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Beyond Time Out and Table Time: Today's Applied Behavior Analysis for Students with Autism

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Abstract

Recent mandates related to the implementation of evidence-based practices for individuals with autism spectrum disorder (ASD) require that autism professionals both understand and are able to implement practices based on the science of applied behavior analysis (ABA). The use of the term “applied behavior analysis” and its related concepts continues to generate debate and confusion for practitioners and family members in the autism field. A general lack of understanding, or misunderstanding, of the science and practice of ABA is pervasive in the field and has contributed to an often contentious dialogue among stakeholders, as well as limited implementation in many public school settings. A review of the history of ABA and its application to individuals with ASD is provided, in addition to a discussion about practices that are/are not based on the science of ABA. Common myths related to ABA and ASD, as well as challenges practitioners face when implementing practices based on the science of ABA in public school settings are also described.

Beyond Time Out and Table Time: Today's Applied Behavior Analysis for Students with Autism

Introduction

The use of applied behavior analysis (ABA) with students with autism spectrum disorders (ASD) is not a new concept, as many professionals working in the autism field state that they "do" ABA with their students/clients. Though the science of ABA has been in use for decades questions remain about what constitutes ABA, its efficacy, and its use with individuals on the autism spectrum. Critics of ABA have historically disputed the evidence of efficacy of ABA for reasons ranging from criticisms that it is too punishment-based, lacks generalizability across settings and contexts, and issues with study methods and design. Such criticisms are not without merit, as will be discussed in this paper. However, much criticism is based on broad misconceptions about what it means to "do" ABA today in public school settings. ABA is much more than "Table Time" or discrete trial training, and "time out" or punishment. Today's ABA is based on a well-founded and researched science, uses positive reinforcement over punishment, seeks to establish a clear connection between treatment and outcome (e.g., functional relationship, discussed later in this paper), and is focused on generalization of socially important skills to the natural environment. This critical issues paper will provide an overview of ABA, which lays the foundation of the science and provides a historical context. Next, strategies and interventions based on the science of ABA will be discussed, as well as some of the myths and misconceptions of ABA as it pertains to individuals with ASD. Finally, challenges in the implementation of ABA (e.g. personnel preparation, litigation, blended methodology) are presented. The purpose of this critical issues paper is to provide readers, both new and seasoned professionals in the field of ASD and ABA, a reference for the use of ABA techniques with

students with ASD, and to provide clarity about what today's ABA is, and is not, for individuals with ASD.

Overview of Applied Behavior Analysis

Applied behavior analysis was first defined by Baer, Wolf, and Risley in 1968 as "the process of applying sometimes tentative principles of behavior to the improvement of specific behaviors, and simultaneously evaluating whether or not any changes noted are indeed attributed to the process of application" (p. 91). Using principles of behavior to shape, modify, or change behavior has a lengthy history in the field of special education, yet behavior modification alone does not qualify as ABA. Applied behavior analysis specifically includes the analysis of whether or not changes in behavior are caused by the behavioral modification techniques used, or whether there were other variables, or pure coincidence that leads to behavior change (Alberto & Troutman, 2009). In this way, the field has gone beyond training and moved to evaluation and prediction as well. In order to say with confidence that a particular intervention has lead to a change in behavior, one must evaluate it according to specific criteria (e.g., against baseline) and determine whether or not it is likely that this behavior change would be seen again, if the same intervention were to be used. This is known in the literature as establishing a functional relation between the behavior and the intervention, and is key to the analysis of behavior change (Kennedy, 2005).

Historical Context

Long before behavioral principles were formally defined, educators were using positive reinforcement and punishment to shape or change the behaviors of their students (Alberto & Troutman, 2009). Family members have for centuries used systems of reinforcement and punishment to teach their children, and to ensure that they grow into "well behaved" adults.

Thus, use of the principles of "applied behavior analysis, is not a new concept to the field of special education. In the early part of the 20th century John Watson began to advocate for a less "mentalistic" view of human behavior in favor of one based on only what could be objectively observed (Alberto & Troutman, 2009). In other words, instead of examining a child's history with his family, for example, one would observe his current behaviors to determine cause and make suggestions for change. This focus on observable behavior has continued in the field to this day. During the time when principles of behavior were first coming into formal description, other scientists began conducting experiments to determine the effect such principles and corresponding variables had on both human and animal behavior. B.F. Skinner is associated with operant conditioning, in which the consequences that follow a behavior determine the likelihood of that behavior increasing or decreasing. Specifically, when reinforcement is applied following a particular behavior, that behavior is expected to at the very least stay the same (in terms of intensity and frequency), and may increase. When punishment is applied following a behavior, the behavior is expected to decrease. A behavior that can be shaped by these consequences is said to be under operant control; it is not automatic, but rather, the individual has been taught to respond in a particular way. Use of such principles was the basis for behavior modification, and received a great deal of research in the early to mid 1900s, while researchers sought to establish that these principles held true for humans as well as animals.

In the 1960s, researchers began to apply behavioral principles in the real world to study and promote generalization of behavior. This move from the laboratory to the applied setting marked the beginning of ABA as it is known today. If one examines Baer, Wolf, and Risley's 1968 definition, it is clear that the use of behavioral principles in abstract, non-functional situations is counter to the purpose of ABA. In order for use of behavioral principles to be

"applied" they must be conducted with meaningful, socially important behaviors and be generalized to the natural environment where those behaviors or skills are needed. The use of behavior modification techniques in the real world became enormously popular because of its great success, and in 1968 the *Journal of Applied Behavior Analysis* (JABA) was introduced so that researchers could share their work with the ever-increasing number of researchers and practitioners using principles of behavior in applied settings.

Using ABA to Educate Students with ASD

For most children and youth, their natural environment consists of a combination of home, community, and school. In education, ABA is routinely used in attempts to teach new skills and decrease challenging behaviors. The use of behavior principles to effect these changes is not new in the field of education, though relatively few teachers may realize their use of ABA throughout their day. Each time a teacher makes a decision to modify or change his teaching to help a student better grasp an important concept, and then watches and records whether or not that student does indeed learn the concept, he/she has used applied behavior analysis. Certainly there is more to ABA than this, and there are professionals (behavior analysts) dedicated to the study and use of ABA, yet the basic definition is really that simple. In reality, teachers use ABA more often than they realize in their day-to-day interactions with students.

When many people think of ABA and autism, they think of the work of Dr. Ivar Lovaas and colleagues (1973; 1987). Lovaas was among the first researchers to use the principles of behavior to teach youngsters with autism. In his seminal work (1987), Lovaas and colleagues compared high intensity (approximately 40 hours per week) of ABA to low intensity (approximately 10 hours per week) of ABA and found that children who received more intensity of services lead to greater gains. Further, in a seven-year follow-up researchers found that many

of the children who had received the high intensity ABA were included in general education classrooms and were virtually indistinguishable from their typical developing peers (McEachin, Smith, & Lovaas, 1993). Other researchers have replicated the findings from Lovaas' original study with similar results (e.g., Eikeseth, Smith, Jahr, & Eldvik, 2002, 2007; McEachin, Smith, & Lovaas, 1993; Reed, Osborne, & Corness, 2006), while other researchers have found that lower intensity of ABA (e.g. 20 hours per week or less) also lead to improved functioning (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Eldevick, Jahr, Eikeseth, & Smith, 2006). Along with methodological concerns (Mesibov, 1993) a criticism of the original Lovaas study has been that the ABA intervention was conducted entirely in a clinical research setting, and does not mimic the environment of the public school, thus those individuals who rely solely on this original research as the basis for their work may question the utility of ABA in a public school setting for children with autism. However, since the original Lovaas study, hundreds of studies have been conducted, with many of them in applied, real world settings including homes, communities, and schools, and have demonstrated the efficacy of the approach. Such studies have found that using the principles of ABA with children with autism is not only effective, it is considered an evidence-based strategy and recommended for use (see discussion below regarding research-based practice and the National Autism Center's National Standards Project [NSP, 2009] for a review of the literature).

Strategies/Interventions Based on the Science of ABA

Along with misperceptions about what ABA is and what it is not, educators and caregivers often struggle in discerning which techniques and interventions are based on the principles of ABA. This confusion is understandable, as even professionals in the field continue to describe ABA as an "autism therapy" or "treatment approach for autism" (Sigafoos &

Schlosser, 2008). Though the field has clearly recognized that treatments based on the science of ABA have the strongest research support at this time (NSP, 2009), it is less clear what specific interventions for individuals with ASD are both empirically-based and fall under the ABA "umbrella." Following are some guidelines for practitioners to use in discerning which practices are based on the science of ABA as well as examples of a number of those practices used with individuals with ASD.

Baer, Wolf, and Risley (1968, 1987) recommended that intervention and/or research based on ABA principles be judged using six criteria. Should these criteria be met, practitioners can determine that the research/treatment is based on the science of ABA. Conversely, if all of these are not met, one can conclude that the intervention or practice does not fall under the umbrella of services based on the principles of ABA.

1. Is the intervention/research *applied?*

To meet this criteria the intervention and/or research must address behaviors that are socially significant for the individual with ASD and those interacting with the individual. These behaviors include social skills, academics, communication, self-care, or other behaviors that improve the day-to-day life experiences of the individuals and their caregivers (Cooper, Heron, Heward, 2007). Practitioners and researchers must evaluate the social significance of the behavior that is addressed. Practices/studies that contribute only to theory or address behavior that is not socially significant (i.e., choosing behaviors or participants based on convenience rather than immediate need) would not be *applied*.

2. Is the intervention/research *behavioral?*

The behavior addressed in the intervention/research must be observable and measurable through direct assessment and/or observation of the behavior. The observer must be well trained in

observing the specific behavior, use a clearly defined written behavior code, and complete frequent reliability assessments. The observer's behavior should be monitored as well, through the use of implementation fidelity measures if appropriate. Interventions/research using only self-report measures, participant-observer reports, or samples of student performance (e.g., IQ or achievement tests) are not deemed *behavioral*.

3. Is the intervention/research *analytic and conceptual*?

The practitioner/researcher must be able to demonstrate a functional relationship between the intervention and the change in targeted behavior. This requires multiple demonstrations of the relationship between the implementation of the intervention and the reliable and measurable change in the identified behavior. Essentially, a "believable demonstration of the events that can be responsible for the occurrence or non-occurrence of the behavior is required" (Baer et al., 1968, p. 94). Interventions/research that only describe a problem behavior or relationships between behaviors and contextual variables, as well as studies that employ exclusively qualitative methods (e.g. record review, case study, interviews, focus groups) are not considered *analytic*.

In addition, the intervention/research methods should make systematic, conceptual sense. It should be clear why the intervention methods worked and the practitioner/researcher should be able to link both the procedures and outcomes to the relevant behavioral principles. Interventions/studies that cannot provide a clear rationale for methods or a systematic justification for the observed behavior changes are not determined *conceptually* sound.

4. Is the intervention/research *technological*?

The intervention must include precise procedures that include enough detail and clarity that a trained professional can replicate the intervention with minimal teaching. All salient ingredients

of the intervention should be described, including how the interventionist should respond to student behavior throughout the intervention. Because a number of interventions based on ABA have been used for decades, practitioners and researchers can use previously published articles or texts as a reference for colleagues/readers. Intervention/research that does not include, or refer readers to, a clear procedural description with information about techniques, along with a set of contingencies between student/practitioner responses, is not deemed to be *technological.*

5. Is the intervention/research *effective?*

The practical and social importance of the behavior change is considered to be the most important feature of an intervention. While statistical significance is valuable, meaningful and noticeable change for the participant and those in the participant's environment is key. Effectiveness should be measured in several ways, including a measure of the problem behavior, the replacement behavior, and a measure of social validity, which addresses consumer satisfaction of the intervention's goals, procedures, and outcomes. When evaluating these measures to determine efficacy, interventionists/researchers must determine if the behavior was altered enough to be socially important (e.g. would changing a student's grade from a D- to a D be deemed socially important?) (Baer et al., 1968, p. 96). Determinations about an intervention's efficacy can often best be made by those impacted by the behavior (e.g. teachers, caregivers, staff members). Research that contributes only to theory or that does not produce practical change, as evaluated by stakeholders, in both replacement behaviors and problem behaviors would not be considered to be *effective*.

6. Does the intervention/research have *generality*?

The behavior change should last over time, after the intervention has been withdrawn, and ideally (but not required), behaviors that were not targeted for intervention should change. In

addition, programming to assist generalizability across a variety of factors is also recommended (Baer et al., 1968). Outcomes that diminish rapidly after an intervention ends and/or have little application across setting or behavior would not have *generality.*

These six criteria can assist practitioners in evaluating and determining which interventions are based on the science of ABA. As educators and caregivers are exposed to the myriad of treatment options available and faced with the choice of selecting interventions to implement, these guidelines should provide a foundation for decision making. In addition to using these criteria, two national centers have recently completed independent and complementary reviews of the intervention literature for individuals with ASD and the related reports can assist in this evaluation process as well. These national centers were charged with reviewing the intervention research literature, identifying standards for determining research quality, evaluating research designs, categorizing evidence-based practices, and disseminating that information to practitioners and families. In 2007, the Office of Special Education Programs in the US Department of Education funded the National Professional Development Center on Autism Spectrum Disorders (NPDC) to promote the use of Evidence Based Practices (EBP) in programs for infants, children, and youth with ASD and their families. In addition, the National Standards Project (NSP), an initiative of the National Autism Center, has recently completed an exhaustive review of the strength of evidence for psychosocial and behavioral interventions for individuals with ASD (NSP, 2009). These two efforts are the most current, comprehensive evaluative reviews of the literature on focused intervention practices for learners with ASD.

Each report identified practices that have strong empirical evidence supporting their use with individuals with ASD. The NSP labeled interventions as “Established” if the most stringent quality criteria were met (see the full report, NSP, 2009, for information about how research was

reviewed and rated). The NPDC labeled interventions as “Evidence-based” if criteria were met (see Odom, Collet-Klinenberg, Rogers, & Hatton, in press for information about how research was reviewed and rated). Both reports identified numerous established and/or evidence-based practices based on the science of ABA. In fact, the NSP reported that two-thirds of the Established Treatments were developed exclusively from the behavioral literature, and 75% of the evidence for the additional one-third of Established Treatments was gleaned from the behavioral literature (2009). Each report identified the strategies in different ways (i.e. “Antecedent Packages”, “Behavioral Treatments”), and included is a description of a sample of the strategies represented in one or both reports. The descriptions presented here, as well as the intervention literature included in both reviews, are certainly not exhaustive, as the interventions are far too numerous to list in one paper (see previously named reports for more detailed descriptions). In addition, the field continues to grow and hundreds (likely thousands) of articles have been published in the last decades using interventions based on the principles of ABA with individuals with ASD.

For inclusion in this evidence-based list and to be identified as a strategy based on ABA in the two reports, interventions must have demonstrated each of the six criteria above. This requires that each intervention include a) frequent observation and b) monitoring of progress through data collection and individualization, as intervention is based on the assessment of specific behaviors of individual students (e.g. curriculum based assessment, functional behavior assessment). Both are crucial components in the science of ABA. For the ease of visual presentation and discussion, intervention examples will be grouped across three broad categories: Antecedent Strategies (modification of situational events that occur before targeted behavior), Instructional Strategies (used to build new skill repertoires), and Consequence Based Strategies

(modification of situational events that immediately follow a targeted behavior) (see Tables 1, 2, and 3). Categories are not exclusive and strategies are often used across categories.

Insert Tables 1, 2, & 3 here

Strategies/interventions that are Not Under the ABA Umbrella

It is important to recognize that though service providers may state they are using an intervention based on the science of ABA, if it is not implemented with fidelity, along with frequent assessment and measurement of efficacy, it is not "ABA." In addition, there is little research that supports the use of eclectic models and programs (e.g. the combining of several approaches with varying theoretical foundations), (Foxx, 2008). However, because an intervention does not fall under the ABA umbrella does not mean it is not effective for some individuals on the autism spectrum. A number of interventions and comprehensive treatment models based on alternative theories (e.g. developmental, social/perceptual-cognitive) have emerging evidence supporting their use with individuals with ASD (NSP, 2009; Odom, Boyd, Hall, & Hume, 2009). Treatments based on alternative theories, either in isolation or in combination with behavioral strategies, should be continued to be studied empirically (NSP, 2009). Several are described below.

Strategies based on behavioral theory center on the notion that behavior change results from manipulating the antecedents and consequences of behavior. Typically discrete, observable behaviors are targeted for intervention. Interventions based on developmental or cognitive developmental theories may share a number of similarities with behavioral interventions; however developmental and social cognitive interventions may emphasize outcomes beyond distinct behaviors, such as "forming a sense of themselves" (Greenspan & Weider, 1999, p. 152), intentionality, and "responding in more thoughtful, flexible ways" (Gutstein, Burgess, &

Montfort, 2007, p.399). In addition, these theories propose or assume that a child's emotional state as well as his/her interpersonal relationships with caregivers impact behavior change. Typically these interventions, such as the Developmental, Individual-Difference, Relationship-Based model (DIR) or the Relationship Development Intervention (RDI) draw heavily from the knowledge base on typical child development, and strongly emphasize relationships with caregivers, emotional development, and the teaching of more broader principles, rather than specific skills (e.g. experience sharing, flexibility, affection with caregivers) (Greenspan & Weider, 1999; Gutstein et al., 2007; Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006).

Other interventions that are based on developmental framework include the Denver Model, Hanen, Responsive Teaching, the Son-Rise program, and the SCERTS model (Odom, Boyd, et al., in press). A number of these models (RDI, DIR, Denver, and Responsive Teaching) offer emerging evidence of efficacy per the NSP and often incorporate behavioral strategies and elements of Applied Behavior Analysis (e.g. applied interventions, a conceptual framework, evidence of generality). Other interventions draw from several theoretical contexts. Structured Teaching, Division TEACCH's intervention approach, for example, draws from behavioral theory, as well as social-cognitive, and developmental psychology (Mesibov, Shea, & Schopler, 2005). Along with addressing specific behavioral targets for intervention and manipulating antecedents and consequences for behavior change, the model emphasizes the role of "one's thoughts, expectations, and understanding of a situation" as a contributor to behavior and behavior change (Mesibov et al., 2005, p. 51). Structured Teaching has been deemed an Emerging Treatment by the NSP (2009). Still other interventions have developed their own idiosyncratic theoretical framework, outside the science of ABA, such as the Higashi School's Daily Life Therapy which emphasizes intensive physical exercise, group instruction, emotional

regulation, and development of self-identity (Kitahara, 1983). This model was not reviewed by the NSP.

Educational interventions with more limited levels of efficacy (labeled as Unestablished by the NSP) and not deemed to be ABA-based strategies, include Facilitated Communication, Auditory-Integration Training, and Sensory Integration Therapy, (NSP, 2009). Medical and biomedical interventions such as psychotropic medication, special diets, and vitamins are beyond the scope of this article and are typically not considered to be based on the science of ABA.

Common Misconceptions about ABA and ASD

Myth #1: ABA and DTT are Synonymous

The most common misconception about ABA and its use with students with ASD is that ABA refers to a particular strategy, namely discrete trial training/teaching, or DTT. Perhaps because of its use in the original Lovaas studies and subsequent replications, many professionals who are not well trained in ABA consider DTT to be "the" program for students with ASD, and synonymous with ABA. When a teacher states that he or she "does" ABA, they are frequently referring to DTT. Often referred to as "Table Time" because historically conducted in a one-to-one setting, usually at a table, DTT involves the use of what is called a three-term contingency for instruction. The three-term contingency includes some antecedent cue, or discriminative stimulus (S^D) provided by the teacher, followed by a behavioral response by the student (which in some cases may require teacher prompting to elicit), followed by a reinforcing consequence delivered by the teacher. Figure 1 provides a visual example of the three-term contingency. Each learning opportunity utilizing this three-term contingency is referred to as a trial. Because it is used to teach skills that typically involve short, discrete behavioral responses (e.g., pointing at an item, answering a question), it is referred to as discrete trial training or discrete trial teaching.

Use of DTT is not limited to “table time”; indeed, anytime someone uses the three-term contingency to teach a skill, they are using DTT.

Insert Figure 1 Here

As discussed previously, discrete trial training is only one part of a comprehensive ABA program. Steege, Mace, Perry, and Longenecker (2007) suggested that, “although DTT has many advantages to recommend its use, it is not well suited to teach the full range of cognitive, social, academic, leisure, and functional living skills children with autism and related disorders need to develop and generalize to varied natural environments. DTT, also does not address the treatment of behaviors that can interfere with instruction and the acquisition, generalization, and maintenance of skills many children with autism bring to instructional situations” (p. 91). Thus, it is clear that ABA and DTT are not synonymous, but also, DTT alone is insufficient to produce the kinds of benefits typically sought in educational programs for students with ASD.

Myth #2: ABA is Punishment-Based

Punishment has been used and will likely continue to be used in the field of ABA. There are a number of misconceptions, however, about what punishment is and the frequency of its usage in the field. It is important to first provide a clear definition of punishment—essentially it is a consequence that reduces the future probability of a behavior (Azrin & Holz, 1966). Punishment can be a commonly-used reprimand such as “Stop” or “No” or the removal of positive reinforcer, like losing free time or privileges after engaging in disruptive behavior. The term punishment has somehow become synonymous with the use of time-out procedures and the use of aversive stimuli, such as noxious smells, electric shock, or isolation. Though the use of these procedures has a history in ABA, as well as in other methods such as TEACCH (Schopler, Lansing, & Waters, 1983) and the broader field of special education (Heron, 1978), few in the

field would advocate for their usage today. In the last twenty years the field has shifted "from viewing behavior support as a process by which individuals were changed to fit environments, to one in which environments are changed to fit the behavior patterns of people in the environment" (Horner, Carr, Strain, Todd, & Reed, 2002, p. 425). The field has increased attention to intervention procedures that focus on what to do before or between interfering behaviors (National Research Council, 2000). Consequence based approaches, including the use of strategies to reduce challenging behavior, will continue to be used in the field, however, this use is only after less intrusive strategies have been tried and failed and only with consent of stakeholders. Inappropriate use of the science of ABA by individuals who have been poorly or inappropriately trained may lead to the inappropriate use of consequences, and thus perpetuate the myth of aversives or isolation as punishment. When conducted correctly, ABA is an effective tool for individuals with ASD; when conducted incorrectly, it can create negative effects. Therefore, it is important that schools (and families) recognize the competencies of those who are well-trained in ABA, as well as those who are not. This issue will be discussed further in the section on personnel preparation.

Myth #3: ABA Must be Conducted 40 Hours per Week

With the original published work of Ivar Lovaas (1987), the field was introduced to the concept of early intensive behavioral intervention (EIBI) for children with ASD, which consisted of 40 hours per week of one-to-one DTT-style instruction. Following three years of such intensive intervention, Lovaas reported that the children who received the highest intensity (i.e., 40 hours per week) made remarkable gains in language, IQ, and were virtually indistinguishable from their typically developing peers. Other researchers have replicated the orginal Lovaas study and found similar results (e.g., Eldevick, Jahr, Eikeseth, & Smith, 2006; Smith, Eikeseth,

Klevstrand, & Lovaas, 1997). However, other studies have found that similar gains can be made with fewer than the recommended 40 hours per week (Sheinkopf & Siegel, 1998; Smith, Groen, & Wynn 2000). Additionally, internal and external validity concerns have been reported with the original Lovaas study (see Gresham & MacMillan, 1997), including the use of different IQ tests at baseline and follow up, the homogeneity of subjects in the study (specifically, higher functioning, verbal subjects), and conducting the study in a clinic, rather than applied, setting (Reed, Osborne, & Corness, 2006). Further, upon replication in a home-based (applied) setting, Reed, Osborne, and Corness (2006) found that while the "high-intensity intervention group produced generally better results than the lower-intensity group, these differences were not always statistically significant. This finding brings in question the strong reliance placed on the temporal input of the program as key to its success" (p. 1820) In addition, no significant changes between high and low intensity groups on adaptive behavior or on severity of autistic symptoms were found by Reed and colleagues. Reed, et al. further examined the relationship between the intensity of the program in terms of number of hours per week and overall child gains and found that "no clear pattern between temporal input and the gains" existed (p. 1820). Moreover, these researchers noted, "This finding implies that the suggested 40 h/week input may not be optimal, and once over a certain level of temporal input, perhaps around 20 h a week, there are diminishing returns for increasing the temporal input of a program" (p. 1820). Clearly there is a disparity in the literature regarding the intensity of ABA programming for youngsters with ASD, including location of such services (e.g., applied vs. clinical) and age (e.g., young children vs. older children and adolescents). Educators especially are frequently concerned with the perceived "requirement" that ABA (in this case, usually meaning DTT) be conducted a minimum 40 hours per week, because the typical public school classroom is not conducive to this intensity

of one-on-one instruction. While debate continues, further research is necessary to address these issues. In the meantime, educators in public schools can rely on increasing evidence that fewer than the originally reported 40 hours per week has been associated with increases in functioning for students with ASD.

Myth #4: ABA is Clinic-Based and Lacks Generalizability

Given the reported success of the Lovaas (1987) study, people may attribute the positive results of that study to its clinic setting. While researchers have conceded that it is possible that Lovaas's results were in part due to the relative controlled nature of clinical research (Reed, et al., 2006), a useful intervention is one that is accessible by all those who interact with the child, not just researchers in a clinic setting. Therefore, research is emerging suggesting that ABA is successful for children with ASD when applied in home and school-based settings (Harris & Delmolino, 2002; Reed, et al., 2006). Further, research continues to support that parents, teachers, and paraprofessionals can be taught to successfully use ABA strategies in a variety of applied, real world settings (Bolton & Mayer, 2008; Dillenburger, Keenan, Gallagher, & McElhinney, 2004; Hayward, Gale, & Eikeseth, 2009; Lerman, Tetreault, Hovanetz, Strobel, & Garro, 2008).

Consider again the original definition of ABA proposed by Baer, Wolf, and Risley (1968). This definition focuses first on the remediation of socially important behaviors; in other words, professionals are directed to address and teach only those skills that have meaning and function for the child now or in the future. Secondly, the applied nature of the science of ABA inherently requires that skills be generalized to the natural environment. Undoubtedly there are professionals, and even some parents, in the field of ASD today who have seen teaching of skills that appeared without function or meaning, and have seen "ABA" (more accurately, DTT)

conducted only at a table and never moved to the natural environment. The Behavior Analyst Certification Board (BACB), the international accreditation agency for behavior analysts, requires as part of its ethical guidelines for practice the generalization of socially important skills. Thus, those using ABA strategies with students with ASD should strive for instruction in the natural environment to the maximum extent appropriate; to increase generalization and to ensure that the skills taught are functional and meaningful in the most socially appropriate setting.

Concerns about Implementation of ABA in Public School Settings

Caregivers and service providers have voiced a number of concerns related to the implementation of high quality public school programs based on the science of ABA. These are often related to the expertise and training of service providers in public school settings, difficulties in blending approaches for students on the spectrum, and the challenges related to providing effective programming that is affordable, while simultaneously avoiding due process (National Research Council, 2001; Scheurmann, Webber, Boutot, & Goodwin, 2003). A brief discussion of each concern as well as possible solutions follows.

Personnel Preparation

The difficulty in finding public school personnel who are trained in both the theory and implementation of ABA with students with ASD is well documented (National Research Council, 2001; Scheurmann, et al., 2003). Preparation of special education teachers varies across states and license requirements are typically not specific to one disability, such as ASD. Exposure to the science of ABA may be limited for many throughout their preservice preparation. An option for service providers is to pursue certification as a behavior analyst; however this requires a master's degree with a minimum of 15 hours of graduate work in the

field of ABA, 1500 hours of supervision in the field, and the completion of the behavior analyst certification exam. While this option certainly provides the most training for service providers, it is a long-term solution to the pressing problem of increased numbers of students with ASD in public schools and the constant teacher shortage, and is not feasible for all staff for a myriad of reasons (e.g. time, finances).

A number of communities have developed effective means of training public school personnel in the implementation of ABA-based strategies. Providing intensive ABA-based training and ongoing consulting to service providers has proven effective in increasing teacher skills as well as student outcomes (Arick, Young, Falco, Loos, Krug, Gense, & Johnson, 2003; Lerman, Tetreault, Hovanetz, Strobel, & Garro, 2008; Swiezy, Maynard, Korzekwa, Pozdol, Hume, Grothe & Miller, 2007). These studies have indicated that providing up to 5 days of intensive training to public school staff through the use of lecture, role play, and application with students with ASD has led to significant increases in staff knowledge and application of skills (Lerman et al., 2008; Swiezy et al., 2007), as well student gains in language, social interaction, and adaptive behavior (Arick et al., 2003). In addition to intensive, hands-on training options, a number of states and schools have partnered with universities or private schools and resource centers specializing in ABA to provide ongoing support and consultation. For example, the National Professional Development Center on ASD, funded by the US Department of Education, has partnered with 12 states across 3 years to provide technical assistance in the implementation of ABA strategies, as well as assist in developing state and district capacity for ongoing training and support (Odom, Collett-Klingenberg, et al., in press). Another example is the River Street Autism program that provides services to individuals with ASD in home settings and a separate facility, but has also established model classrooms in school districts that can serve as training

facilities (Dyer, Martino, & Parvenski, 2006). A third viable option that schools are pursuing is the development of district ASD support team that employ board-certified behavior analysts (BCBA) to serve as consultants to district classrooms. The Valley Program in New Jersey, for example, is a 16-class public school program based on the science of ABA (Handleman & Harris, 2006). It is supported by 4 BCBAs, including a program administrator, who provide skill development and behavior support for the larger program. Though published outcomes from the Valley Program are not yet available, this model of personnel preparation and support warrants further investigation (Odom, Boyd, et al., in press).

The Law

With the rise in autism rates has come an increase in litigation concerning the education of students with ASD (Zirkel, 2001), particularly concerning effective programming and the use of ABA (Choutka, Doloughty, & Zirkel, 2004). According to Choutka, et al. (2004), the two areas most predominate in ABA/ASD litigation are "program selection (i.e., the choice between competing instructional approaches) and implementation of said program (e.g., its location, duration, or frequency)" (p. 95). Choutka and colleagues completed a review of case law relevant to ASD and ABA; specifically they compared ABA and TEACCH (previously discussed) as the two competing programs most litigated (2004). Cases concerning program selection were those wherein parents had requested that the school district use ABA (specifically, DTT or the Lovaas method) rather than the district program (e.g., TEACCH). When the parties had agreed on use of DTT, concerns over program implementation became the disputed issue (specifically home vs. school, the number of hours provided, and whether or not the DTT provider was qualified to provide DTT). While this study found that the chances of winning (whether parent or district, concerning program selection or implementation) were 50/50, a number of factors emerged

concerning the litigation over ABA/DTT in schools. Specifically, cases won by either party tended to include three factors that are suggested for use by either parents or schools when entering into litigation over programming: proof of efficacy, expert testimony, and qualified providers. First, parents and schools must provide documentation as to the effectiveness of whatever program they used. Evidence supporting that the program provided some educational benefit and that the child made progress toward educational goals is key. The second suggestion by Choutka and colleagues was that both parties should include testimony from qualified expert witnesses who can attest to the efficacy of the program chosen as well as to its appropriateness for the child in question. Third, it is incumbent upon schools to show that the staff who carry out DTT programming are well trained and qualified to do so. Further, staff must also be knowledgeable not only in programming and in the nature of autism, but also in regard to the unique and individual needs of the child in question.

The suggestions by Choutka, et al., (2004) are consistent with the literature on best practices for students with ASD. As previously discussed, literature suggests that staff implementing ABA be well trained (e.g., Scheuermann, et al., 2003) and that programming must be based on the unique needs of the child. Their review of case law, however, does not suggest that ABA (specifically, DTT) is always selected as the program of choice for all students with ASD. Again, hearing officers/judges are charged with determining which practice or program provides evidence of educational benefit for a specific child based on that child's individual needs. Thus, use of ABA or DTT alone may not win a due process case simply on its own merit.

Blended Methods

The above referenced review of case law suggests, as previously mentioned, that the use of ABA alone may not be sufficient for all children with ASD, particularly when the "ABA"

being used is only DTT. Further, most researchers agree that the most appropriate program for students with ASD is one based on the child's individual needs (e.g., Simpson, 2005). As previously discussed, there are a number of other programming options for students on the autism spectrum, with varying degrees of research support (see NSP, 2009 for a review of these practices). And while many strategies and approaches are based on the science of ABA, "ABA" is not a program in and of itself. Teachers and parents alike have found that what works best for an individual child is often a combination of strategies, based on the impact of the autism, the child's level of functioning, and other factors. Boutot and Dukes (2011) suggested a multi-theoretical approach to teaching students with ASD. Based heavily in the science of ABA (because of its known efficacy), but acknowledging that the unique needs of various students and families may require additional strategies beyond ABA, a multi-theoretical approach utilizes other established practices such as TEACCH (based on a perceptual-cognitive/social-cognitive model) and those strategies based on a more developmental model (e.g., DIR) in addition to ABA. Though evidence for such approaches is currently limited, study is ongoing. The key to success, in the end, may be how well the program works for an individual child and family members rather than what it is called.

Conclusions

Recognizing, understanding, and implementing practices based on the science of ABA is essential for practitioners serving individuals with ASD. Professionals must provide clarity when describing what one "does" when using the science of ABA, why one "does" it, and what the data reveals after it is "done." Though a number of challenges are presented when implementing these interventions in the public school settings, service providers will be more adept at navigating these challenges when armed with an awareness of what ABA is (and is not), what

the practices look like in school settings, and where its theories are derived. Further, as has already been suggested, educators and caregivers/families must recognize that ABA goes beyond DTT ("Table Time"), and includes concepts such as pivotal response training, incidental teaching, task analysis and chaining, progress monitoring, functional behavior assessment and analysis, and generalization and maintenance of skills across time and setting. Similarly, critics of ABA must recognize that today's ABA is heavily focused on the use of positive reinforcement and antecedent modifications to shape behavior, rather than the use of punishment ("Time Out"). A challenge for the field will be to support the use of ABA in programs for learners with ASD. If equipped with proper training and support (a number of effective options are described previously), practitioners can successfully implement ABA-based strategies, which are likely to produce the most measurable changes in behavior for their students (NSP, 2009).

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Table 1

Examples of ABA Based Interventions for Individuals with ASD- Antecedent Strategies

Antecedent Strategies	*Description*	*Sample Reference*
Behavioral Momentum	Presenting a series of requests for behaviors that are associated with a high rate of reinforcement (have a high probability of occurring), and then presenting a request for a behavior that has a low probability of occurrence	Romano, J. P., & Roll, D. (2000). Expanding the utility of behavioral momentum for youth with developmental disabilities. *Behavioral Interventions, 15,* 99-111
Choice	Allowing individuals to exhibit preferences in the selection of materials, activities, order of task completion, and/or other elements of the instructional day (e.g. reinforcers, setting)	Romaniuk, C., Miltenberger, R., Conyers, C., Jenner, N., & Jurgens, M. (2002). The influence of activity choice on problem behaviors maintained by escape versus attention. *Journal of Applied Behavior Analysis, 35,* 349-362.
Environmental Modification	Changing conditions in the environment or activity to increase the likelihood that appropriate behavior will occur (while decreasing the likelihood that interfering behavior is reinforced)	Schilling, D. L., & Schwartz, I. S. (2004). Alternative seating for young children with autism spectrum disorder: Effects on classroom behavior. *Journal of Autism and Developmental Disorders, 34,* 423-432.
Errorless Learning	Teaching procedures that reduce the likelihood of incorrect	Ducharme, J. M., Sanjuan, E., & Frain, T. (2007). Errorless compliance training: Success-focused behavioral treatment of

	responding (e.g. stimulus fading, delayed prompting, response prevention)	children with asperger syndrome. *Behavioral Modification, 31,* 329-344.
Incorporating Student Interest	Using highly preferred activities/items during instruction to increase student engagement	Vismara, L. A., & Lyons, G. L. (2007). Using perseverative interests to elicit joint attention behaviors in young children with autism: Theoretical and clinical implications for understanding motivation. *Journal of Positive Behavior Interventions, 9,* 214-228.
Priming	Previewing student's future task/activity	Bainbridge, N., & Myles, B. S. (1999). The use of priming to introduce toilet training to a child with autism. *Focus on Autism and other Developmental Disabilities, 14,* 106-109.
Task Interspersal	Interspersing mastered tasks with new or unknown tasks during instruction	Charlop, M. H., Kurtz, P. F., & Milstein, J. P. (1992). Too much reinforcement, too little behavior: Assessing task interspersal procedures in conjunction with different reinforcement schedules with autistic children. *Journal of Applied Behavior Analysis, 2*5, 795-808.
Time delay	Providing a brief delay between the initial instruction and any additional prompts or instructions (used in conjunction with prompting procedures)	Godby, S., Gast, D. L., & Wolery, M. (1987). A comparison of time delay and system of least prompts in teaching object identification. *Research in Developmental*

		Disabilities, 8, 283-305.
Visual prompts	Tools presented visually (e.g. pictures, words, objects, checklists) that support students across setting and/or curriculum area	Johnston, S., Nelson, C., Evans, J., & Palazolo, K. (2003). The use of visual supports in teaching young children with autism spectrum disorder to initiate interactions. *AAC: Augmentative and Alternative Communication, 19*, 86-103.

Table 2

Examples of ABA Based Interventions for Individuals with ASD- Instructional Strategies

Instructional Strategies	*Description*	*Sample Reference*
Chaining	Reinforcing individual responses occurring in sequence to form a complex behavior	Lalli, J. S., Casey, S., & Kates, K. (1995). Reducing escape behavior and increasing task completion with functional communication training, extinction, and response chaining. *Journal of Applied Behavior Analysis, 28*, 261-268.
Discrete Trial Training	Teaching using small units of instruction (typically in 1:1 settings) where teachers provide clear cues, prompts, and consequences after student response	Dib, N., & Sturmey, P. (2007). Reducing student stereotypy and improving teachers implementation of discrete-trial teaching. *Journal of Applied Behavior Analysis, 40*, 339-343.
Functional Communication Training	Replacing inappropriate behavior (with a communicative function) with more appropriate and effective communicative behaviors or skills	Keen, D., Sigafoos, J., & Woodyatt, G. (2001). Replacing prelinguistic behaviors with functional communication. *Journal of Autism and Developmental Disorders*, *31*, 385-398.
Incidental Teaching	Teaching in the natural environment using child interests, as well as child-selected reinforcers and natural consequences	McGee, G. G., Krantz, P. J., Mason, D., & McClannahan, L. E. (1983). A modified incidental-teaching procedure for autistic youth: Acquisition

		and generalization of receptive object labels. *Journal of Applied Behavior Analysis, 16,* 329-338.
Modeling	Demonstrating a desired behavior (live or via video) in order to produce an imitative response in student	Apple, A. L., Billingsley, F., & Schwartz, I. S. (2005). Effects of video modeling alone and with self-management on compliment- giving behaviors of children with high-functioning ASD. *Journal of Positive Behavior Interventions, 7,* 33-46.
Pivotal Response Treatment	Naturalistic intervention focused on targeting pivotal behavioral areas (e.g. motivation, self-management) that create collateral changes across skill areas	Koegel, R. L., Openden, D., & Koegel, L. K. (2004). A systematic desensitization paradigm to treat hypersensitivity to auditory stimuli in children with autism in family contexts. *Research and Practice for Persons with Severe Disabilities, 29,* 122-134.
Prompting	Providing help to students (e.g. verbally, gesturally, physically, visually) that assist them in using a specific skills	Gena, A. (2006). The effects of prompting and social reinforcement on establishing social interactions with peers during the inclusion of four children with autism in preschool. *International Journal of Psychology, 41,* 541-554.
Shaping	Reinforcing students for exhibiting closer and closer approximations to desired behavior	Ricciardi, J. N., Luiselli, J. K., & Camare, M.(2006). Shaping approach responses as intervention for specific phobia in a child with autism. *Journal of Applied Behavior*

		Analysis, *39*, 445-448
Task Analysis	Breaking down complex behavior into its component steps	Browder, D., Trela, K., Jirnenez, B. (2007). Training teachers to follow a task analysis to engage middle school students with moderate and severe developmental disabilities in grade-appropriate literature. *Focus on Autism & Other Developmental Disabilities*,*22*, 206-219.

Table 3

Examples of ABA Based Interventions for Individuals with ASD- Consequence Based Strategies

Consequence Based Strategies	*Description*	*Sample Reference*
Contingency Contracting	A document that identifies a contingent relationship between the completion of a specific behavior and access to a specific reward	Mruzek, D. W., Cohen, C., & Smith, T. (2007). Contingency contracting with students with autism spectrum disorders in a public school setting. *Journal of Developmental and Physical Disabilities*, *19*, 103-114.
Delayed Contingencies	Providing a response to student's behavior after a designated period of time has passed, rather than immediately following behavior	Dunlap, G., Koegel, R. L., Johnson, J., & O'Neill, R. E. (1987). Maintaining performance of autistic clients in community settings with delayed contingencies. *Journal of Applied Behavior Analysis*, *20*, 185-191.
Differential Reinforcement	Providing reinforcement for behaviors when they occur at certain times and places, while NOT providing reinforcement when the behaviors do not occur during other times and places	Drasgow, E., Halle, J. W., & Ostrosky, M. M. (1998). Effects of differential reinforcement on the generalization of a replacement mand in three children with severe language delays. *Journal of Applied Behavior Analysis*, *31*(3), 357-374.
Extinction	Withdrawing or ending the use of a reinforcer that maintained an interfering behavior	Aiken, J. M., & Salzberg, C. L. (1984). The effects of a sensory extinction procedure on stereotypic sounds of

		two autistic children. *Journal of Autism and Developmental Disorders, 14,* 291-299.
Overcorrection	Requiring students to restore or correct an environment he/she has disturbed beyond its original condition and/or requiring student to practice an appropriate behavior repeatedly	Preator, K. K., Jenson, W. R., Petersen, P., & Ashcraft, P. (1984). Overcorrection and alternative response training in the reduction of an autistic child's inappropriate touching. *School Psychology Review, 13*, 107-110.
Response Interruption	Blocking a student's attempt to engage in interfering behavior (e.g. repetitive or stereotypic behavior)	Roberts-Pennel, D., & Sigafoos, J. (1999). Teaching young children with developmental disabilities to request more play using the behaviour chain interruption strategy. *Journal of Applied Research in Intellectual Disabilities*, *12*, 100-112.
Redirection	Prompting a student to engage in a more appropriate, alternative behavior	Duker, P. & Schaapveld, M. (1996). Increasing on-task behavior through interruption-prompting. *Journal of Intellectual Disability Research, 40*, 291-297.
Reinforcement	A consequence that is likely to maintain or increase the probability that a behavior will occur in the future	Adelinis, J. D., Piazza, C. C., & Goh, H. (2001). Treatment of multiply controlled destructive behavior with food reinforcement. *Journal of Applied Behavior Analysis, 34*, 97-100.

Token Economy	A system in which students receive tokens that can be exchanged for reinforcing object/activities when a target skill/behavior is used appropriately	Tarbox, R. S., Ghezzi, P. M., & Wilson, G. (2006). The effects of token reinforcement on attending in a young child with autism. *Behavioral Interventions, 21,*155-164.

Figure Caption

Figure 1. Example of the three-term contingency

Antecedent/Instructional Cue/ S^D	Behavioral Response	Reinforcing Consequence
Example: teacher asks child to "Show me your nose"	Example: child touches her nose	Example: teacher gives student a high five