

## What is Applied Behavior Analysis (ABA)?

Applied Behavior Analysis is the design, implementation, and evaluation of environmental modifications to produce socially significant improvement in human behavior. ABA includes the use of direct observation, measurement, and functional analysis of the relations between environment and behavior. ABA uses antecedent stimuli and consequences, based on the findings of descriptive and functional analysis, to produce practical change. ABA is based on the belief that an individual's behavior is determined by past and current environmental events in conjunction with organic variables such as genetics. Thus, it focuses on explaining behavior in terms of external events that can be manipulated rather than internal constructs that are beyond our control.

Applied behavior analysis (ABA) is the science of human behavior. Over the past 30 years, several thousand published research studies have documented the effectiveness of ABA across a wide range of:

- populations (children and adults with mental illness, developmental disabilities and learning disorders)
- interventionists (parents, teachers and staff)
- settings (schools, homes, institutions, group homes, hospitals and business offices), and
- behaviors (language; social, academic, leisure and functional life skills; aggression, self-injury, oppositional and stereotyped behaviors)

Applied behavior analysis is the process of systematically applying interventions based upon the principles of learning theory to improve socially significant behaviors to a meaningful degree, and to demonstrate that the interventions employed are responsible for the improvement in behavior (Baer, Wolf & Risley, 1968; Sulzer-Azaroff & Mayer, 1991).

"Socially significant behaviors" include reading, academics, social skills, communication, and adaptive living skills. Adaptive living skills include gross and fine motor skills, eating and food preparation, toileting, dressing, personal self-care, domestic skills, time and punctuality, money and value, home and community orientation, and work skills.

ABA methods are used to support persons with autism in at least six ways:

1. to increase behaviors (eg reinforcement procedures increase on-task behavior, or social interactions);
2. to teach new skills (eg, systematic instruction and reinforcement procedures teach functional life skills, communication skills, or social skills);
3. to maintain behaviors (eg, teaching self control and self-monitoring procedures to maintain and generalize job-related social skills);
4. to generalize or to transfer behavior from one situation or response to another (eg, from completing assignments in the resource room to performing as well in the mainstream classroom);
5. to restrict or narrow conditions under which interfering behaviors occur (eg, modifying the learning environment); and
6. to reduce interfering behaviors (eg, self injury or stereotypy).

ABA is an objective discipline. ABA focuses on the reliable measurement and objective evaluation of observable behavior.

Reliable measurement requires that behaviors are defined objectively. Vague terms such as anger, depression, aggression or tantrums are redefined in observable and quantifiable terms, so their frequency, duration or other measurable properties can be directly recorded (Sulzer-Azaroff & Mayer, 1991). For example, a goal to reduce a child's aggressive behavior might define "aggression" as: "attempts, episodes or occurrences (each separated by 10 seconds) of biting, scratching, pinching or pulling hair." "Initiating social interaction with peers" might be defined as: "looking at classmate and verbalizing an appropriate greeting."

ABA interventions require a demonstration of the events that are responsible for the occurrence, or non-occurrence, of behavior. ABA uses methods of analysis that yield convincing, reproducible, and conceptually sensible demonstrations of how to accomplish specific behavior changes (Baer & Risley, 1987). Moreover, these behaviors are evaluated within relevant settings such as schools, homes and the community. The use of single case experimental design to evaluate the effectiveness of individualized interventions is an essential component of programs based upon ABA methodologies. This is a process that includes the following components:

- a. selection of interfering behavior or behavioral skill deficit
- b. identification of goals and objectives
- c. establishment of a method of measuring target behaviors
- d. evaluation of the current levels of performance (baseline)
- e. design and implementation of the interventions that teach new skills and/or reduce interfering behaviors
- f. continuous measurement of target behaviors to determine the effectiveness of the intervention, and
- g. ongoing evaluation of the effectiveness of the intervention, with modifications made as necessary to maintain and/or increase both the effectiveness and the efficiency of the intervention.

This process incorporates all of the features that constitute a favorable and accountable approach to behavior change (Sulzer-Azaroff & Mayer, 1991).

### **Discrete Trial Training**

Discrete trial training (DTT) is a particular ABA teaching strategy which enables the learner to acquire complex skills and behaviors by first mastering the subcomponents of the targeted skill. For example, if one wishes to teach a child to request a desired interaction, as in "I want to play," one might first teach subcomponents of this skill, such as the individual sounds comprising each word of the request, or labeling enjoyable leisure activities as "play." By utilizing teaching techniques based on the principles of behavior analysis, the learner is gradually able to complete all subcomponent skills independently. Once the individual components are acquired, they are linked together to enable mastery of the targeted complex and functional skill. This methodology is highly effective in teaching basic communication, play, motor, and daily living skills.

Initially, ABA programs for children with Autism utilized only (DTT), and the curriculum focused on teaching basic skills as noted above. However, ABA programs, such as the program implemented at CARD, continue to evolve, placing greater emphasis on the generalization and spontaneity of skills learned. As patients progress and develop more complex social skills, the strict DTT approach gives way to treatments including other components.

Specifically, there are a number of weaknesses with DTT including the fact the DTT is primarily teacher initiated, that typically the reinforcers used to increase appropriate behavior are unrelated to the target response, and that rote responding can often occur. Moreover, deficits in areas such "emotional understanding," "perspective taking" and other Executive Functions such as problem solving skills must also be addressed and the DTT approach is not the most efficient means to do so.

Although the DTT methodology is an integral part of ABA-based programs, other teaching strategies based on the principles of behavior analysis such as Natural Environment Training (NET) may be used to address these more complex skills. NET specifically addresses the above mentioned weaknesses of DTT in that all skills are taught in a more natural environment in a more "playful manner." Moreover, the reinforcers used to increase appropriate responding are always directly related to the task (e.g., a child is taught to say the word for a preferred item such as a "car" and as a reinforcer is given access to the car contingent on making the correct response). NET is just one example of the different teaching strategies used in a comprehensive ABA-based program. Other approaches that are not typically included in strict DTT include errorless teaching procedures and Fluency-Based Instruction.

### **Discussion**

The effectiveness of ABA-based interventions with persons with autism is well documented, with current research replicating already-proven methods and further developing the field. Documentation of the efficacy of ABA-based interventions with persons with autism emerged in the 1960s, with comprehensive evaluations beginning in the early 1970s.

Hingtgen & Bryson (1972) reviewed over 400 research articles pertinent to the field of autism that were published between 1964 and 1970. They concluded that behaviorally-based interventions demonstrated the most consistent results. In a follow-up study, DeMeyer, Hingtgen & Jackson (1981) reviewed over 1,100 additional studies that appeared in the 1970s. They examined studies that included behaviorally-based interventions as well as interventions based upon a wide range of theoretical foundations. Following a comprehensive review of these studies, DeMeyer, Hingtgen & Jackson (1982) concluded ". . .the overwhelming evidence strongly suggest that the treatment of choice for maximal expansion of the autistic child's behavioral repertoire is a systematic behavioral education program, involving as many child contact hours as possible, and using therapists (including parents) who have been trained in the behavioral techniques" (p.435).

Support of the consistent effectiveness and broad-based application of ABA methods with persons with autism is found in hundreds of additional published reports. Baglio, Benavidiz, Compton, et al (1996) reviewed 251 studies from 1980 to 1995 that reported on the efficacy of behaviorally-based interventions with persons with autism. Baglio, et al (1996) concluded that since 1980, research on behavioral treatment of autistic children has become increasingly sophisticated and encompassing, and that interventions based upon ABA have consistently resulted in positive behavioral outcomes. In their review, categories of target behaviors included aberrant behaviors (ie self injury, aggression), language (ie receptive and expressive skills, augmentative communication), daily living skills (self-care, domestic skills), community living skills (vocational, public transportation and shopping skills), academics (reading, math, spelling, written language), and social skills (reciprocal social interactions, age-appropriate social skills).

In 1987, Lovaas published his report of research conducted with 38 autistic children using methods of applied behavior analysis 40 hours per week. Treatment occurred in the home and school setting. After the first two years, some of the children in the treatment group were able to enter kindergarten with assistance of only 10 hours of discrete trial training per week, and required only minimal assistance while completing first grade. Others, those who did not progress to independent school functioning early in treatment, continued in 40 hours per week of treatment for up to 6 years.

All of the children in the study were re-evaluated between the ages of six and seven by independent evaluators who were blind as to whether the child had been in the treatment or control groups. There were several significant findings:

1. In the treatment group, 47% passed "normal" first grade and scored average or above on IQ tests. Of the control groups, only one child had a normal first grade placement and average IQ.
2. Eight of the remaining children in the treatment group were successful in a language disordered classroom and scored a mean IQ of 70 (range = 56-95). Of the control groups, 18 students were in a language disordered class (mean IQ = 70).
3. Two students in the treatment group were in a class for autistic or retarded children and scored in the profound MR range. By comparison, 21 of the control students were in autistic/MR classes, with a mean IQ of 40.
4. In contrast to the treatment group which showed significant gains in tested IQ, the control groups' mean IQ did not improve. The mean post-treatment IQ was 83.3 for the treatment group, while only 53.3 for the control groups.

In 1993, McEachin, et al investigated the nine students who achieved the best outcomes in the 1987 Lovaas study. After a thorough evaluation of adaptive functioning, IQ and personality conducted by professionals blind as to the child's treatment status, evaluators could not distinguish treatment subjects from those who were not.

Subsequent to the work of Lovaas and his associates, a number of investigators have addressed outcomes from intensive intervention programs for children with autism. For example, the May Institute reported outcomes on 14 children with autism who received 15 - 20 hours of discrete trial

training (Anderson, et al, 1987). While results were not as striking as those reported by Lovaas, significant gains were reported which exceeded those obtained in more traditional treatment paradigms. Similarly, Sheinkopf and Siegel (1998) have recently reported on interventions based upon discrete trial training which resulted in significant gains in the treated children's IQ, as well as a reduction in the symptoms of autism. It should be noted that subjects in the May and Sheinkopf and Siegel studies were given a far less intense program than those of the Lovaas study, which may have implications regarding the impact of intensity on the effectiveness of treatment.

Finally, according to a cost/benefit analysis conducted by Jacobson, Mulick & Green (1996), competently-delivered, early, intensive behavioral intervention can offer the hope of unprecedented gains for both children and taxpayers: estimated savings per child to age 22 are about \$200,000; to age 55, \$1,000,000.

Behavioral intervention is not without controversy, despite the empirical support. Detractors theorize behavioral programs produce robotic children. Research reviewed by MADSEC reveals nothing to substantiate this theory. On the contrary, one of the more consistent findings of the research is improved social skills in those children treated (eg Lovaas, 1987; Maurice, 1993). Others question whether Lovaas (1987) used a representative sample of children with autism. While that debate continues, subsequent research using a variety of samples (eg Anderson, et al, 1987; Sheinkopf & Siegel, 1998; Birnbrauer & Leach, 1993; Fenske, et al, 1985) shows that unlike other treatments proposed for autism, there have been no studies which do not support the effectiveness of behavioral intervention. To date, there are no published studies which refute the effectiveness of this approach.

## Conclusions

There is a wealth of **validated and peer-reviewed studies supporting the efficacy of ABA** methods to improve and sustain socially significant behaviors in every domain, in individuals with autism. Importantly, results reported include "meaningful" outcomes such as increased social skills, communication skills academic performance, and overall cognitive functioning. These reflect clinically-significant quality of life improvements. While studies varied as to the magnitude of gains, all have demonstrated long term retention of gains made.

Other major contributions of ABA to the education and treatment of individuals with autism include:

- a large number of empirically-based systematic instruction methods that lead to the acquisition of skills, and to the decrease/elimination of aberrant behaviors;
- a technology for systematically evaluating the efficacy of interventions intended to affect individual learning and behavior; and
- substantial cost/benefit.

Over 30 years of rigorous research and peer review of applied behavior analysis' effectiveness for individuals with autism demonstrate ABA has been objectively substantiated as effective based upon the scope and quality of science. Professionals considering applied behavior analysis should portray the method as **objectively substantiated as effective**. Methods of applied behavior analysis should be considered to evaluate the effectiveness of any intervention used to help individuals with autism. Researchers should continue to vigorously investigate behavioral intervention as the most promising area of research and treatment benefiting individuals with autism known today. Early interventionists should leverage early autism diagnosis with the proven efficacy of intensive ABA for optimal outcome and long-term cost benefit.

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