Teaching Complex Verbal Operants with the PEAK Relational Training System

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Published online: 31 July 2015

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Abstract The present study evaluated the effectiveness of five packaged protocols from the *Promoting the Emergence of Advanced Knowledge* (PEAK) curriculum. The skills targeted in the study included complex verbal operants proposed by Skinner (*Verbal behavior*. Englewood Cliffs, NJ: Prentice Hall, 1957), an area that is lacking in the current literature. The target skills included autoclitics, metonymical tacts, tacting planet names, and guessing. The results suggest that the PEAK methodology was effective in teaching each of the targeted skills to a mastery criterion, as well as maintenance of those skills at a 2-week follow-up phase.

Keywords Autism · Verbal behavior · Curriculum · PEAK

Highlights

- Replication of methods used to train elementary verbal operants with the more complex operants proposed by Skinner
- Demonstration of the effectiveness of a packaged protocol (i.e., PEAK) that is accessible and can be implemented by clinicians and parents with limited experience
- Inclusion of 2-week follow-up probes that show the maintenance of skills acquired through a direct-training approach

- Demonstration of how direct training can be implemented in a classroom setting

Introduction

According to the Center for Disease Control's Autism and Developmental Disabilities Monitoring (ADDMM) Network, the prevalence of autism in the USA is currently at 1 in 68 children (Wingate et al. 2014), representing a 123 % increase in just 8 years. With the rising prevalence of autism comes an increased need for treatment which addresses its associated deficits. One of the primary deficits of autism is the ability to use language functionally. As such, language training is a vital part of any treatment protocol for individuals with autism (Sundberg and Michael 2001). B. F. Skinner provided the first behavior analytic account of language with his book *Verbal Behavior* (1957). Skinner provided a functional description of language, defining six elementary verbal operants: mands, tacts, intraverbals, echoics, transcription, and textual. In addition, he went on to describe more complex forms of verbal behavior (e.g., tact extensions, private verbal behavior, autoclitics). Although much research has been conducted on Skinner's elementary operants, there is much left to explore. The education of individuals with disabilities requires treatments which are both comprehensive in their scope and accurate enough to address each individual's specific needs (Gould et al. 2011; Love et al. 2009). Though training basic verbal operants such as mands, tacts, and echoics is certainly necessary, the current literature provides little information on how to train more complex language and social skills which many individuals with disabilities lack (Dymond et al. 2006).

The *Promoting the Emergence of Advanced Knowledge Relational Training System: Direct Training Module*

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(PEAK-DT; Dixon 2014) is the first module of the PEAK relational training system, an assessment and curriculum guide which incorporates behavior analytic technologies in training new skills. The PEAK-DT module consists of 184 programs incorporating discrete trial training to teach skills ranging from basic learning skills such as eye contact and motor imitation to advanced language and learning skills such as telling jokes and metaphorical language. The goal of the current study was to evaluate the efficacy of PEAK in training five skills to children with autism, including the following: basic autoclitics, receptive metonymical tacting, expressive metonymical tacting, tacting planets, and guessing.

Three children with autism ages 9 to 11 who attended self-contained classrooms at a school for children with disabilities participated in the current study. Three skills were targeted for each participant following an initial assessment using the PEAK-DT module. Correct responding was assessed in terms of participants' PEAK scores within a 10-trial block. Scores ranged from 0 to 10 for each trial where 0 indicated that the skill was not demonstrated, 2 through 8 indicated decreasing levels of prompting needed for a correct response, and 10 indicated an independent response. All skills were tested using a multiple probe design, with no consequences being provided during test trial-blocks. Following an initial baseline, three training phases targeting one skill each occurred, followed by a follow-up phase.

The results of the present study are summarized in Fig. 1. In the baseline phase, none of the participants demonstrated mastery of the targeted skills. Greg achieved mean PEAK scores of 0, 10, and 0 for basic autoclitics, receptive metonymical tacts, and tacting planet names, respectively; Sandy achieved mean PEAK scores of 12.5, 0, and 0 for the same skills; and Lopez achieved mean PEAK scores of 2.5, 5, and 0 for guessing, receptive metonymical tacts, and expressive metonymical tacts. In the first training phase, which targeted basic autoclitics for Greg and Sandy and guessing for Lopez, each participant demonstrated mastery of the trained skills within three trial blocks. Probes conducted after training suggested that the participants failed to demonstrate mastery of the remaining two skills. In the second training phase, during which the participants were taught to receptively identify metonymical tacts, each participant achieved the mastery criterion within two trial blocks. Probes of the untrained skills suggested that each of the participants maintained the skill that they were previously taught, but did not demonstrate mastery of the final untrained skill. In the third training phase, the participants demonstrated mastery of the third skill following training, and mastery of the two previously trained skills maintained for all participants. Follow-up probes for each of the participants suggest that PEAK scores remained higher than in the baseline phase.

The results provide a demonstration of the effectiveness of a packaged curriculum grounded in applied behavior analysis

(i.e., PEAK) in directly training and promoting the maintenance of complex verbal behavior. Prior research has demonstrated the utility of applied behavior analysis in teaching Skinner's elementary verbal operants, but the methods used in the extant literature may be difficult for clinicians with limited experience to implement. PEAK provides a curriculum with packaged techniques for training skills that is designed for clinicians or parents with limited experience to implement. In addition, the skills targeted in PEAK go beyond Skinner's elementary verbal operants, and the results reported herein provide an initial demonstration of the effectiveness of the methods used in PEAK for training these more complex language skills. The results should be interpreted with caution, however, due to the similar age and disabilities of the participants, the limited number of stimuli, and the limited number of trial blocks during which mastery was demonstrated in the training phases. An additional potential limitation which may account for the limited number of trial blocks to mastery is the use of the PEAK scoring system as a measure. The scoring system was utilized to promote the external validity of the current study; however, the use of a prompt-based scoring system may not be as sensitive to learning curves as the traditional use of percent of correct trials. Because an incorrect (prompted) response can yield a score greater than zero, training phases may appear artificially inflated. However, tested trial blocks represent a measure of percent correct due to the fact that participants can only score a 0 or 10 for each trial. For this reason, the criterion of a PEAK score of 90 was included as this ensures that over half of the trials were independent within that trial block during trained trials.

Future research may consider the degree to which the training procedures used in the present study promote the generalization of trained skills to novel stimuli. Assessing for generalization could demonstrate the occurrence of broader learning from direct instruction, or highlight the need for training methods that promote a greater degree of generalized responding. Additionally, future research should investigate how the training of advanced verbal operants relates to the learner's language and learning skills as assessed by common standardized measurements.

Methods

Participants were selected based on their performance on the PEAK-DT assessment. Three children with autism spectrum disorder, Greg (male, age 11), Sandy (female, age 9), and Lopez (male, age 11) participated. Each participant was able to demonstrate expressive and receptive language skills including requesting and labeling common items and would follow simple classroom directions. All research sessions took place at a school for children with disabilities in the Midwest that the participants attended and lasted between 10 and

Fig. 1 PEAK score for all trained and tested skills within PEAK programs for all participants. *Diamonds* represent the first targeted skill, *squares* represent the second targeted skill, *circles* represent the third targeted skill, and data paths show where direct training occurred

40 min. Participants were either taken to a separate section of their classroom or a separate room within the school as needed (e.g., if other students were engaging in disruptive behavior or other students were distracted by the experimental procedures taking place in their classroom) to minimize interference with the school's regular functioning.

The materials used were those described within the PEAK-DT module for targeted programs. Examples of stimuli utilized include pictures of common items, planets, and word cards. Other stimuli included reinforcers identified by teachers and aides from the students' classrooms and verified through a brief multiple stimuli without replacement preference assessment (MSWO; DeLeon & Iwata 1996) or by simply asking

the participant what they would like to work for. Each participant was taught three skills in a multiple probe across both skills and participant's design. All participants began with a baseline phase where no feedback was provided for responding. During baseline, every skill was tested to ensure that the participants could not independently demonstrate the targeted skill prior to training. Following the baseline phase, each participant was exposed to three separate training phases. Each of the three phases consisted of discrete trial training for one target skill as well as test probes for the two skills not being taught within the respective phases. During test probes, conditions were identical to those in baseline (i.e., no feedback was provided following a response). Finally, each participant

was exposed to a follow-up phase 2 weeks after their last trial-block in the third training phase where skills were tested as in baseline.

During training phases, responses were measured based on the scoring system provided by the PEAK-DT curriculum (Dixon 2014). Each trial could receive a score between 0 and 10 where a 0 represented failure to demonstrate the behavior, a 2 represented multiple prompt attempts or a single stimulus in the array, a 4 represented two prompt attempts or a reduced array, an 8 represented a single prompt and a full array, and a 10 represented independent demonstration of the skill (see Dixon 2014 for further information on this scoring system). During instruction, a least-to-most prompt hierarchy was used ranging from verbal or gestural prompts to physical prompts as necessary. As the participants demonstrated successful responding with these prompts, they were faded to the next less intrusive prompt during the next trial (e.g., if a participant was successful with a physical prompt, the researcher would incorporate a partial physical prompt on the next trial). Prompt fading continued until the participant could independently display the skill. During test probes, the same scale was used; however, because no consequences were delivered, participants could only score a 0 or a 10 on each trial. This scoring system was utilized to enhance the external validity of the study as the same scoring would be utilized in an applied setting where the PEAK curriculum is implemented. Sessions were conducted in 10-trial blocks, and PEAK scores were reported as a total within each block. For example, if a participant demonstrated independent completion of the target skill during each trial within a block, their PEAK score would be 100. Mastery during test phases consisted of a criterion of an overall PEAK score of 90 for at least two consecutive trial blocks.

Five programs from the PEAK-DT curriculum were targeted: metonymical tacts: receptive (all participants), basic autoclitics (Greg and Sandy), tact planet names (Greg and Sandy), guessing (Lopez), and metonymical tacts: expressive (Lopez). Training for basic autoclitics consisted of teaching the words “might,” “maybe,” and “I think.” The experimenter first showed the participant a preferred item, then placed it behind his or her back and said, “Which hand is it in?” The participant was then taught to provide an autoclitic prior to guessing the hand they thought it was in. Training for receptive metonymical tacts involved placing an array of 3–10 pictures in front of the participant and asking the participant to point to pictures where stimulus control occurred based solely on frequent accompaniment of the two stimuli together. For

example, if the target picture was a bird, the experimenter might say, “Point to the tree.” Here, the correct response is to select the bird because both stimuli frequently accompany one another. Training for expressive metonymical tacts involved showing the participant a picture and asking, “What is it?” If the participant responded with the label of the picture, the experimenter would ask, “What else could you call it?” where an answer which frequently accompanied the target stimuli was appropriate. Despite the fact that metonymical tact extensions may seem erroneous, emitting these tact extensions is a common part of language. In order to develop a comprehensive and competent language repertoire, it is vital to teach the ability to understand language which may be poorly communicated. Training for tacting planet names involved presenting pictures of a planet and asking, “What planet is this?” Finally, training for guessing involved asking the participant to guess an event that occurred (e.g., “Guess what I did today?”). The participant was then prompted to respond appropriately (e.g., “Woke up”, “ate breakfast,”).

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