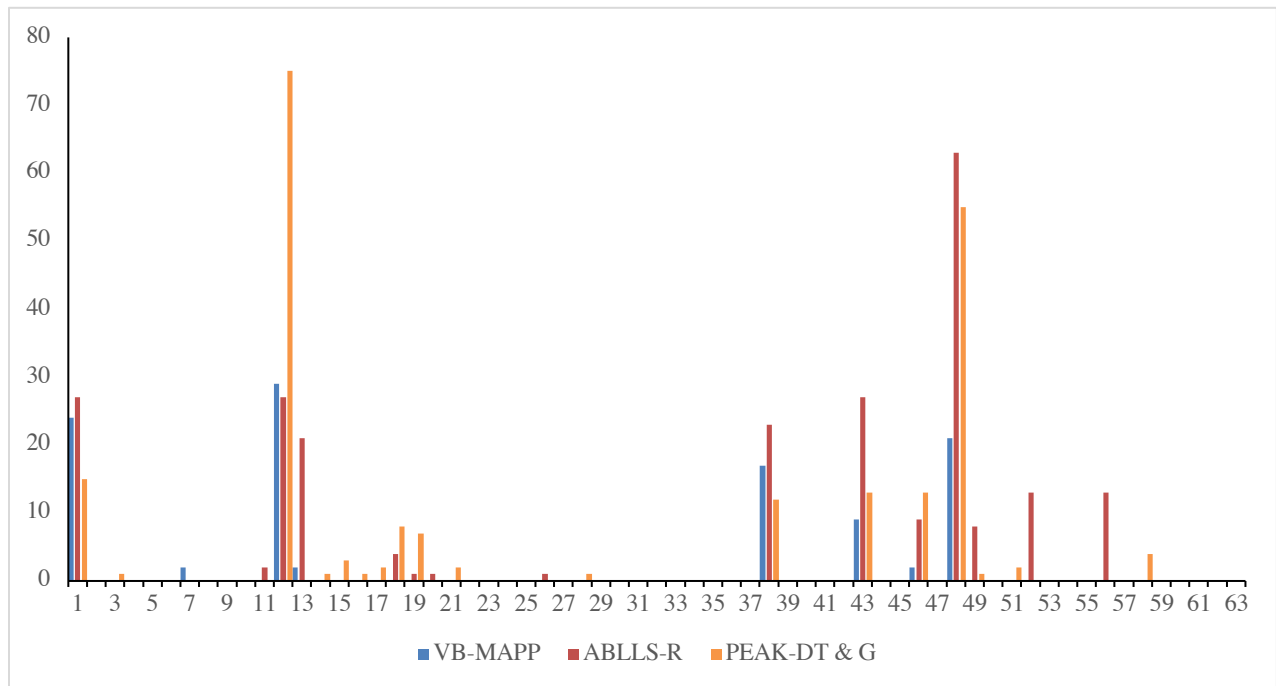


Figure 4. Distribution of the verbal operants based on assessment. Numbers on the x-axis reflect the numbers in Table 1 in reference to each verbal operant.