ABAI
Association for Behavior Analysis International

DISCUSSION AND REVIEW PAPER

CrossMark

The Big Four: Functional Assessment Research Informs Preventative Behavior Analysis

Shahla Ala'i-Rosales[1] · Joseph H. Cihon[2,3] · Thomas D. R. Currier[4] · Julia L. Ferguson[2] · Justin B. Leaf[2,3] · Ron Leaf[5] · John McEachin[5] · Sara M. Weinkauf[6]

Abstract
Current practice guidelines suggest that the assessment and treatment of challenging behavior should consist of conducting a functional behavior assessment following the onset of problem behavior. This assessment process can include indirect and direct assessment, as well as manipulation of variables to determine function. The purpose of this article is to outline a proposal that would add prevention practices to early intervention guidelines for problem behavior. Based on decades of research, the suggestion is to proactively teach children at risk for problem behavior to navigate four of the most common conditions that have been demonstrated to occasion problem behavior. Prevention is made a possibility because a large body of research examining the conditions under which challenging behavior occurs has been reliably replicated. Preventative approaches are an emerging phenomenon and reflect a progression in the practice of behavior analysis. Prevention may lead to acquisition of prosocial behavior before problems arise, to expedited and enhanced treatment, to increased access to favorable learning environments, and, we hope, to improvement in the quality of life for many children at risk for the development of problem behavior.

Keywords Problem behavior · Functional analysis · Functional behavior assessment · Prevention · Early childhood interventions

Although it is not a diagnostic criterion, individuals diagnosed with an intellectual disability (ID) or developmental disability (DD), such as autism spectrum disorder (ASD), commonly engage in problem behavior (Didden et al., 2012; Kanne &

The second through eighth authors are listed in alphabetical order by their last names as they all had equal contributions to this article throughout the process.

✉ Shahla Ala'i-Rosales
Shahla.Alai-Rosales@unt.edu

✉ Justin B. Leaf
Jblautpar@aol.com

[1] Department of Behavior Analysis, The University of North Texas, 1155 Union Circle, Box 310919, Denton, TX 76203, USA

[2] Autism Partnership Foundation, BCBA, 200 Marina Drive, Seal Beach, CA 90740, USA

[3] The Institute for Behavioral Studies, Endicott College, Beverly, MA, USA

[4] The Lovaas Institute, Minneapolis, MN, USA

[5] Autism Partnership, Seal Beach, CA, USA

[6] JBA Institute, Torrance, CA, USA

Mazurek, 2011; Richards, Oliver, Nelson, & Moss, 2012). For example, researchers have shown that the prevalence of self-injurious behavior (SIB; e.g., hitting, biting, or pinching oneself) ranges from 4% to 12% for individuals diagnosed with an ID; for individuals diagnosed with ASD, the range is from 33% to 71% (Bartak & Rutter, 1976; Cooper et al., 2009; Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Richards et al., 2012). Another common topography of problem behavior frequently observed is aggression (e.g., hitting, biting, or punching others), with prevalence rates ranging from 7% to 56% for individuals diagnosed with an ID and/or ASD (e.g., Kanne & Mazurek, 2011). The prevalence of some forms of stereotypic behavior within this population has been documented to be as high as 71%. In addition to self-injury, aggression, and stereotypic behavior, individuals diagnosed with an ID or DD may engage in other topographies of problem behavior such as, but not limited to, elopement (with rates as high as 49%; Anderson et al., 2012), feeding problems (range 25%–34%; Didden et al., 2012), and pica (range 5%–60% of the sample; Didden et al., 2012).

Problem behavior can have serious deleterious consequences for the individuals (e.g., injury, death) and their families (e.g., depression, anxiety). The occurrence of problem

behavior also presents a barrier to participation in the community and could make the individual less responsive to important learning opportunities. For over 60 years, researchers in behavior analysis have successfully developed and evaluated the use of procedures (e.g., shaping, time-out, functional communication training, tolerance delay, task choice) to increase desired behaviors and decrease problem behavior such as aggression (e.g., Hanley, Jin, Vanselow, & Hanratty, 2014), self-injury (e.g., Ghaemmaghami, Hanley, & Jessel, 2016), stereotypic behavior (e.g., Falcomata, Roane, Feeney, & Stephenson, 2010), elopement (e.g., Roane & Derosa, 2014), pica (e.g., Mace & Knight, 1986), and noncompliance (e.g., Fischetti et al., 2012). The relationship between research and practice has resulted in a grounded theoretical framework that places a heavy emphasis on the function (i.e., control by consequences), as opposed to the structure (i.e., the form), of behavior. The purpose of this article is to describe the foundational research base for effectively treating problem behavior and to propose that it should inform preventative practices for young children at risk for problem behavior. The specific preventive strategies are based on the hundreds of published studies on functional assessment and treatment. Although there is limited support for these specific strategies as preventative, rather than reactive, treatments, there is support for early prevention in general (e.g., Campbell & Ramey, 1994; Lovaas, 1987). Furthermore, we hope that this article can serve as a stimulus for increased prevention research in this area of behavior analysis.

Foundations

The current approach for addressing problem behavior requires a functional behavior assessment (FBA; Neef & Peterson, 2007), sometimes followed by a standard functional analysis (SFA; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982), also referred to as functional analysis or experimental functional analysis (Hanley, 2012), and then implementation of a function-based intervention (e.g., differential reinforcement of other behavior, extinction). The goal is to develop and implement procedures that reduce the rate and prevalence of problem behaviors while teaching functional, socially desired alternatives. This is typically done with a goal of decreasing the frequency of the problem behavior while teaching a functionally equivalent alternative response with FBA- or SFA-identified functions (e.g., if the function of the problem behavior is determined to be accessing attention, the functionally equivalent target behavior would yield access to attention; if escape from a difficult task, the task would be modified, or a break response would be taught). This is the general approach to functional assessment (e.g., Hanley, 2012) and is considered the convention in behavior analysis.

Historical Development of the FBA and SFA

A typical FBA consists of two or three components. The first component, an indirect assessment, involves interviewing stakeholders, the people who care and are responsible for the individual with the problem behavior (e.g., the individual him- or herself, parents, teachers, other professionals). This can be done via structured or unstructured interviews, the purpose of which is to gather information on the type of problem behavior occurring, when the problem behavior is occurring, what events occur prior to the onset of the problem behavior, and what events follow the occurrence of the problem behavior. The second component, descriptive assessment, consists of observations of the individual in his or her natural environment without any manipulation of environmental variables. During these observations, data on antecedent events, target behavior, and consequences can be collected and used for a descriptive analysis. Sometimes, an SFA is deemed necessary (Hanley, 2012; Oliver, Pratt, & Normand, 2015). An SFA involves "an analysis of the purposes (functions) of problem behavior, wherein antecedents and consequences representing those in the person's natural routines are arranged within an experimental design so that their separate effects on problem behavior can be observed and measured" (Cooper, Heron, & Heward, 2007, p. 696). During an SFA, the individual is systematically exposed to specific conditions to determine antecedents and consequences that may be setting the occasion for, or maintaining, the problem behavior. The components are implemented in order to develop a treatment plan to reduce problem behavior by addressing behavioral function.

The science of human behavior largely rests on understanding the functions of behavior through experimental analysis (e.g., Skinner, 1953). In an early example, Lovaas, Freitag, Gold, and Kassorla (1965) evaluated the variables controlling the SIB of a woman with schizophrenia. The authors demonstrated that social reinforcement, and its withdrawal, altered the frequency of self-destructive behavior. Like SFA, this study systematically altered the environmental conditions of which behavior was a function and thereby provided an early demonstration of how environmental variables controlled the occurrence of problem behavior. Several studies followed that examined the role of function in both clinical interventions and carefully controlled intervention conditions (e.g., Carr & McDowell, 1980; Carr, Newsom, & Binkoff, 1976; Favell, McGimsey, & Schell, 1982; Martin & Foxx, 1973; Rincover & Devany, 1982).

In a seminal paper, Carr (1977) presented a review of variables hypothesized to influence the occurrence of SIB. The review included supporting or refuting evidence for each of the hypotheses reviewed: positive reinforcement, negative reinforcement, sensory stimulation, biochemical or organic factors (e.g., Lesch-Nyhan syndrome, otitis media), and psychodynamic theories (e.g., self-injury results from the inability to

distinguish oneself from the external world). Carr dismissed the prevailing psychodynamic interpretations of SIB, due to contrary and absent data, and concluded that SIB may be determined by multiple, and largely environmental, factors (as opposed to one single "cause"). This article was an important part of a nascent technology, built on the analysis of behavioral functions.

Iwata et al. (1982) were the first to formally develop and evaluate a standardized protocol to analyze the possible functions of problem behavior, the SFA. Iwata et al. used a multielement experimental design and exposed participants to four different environmental conditions, manipulating antecedent and consequent events to determine if these conditions evoked more or less problem behavior. One condition evaluated the presence of a *positive reinforcement contingency*. Within this condition, the interventionist sat away from the individual in a room and began to acted busy (e.g., read a magazine, act as if working) and only provided attention, edibles, and tangibles contingent on the occurrence of SIB. A second condition evaluated the presence of a *negative reinforcement contingency*. Within this condition, demands were delivered and were discontinued contingent on the occurrence of SIB. A third condition consisted of the individual in a barren environment, in which no social attention, edibles, or tangibles were provided. This condition was intended to evaluate the presence of an *automatic reinforcement contingency*. Finally, they created a control condition in which the researchers provided noncontingent attention, placed no demands, and presented enrichment materials. For the majority of the participants, SIB was correlated with specific conditions, meaning specific contingencies evoked the problem behavior. The authors concluded that conducting an SFA to identify the function of problem behavior would better inform interventions and be more useful than beginning arbitrary and, perhaps unnecessary, interventions.

Following over more than a decade of SFA research, Iwata et al. (1994) presented an analysis and summary of the responding of 152 participants from many SFA single-case research studies conducted up to that point in time. The studies selected for review were on the function and treatment of SIB (e.g., head banging, hand biting, pica). Function was evaluated through the use of multielement experimental designs, reversal designs, and comparisons between opposing pairs of conditions (e.g., demand vs. play). The analysis revealed that 26.3% of the participants engaged in higher rates of SIB within the positive reinforcement condition. For this group, interventions based upon noncontingent attention, extinction, differential reinforcement of other behaviors (DRO), and time-out proved most effective, whereas verbal reprimands and response interruption were least effective. Thirty-eight percent of the participants engaged in higher rates of SIB within the negative reinforcement condition. For this group,

interventions based upon removal of aversive stimuli, reduction of task frequency, extinction from escape, and DRO were most effective, whereas escape from social attention and time-out were least effective. Twenty-five percent of the participants engaged in higher rates of SIB within the automatic reinforcement condition. In these cases, interventions based upon noncontingent access to reinforcement, sensory extinction, DRO, and response interruption were more effective than contingent attention, extinction, and time-out. The remaining cases were determined to be of unidentified function (4.6%) or to be controlled by multiple variables (5.3%).

In a discussion of the review, Iwata et al. (1994) raised multiple issues. First, the data should be interpreted with caution. The sample was a referred population sample and may or may not reflect distribution or incidence of controlling variables for other populations. Second, the SFA methodology allowed the interventions to be tailored to the identified functions of the problem behavior. Third, in most of these cases, SIB seems to be maintained by socially mediated consequences (e.g., access to attention, removal of a demand). Fourth, they suggested that many individuals have not learned socially acceptable, and less harmful, means of accessing reinforcement, or their environments do not provide adequate reinforcement for more adaptive behavior. Fifth, and important to the aims of this article, data such as these can be useful in the identification and instruction of topographically different and more socially acceptable responses that serve the same function as the SIB and guide a "preventative strategy for all individuals at risk for SIB" (Iwata et al., 1994, p. 235).

Current FBA and SFA Conventions

Since the seminal work of Iwata et al. (1982, 1994), SFAs have been one of the most studied methodologies and protocols employed by behavior analysts in research (Beavers, Iwata, & Lerman, 2013; Hanley, Iwata, & McCord, 2003). In 2003, Hanley et al. conducted a review of functional analysis research from 1961 to 2000 and found 277 published functional analysis studies during that period. Beavers et al. (2013) extended Hanley et al.'s (2003) review by analyzing research on functional analyses from 2001 to 2012. Beavers et al. (2013) found that an additional 158 articles were published that used functional analysis methodology. In total, as of 2012, there had been at least 435 studies published using SFAs.

The research corpus also includes variations in the configuration of an SFA. These include, but are not limited to, brief functional analyses in which a series of short analogue conditions are rapidly changed during a relatively short duration (e.g., 90 min; Northup et al., 1991), trial-based functional analyses in which the analogue conditions are modified into a series of trials (e.g., Bloom, Iwata, Fritz, Roscoe, & Carreau, 2011), and the interview-informed synthesized contingency analysis (e.g., Hanley et al., 2014), which consists of

providing a semistructured interview with stakeholders followed by a brief functional analysis in which multiple conditions are combined and compared to a control condition through the use of a multielement design to determine the contingencies maintaining the problem behavior. The use of FBAs and SFAs is considered recommended practice in many areas of education and health care. For example, it is a component of the Individuals With Disabilities Education Act (2003, 2004), the legislation governing services in educational settings (Hanley et al., 2003). It is also a part of the ethical guidelines for the practice of behavior analysis (Behavior Analyst Certification Board, 2014) and thereby a mandate for practicing certified behavior analysts. Research, law, and practice recommendations from professionals have resulted in the FBA becoming an important part of clinical practice (Oliver et al., 2015). Oliver et al. (2015) surveyed 724 certified behavior analysts on the implementation of FBAs and SFAs. The results of this survey showed that around 90% of behavior analysts surveyed used some component of an FBA as part of their practice; however, around 63% reported to never or almost never use an SFA as part of the FBA process. Although there is variation in how FBAs may be conducted within clinical practice, and SFAs remain much less commonly used than FBAs, it is clear that taking a functional approach to understanding challenging behavior is common practice. It is also evident that this has contributed to the development of interventions based on the functions of problem behavior. Within both research and practice, functional analysis is widely regarded as the gold standard in addressing problem behavior (Gardner, Spencer, Boelter, DuBard, & Jennett, 2012; Wacker et al., 1998).

A Proposal for Progressing to Preventative Practices

Based on the strength of the functional analysis research, we propose that in addition to current SFA and FBA conventions, we allocate increased attention to the prevention of problem behavior, especially in the case of young children. One of the hallmarks of applied behavior analysis (ABA) is that researchers and practitioners are responsive to data, and that responsiveness has caused our practices to become more effective and our science to progress (Leaf et al., 2016). The previous decades and hundreds of SFA and FBA studies can inform this preventative practice. Professional practice, based on science, should progress as the science and social understanding of data and their use advance. Our proposal is similar to advances in other realms of health and education. For example, medical advances are made, and continue to be made, toward understanding the basic mechanisms and treatments for the human immunodeficiency virus (HIV). Based on an understanding of the conditions responsible for HIV

transmission, public health initiatives concentrate on prevention and early action to prevent HIV, while both sets of activities continue (e.g., Kelly, St. Lawrence, Hood, & Brasfield, 1989; Stover et al., 2006). This proposal also contributes to other preventative initiatives within behavior analysis (e.g., Dunlap, Johnson, & Robbins, 1990; Dunlap et al., 2006; Fahmie, Iwata, & Mead, 2016; Fahmie, Macaskill, Kazemi, & Elmer, 2018; Fox, Dunlap, Hemmeter, Joseph, & Strain, 2003; Luczynski & Hanley, 2013; Lutzker, Frame, & Rice, 1982; Lutzker & Rice, 1988; Richman & Lindauer, 2005).

Understanding the core functions likely to produce problem behavior informs our capacity to arrange environments and teach skills that would prevent problems from occurring. An increase in prevention efforts would likely result in a decreased need for conducting FBAs and SFAs. That is, if problem behavior is prevented, then the need to conduct a functional analysis of behavior might be eliminated. The goal would be to proactively teach young children at risk for problem behavior all the necessary skills to navigate the common contexts that have been extensively documented to occasion problem behavior, instead of waiting for the problems to occur. This would preempt deleterious consequences for the child and other stakeholders. Decades of published research permit us to identify the most common conditions that occasion problem behavior (Beavers et al., 2013; Carr, 1994; Hanley et al., 2003; Iwata et al., 1982). Additionally, if a behavior analyst is already working with a client who is displaying problem behavior, there is no harm, yet several benefits, to reactively teach the appropriate skills needed to navigate these conditions without engaging in problem behavior. In the following sections, we expand upon the emerging discussion of the prevention of problem behavior for young children diagnosed with an ID or DD, such as ASD (e.g., Fahmie et al., 2016; Fahmie et al., 2018), and outline a proposal to expand current conventions for problem behavior. Our prevention proposal is aimed at young children at risk for problem behavior. Preventative intervention is more likely to be more effective the younger the child; progress is more rapid, generalization is more likely, learning histories and living environments are less complicated, families have more energy, and the topography of problem behaviors in small children is usually less dramatic and more tolerable to adults (Dunlap & Robbins, 1991).

Conceptualization

Prevention efforts for young children would consist of several distinct components. The first three involve the context and assumptions, whereas the fourth focuses on specific skills and conditions. First, the behavior analyst creates an appropriate and nurturing educational environment that is conducive to learning. This aligns with general behavior-analytic practice (cf. Biglan, Flay, Embry, & Sandler, 2012; Delprato, 1981;

Goldiamond, 1974) and early childhood intervention recommendations (Division for Early Childhood, 2014; Hemmeter, Ostrosky, & Fox, 2006). This is the first layer of groundwork for minimizing the probability of problem behavior. Such efforts should routinely include ensuring that (a) the level and type of demands are matched to the skill and level of reinforcement that is available (minimizing motivation to escape), and (b) positive reinforcement is provided throughout the day and is consistently higher when adaptive behavior is displayed (minimizing differential reinforcement of problem behavior).

Second, through reviews of the empirical literature and surveying successful practitioners and leaders in the field of early intervention, recommended practices have been developed and revised over the last 20 years that align with the conceptualization of a preventative approach to problem behavior (Division for Early Childhood, 2014; McLean & Odom, 1996; Odom, McLean, Johnson, & LaMontagne, 1995; Smith et al., 2002). In particular, the Division for Early Childhood (DEC) Recommended Practices are crafted to understand and synthesize evidence and expertise to promote the highest degree of leverage and impact on long-term outcomes, or "keystone" behaviors (Wolery & Sainato, 1996). For example, DEC recommendation strands emphasize the role of the family and collaborators (stakeholders) throughout the assessment and intervention process, the importance of environmental assessment and planning, the need for transition planning, the critical role of effective behavior-change procedures, and the necessity of well-designed systems and personal preparation strategies. Furthermore, there is an overriding focus on the sensitivity and responsiveness of provider interactions. These include interactional practices (environmental arrangements, models, prompts, and consequences) contingently directed toward very specific classes of behavior related to social development. Although known widely to professionals in early intervention, the DEC-recommended practices are not generally part of the base informing behavior-analytic practice when treating young children. Many of these recommendations are not new to behavior analysts. As presented in the DEC strands, however, they comprise an integrated whole that is specific to the needs and well-being of young children.

Third, instead of an a priori assumption of one sole function of a problem behavior (e.g., behaviors only maintained by access to attention or only maintained by escape from demands), there is an assumption that multiple control and synthesized contingencies can, or will, develop over time (cf. Michael, Palmer, & Sundberg, 2011; Slaton, Hanley, & Raftery, 2017), which may include variables not typically tested within FBAs or SFAs (e.g., control, reflexive, or respondent). In the natural environment, contingencies in life work in concert (Slaton et al., 2017) and behavior can have multiple or combined controlling contingencies, and often, contingencies maintaining problem behavior could change from moment to

moment, condition to condition. For instance, a child might gain control over the environment, momentarily suppressing pain from a migraine and/or escaping from a task, as a result of hitting himself. Each of the consequences could be operating concurrently, sequentially, or periodically. The assumption of multiple control and synthesized contingencies allows for preventative approaches to address a variety of potential maintaining variables in a variety of contexts.

Fourth, the data gathered from decades of SFA research can be synthesized into a constructive and proactive focus that directly addresses four common conditions that have been demonstrated to evoke challenging behavior. Knowledge of these conditions can be used to define repertoires with the hope that children learn the essential skills required to navigate the troublesome conditions in socially acceptable and behaviorally healthy ways—before problems develop. Each of these repertoires yokes directly to the SFA conditions. The "Big Four" focus areas are:

1. Safely, effectively, and respectfully communicating wants, needs, likes, and dislikes in ways that are understood by others and do not result in harm to self or others;
2. Safely, effectively, and pleasantly gaining the attention and affection of others in ways that are understood by others and do not offend or hurt others;
3. Joyfully engaging in activities alone and with others in ways that increase in number, duration, and complexity and do not cause harm to self or others; and
4. Safely, effectively, and diplomatically, coping with, tolerating, and accommodating adversity in situations that are in the child's best interests over the long term.

It should be noted that there are emotions included in the descriptions, which was an intentional attempt to tact particular contingencies. We chose to qualify the way that we stated each of the Big Four to encourage action beyond satisfying functional equivalents of potentially problematic behaviors. This is an initial effort (a) to support the goals of stakeholders (families generally want children who are happy, joyful, pleasant, respectful, and diplomatic); (b) to stress that the responses learned must be effective, as a response without a corresponding consequence is unlikely to maintain; and (c) to use words (e.g., emotion labels) that tact contingencies beyond alleviation/toleration of discomfort, receipt of desired items, or avoidance of causing trouble. For example, when we speak of *joyful*, it probably describes something beyond satisfaction with receiving attention. We hope that it means that the interaction has acquired reinforcing value for all parties. Similarly, *respectfully* might indicate some perspective-taking ability in terms of what the communicative attempt means to the other person. As part of our proposal, we attempt to expand the goal descriptions in ways that are more likely to, over time, enrich the life of the child and the family. This was one of the closing

points of the seminal paper by Wolf, Risley, and Mees (1964), in which Dickey had become "a new source of joy" (p. 312). Including the language of emotions and feelings, although not common, is not new to behavior analysis (e.g., Wolf, 1978; Wolf et al., 1964), is supported by commentaries on behavior-analytic terminology (e.g., Becirevic, Critchfield, & Reed, 2016; Jarmolowicz et al., 2008; Rolider, Axelrod, & Van Houten, 2009), and has been the subject of research (Green & Reid, 1999; Parsons, Reid, Bentley, Inman, & Lattimore, 2012).

From a conceptual standpoint, each of the Big Four repertoires we propose should be designed to increase the likelihood of behavioral cusps (Rosales-Ruiz & Baer, 1997). Behavioral cusps produce generative and pervasive changes: "What makes a behavior change a cusp is that it exposes the individual's repertoire to new environments, especially new reinforcers and punishers, new contingencies, new responses, new stimulus controls, and new communities of maintaining or destructive contingencies" (Rosales-Ruiz & Baer, 1997, p. 534). In the case of prevention, cusps should lead to socially desirable behaviors and opportunities, as opposed to socially undesirable behavior. If a cusp involves the development of problem behavior,

> this cusp brings danger to self and others; interferes with treatment, learning, and relationships; decreases access to mainstream environments; and, when left unsuccessfully treated, all of these factors interact to produce a worsening of quality of life over time for the individual with DD and important others. (Robertson, 2015, p. 11)

Conversely, *if* they are developed with stakeholders, *if* the specifics are analyzed in terms of current and potential environments, responses, stimulus control, and communities of reinforcement for the child in question, and *if* meaningful, measurable assessment occurs over time, locations, and settings, the Big Four repertoires could be developed as desirable cusps prior to the development of problem behavior (cf. Bosch & Fuqua, 2001; Smith, McDougall, & Edelen-Smith, 2006). These four repertoires are likely universal repertoires that may constitute a core curriculum for a child at risk for problem behavior and would increase the likelihood of navigating his or her environment effectively in such a way as to contribute to overall quality of life over time. What follows is a brief description and examples of research in each area.

The Big Four

Communication Access to preferred events and escape from nonpreferred events are two of the conditions that appear to maintain problem behavior. For that reason, one of the Big Four repertoires that should be a target of intervention is for the child to safely, effectively, and respectfully communicate wants, needs, likes, and dislikes in ways that are understood by others and do not cause harm. Communication has been proposed as a necessary area of assessment and attention for every child with disabilities (Goldstein, Kaczmarek, & Hepting, 1996; Weiss & Zane, 2010). When children fail to develop the skills to express their preferences, challenging behavior is likely to occur, which means that communication goals are paramount in the education of young children with disabilities (Kaiser & Roberts, 2011). The repeated demonstrations of functional communication training (FCT; Carr & Durand, 1985), a common intervention within the SFA literature to address challenging behavior (e.g., Carr & Durand, 1985), suggest that this technology could also be an effective method to establish desirable forms of communication *before* atypical or dangerous forms develop (for a review of FCT research, see Tiger, Hanley, & Bruzek, 2008). That is, instead of developing an FCT program in response to problem behavior, functional communication for expressing preferences occurs at the onset of early intervention. Kaiser and Roberts (2011) suggested that prelinguistic skills such as joint attention, using gestures, and even symbolic play could facilitate the development of more complex forms of communication. In some cases, it may be necessary to establish communication skills with augmented or alternative communication devices, a promising area of research (Drager, Light, & McNaughton, 2010).

Gaining Attention Failure to develop more desired forms of gaining attention (e.g., tapping on the shoulder, using someone's name, or seeking out a friend to vocally share a desired event that just occurred) can lead to the development of less desirable, often harmful, forms of problem behavior (e.g., aggression toward self or others, elopement). As such, the second repertoire within the Big Four is safely, effectively, and pleasantly gaining the attention and affection of others in ways that are understood by and do not offend or hurt others. This repertoire is similar to that of the communication repertoire previously discussed and can be targeted with similar approaches (e.g., FCT). However, instead of solely focusing intervention on the development of single requests, or mands, for specific activities or items, the development of this repertoire requires careful intervention for the development of a general class of responses to gain the desired form of attention and the corresponding meaningful exchanges that maintain that appropriate attention seeking.

As this communicative repertoire develops and children move into adolescence and adulthood, gaining prosocial attention becomes more complex, which requires this repertoire to expand beyond the initial appropriate gaining of attention. At this stage, the behavior analyst should focus on teaching social skills that lead to the development of meaningful relationships that result in prosocial attention. It is through these relationships that most receive "attention," but only when the

skills to develop meaningful relations are developed. The initial communicative repertoire can be expanded to develop social skills such as, but not limited to, perspective taking/theory of mind, giving compliments, apologizing, soliciting help, and eing a good sport (Taubman, Leaf, & McEachin, 2011). These skills can and have been developed through the use of procedures based upon the principles of behavior analysis such as behavioral skills training, the teaching interaction procedure (Cihon, Weinkauf, & Taubman, 2017), and video modeling.

Engaging in Play and Leisure Activities Children also appear to develop problems when they do not have acceptable activities to engage in when they are alone or in social groups. For that reason, the third repertoire that should be a target of intervention for children at risk for problem behavior is joyfully engaging in activities alone and with others in ways that increase in duration and complexity and do not cause harm. Appropriate solitary play is, by definition, incompatible with challenging behavior, and research has helped to identify how to most effectively teach these skills. For instance, Baker (2000) and DiCarlo, Schepis, and Flynn (2009) demonstrated that manipulating play materials increased the likelihood that children will play with them. Paterson and Arco (2007) observed that children's play behaviors with toys were more likely to generalize to similar toys, establishing a strategy for expanding the breadth of toy play. Others investigated how the physical structure of solitary work areas can promote desirable downtime activities (Hume, Loftin, & Lantz, 2009; Hume & Odom, 2007). There are also many recent advances in technological toys, such as handheld video games, smartphone applications, and computer-based activities, that require future research but may also be tools to help children with disabilities safely engage in downtime activities (Lifter, Mason, & Barton, 2011).

Although there are many effective ways to teach children to play alone, to occupy themselves without getting into trouble, these skills are too often taught in reaction to ongoing problem behavior. We propose that teaching these skills should be a priority for all children at risk for problem behavior at the onset of treatment, not after the onset of problem behavior. That is, if children are taught the necessary skills required to engage with a variety of activities, the probability of developing problem behavior may be minimized. Furthermore, expansion of activity engagement and preferences can be considered an important part of the process of developing constructive play and leisure repertoires, and there is a growing number of examples, from rotating exposure, to observational learning (e.g., Ala'i-Rosales, Zueg, & Baynam, 2008; Frey & Kaiser, 2011; Leaf et al., 2012).

Coping Skills Task demands appear to occasion a great deal of problem behavior. At the same time, there are tasks that are important for children to participate in because they will have benefit to the child over time. The final repertoire of the Big Four involves teaching children how to safely, effectively, and pleasantly negotiate, tolerate, and accommodate adversity. There will undoubtedly be circumstances during which appropriate escape or avoidance is not feasible. This could be due to practical reasons because the activity is necessary to ensure the child's continued progress or to ensure his or her long-term health. Events such as doctor visits, waiting for desired toys or activities, and scheduled or unplanned changes to routines can be nonpreferred, but the benefits of tolerance and continuation of learning despite these circumstances outweigh the burdens. Although it is difficult to identify all potential aversive events, especially novel events, prior to the onset of the aversive event, there are many skills that, if taught proactively, may minimize difficulties surrounding aversive events. Learning to tolerate, cope with, and/or enjoy these circumstances does not have to be painful though. There is considerable evidence that children can learn to tolerate less preferred tasks through systematic teaching (e.g., Dixon, Rehfeldt, & Randich, 2003; Fisher, Thompson, Hagopian, Bowman, & Krug, 2000; Ghaemmaghami et al., 2016).

Dooley, Wilczenski, and Torem (2001) signaled schedule changes and reinforced the calm behavior of a 3-year-old boy, which resulted in consistently successful transitions. Lee, Sugai, and Horner (1999) observed lower rates of challenging behavior when children engaged in easier tasks than when the same children completed more complex tasks, suggesting that systematically increasing the complexity of the task can reduce or prevent the onset of problem behavior. Ducharme and Worling (1994) brought this observation to fruition when they showed that by systematically manipulating the sequence of activities with divergent preference levels, a child can learn to comply with less preferred tasks. Using clinical applications of changing criterion designs, several researchers also demonstrated successful shaping of calm behavior during aversive events (Ellis, Ala'i-Rosales, Glenn, Rosales-Ruiz, & Greenspoon, 2006; Lalli, Casey, & Kates, 1995; Ricciardi, Luiselli, & Camare, 2006; Wolf et al., 1964).

Tolerating aversive events is an important skill at any age, especially for children at risk for problem behavior. This may be one of the most difficult repertoires of the Big Four to develop proactively. However, if targeted in combination with the other three repertoires (i.e., communicating preferences, obtaining attention, and engaging in activities), teaching the skills necessary to tolerate aversive events may become a less daunting task. For example, developing a communicative repertoire to express likes and dislikes may allow the child to communicate his or her discomfort of potential aversive events prior to their onset and allow for the necessary support and learning to occur proactively.

Implementation

Ideally, when teaching children, the Big Four would be targeted proactively (i.e., before the onset of problem behavior and at the onset of treatment). To establish these skills, behavioral procedures would be employed (e.g., discrete trial teaching, incidental teaching, behavioral skills training, the teaching interaction procedure) to teach each of these skills. Within comprehensive early intervention programs, this would be easily incorporated. In focused programs, it may be difficult for behavior analysts to come in contact with clients prior to the onset of problem behavior due to diagnostic criteria. In those cases, one strategy may be to train caregivers how to develop the Big Four skills proactively so that other difficulties do not arise. If behavior analysts can develop system-level changes with respect to parent education and training for teachers, it may be possible to preemptively combat the frequency, duration, or even onset of problem behavior.

Unfortunately, outside of early intervention, referral to a behavior analyst typically occurs because an individual is engaging in problem behavior. In such situations, behavior analysts could conduct an SFA to determine a function and ensure that a functional alternative to the immediate problem is available. At the same time, behavior analysts may wish to teach the Big Four skills, as doing so would produce no harm to that child and could teach behaviors that could potentially offset the development of other problems in the future.

Why Adopt the Big Four?

There are several benefits to adopting the Big Four as a preventative approach to problem behavior. Although we have not yet conducted research on prevention, within our clinical experience we have provided early intervention for children at risk for the development of problem behavior at an early onset (e.g., before problem behavior was present or upon early signs of the development of problem behavior) and were able to either combat problem behavior before it started or to stop continued development or escalation. The benefits and rationales provided in the following sections are done so in the context of data synthesized from the literature on problem behavior (e.g., Hanley, Heal, Tiger, & Ingvarsson, 2007). The benefits discussed in the following sections are not meant to be exhaustive, as there may be other benefits to adopting the Big Four as a progressive approach to problem behavior. These will be identified with increased efforts toward prevention and research that evaluates the effects of those efforts.

Prevention

One of the main benefits for adopting the Big Four is the potential to prevent the onset of problem behavior altogether.

That is, if these four repertoires are at the core of all early intervention, at-risk children will develop the skills necessary to successfully navigate environments that we know occasion problem behavior. Without these repertoires in place, problem behavior may be more likely to develop. This aligns with other suggestions of similar approaches to preventing problem behavior (e.g., preschool life skills; Hanley et al., 2007). Furthermore, in many ways, this is similar to public health initiatives, as described earlier. In public health campaigns, such as HIV and malaria prevention, variables that contribute to the spread of disease are prevented based on prior research about the disease. The wealth of SFA research described previously has given us the information needed to be preventative in the case of problem behavior in much the same way.

Less Risk

Adopting this approach to problem behavior allows a behavior analyst to avoid intentionally evoking behaviors that may put a child at risk of hurting him- or herself and/or others. When conducting SFAs (Iwata et al., 1982; Iwata et al., 1994), problem behavior is evoked to identify the conditions under which the problem behavior occurs, as well as to inform treatment. Even when conducting an FBA, one goal of the behavior analyst is to observe the client engage in problem behavior (Hanley, 2012) prior to the onset of intervention. Some professionals have argued that evoking harmful behavior during an SFA is justified because it could reduce the chance of injury in the long term. Furthermore, studies have identified safer means of conducting SFAs (e.g., latency measures; Thomason-Sassi, Iwata, Neidert, & Roscoe, 2011), and we encourage future researchers to continue to pursue safer means of evaluating behavioral function. Nonetheless, intentionally evoking problem behavior or allowing the client to engage in problem behavior in the natural environment (e.g., direct observation) without providing treatment may be unnecessary if a potential alternative prevents the development of problem behavior in the first place. This is especially true as behavior analysts have the technology to teach the necessary skills prior to the onset of problem behavior; the program just has to begin before the problem occurs.

Multifunction

Another reason for adopting the Big Four as a progressive approach to problem behavior is that behavior analysts trained under this progressive approach acknowledge that problem behavior can be multiply controlled, or consequences can be synthesized (cf. Michael et al., 2011; Slaton et al., 2017), and function can change from moment to moment and context to context. Although existing SFA research has often focused on isolating single functions (Iwata, 2017), there is a growing body of research supporting the notion of synthesized

consequences with respect to problem behavior (e.g., Hanley et al., 2014; Slaton et al., 2017). Much more research is needed on multiple control and synthesized functions (Slaton et al., 2017), but it is probably safer to assume in practice that behavior has, or may come to have, multiple functions. It would seem that the worst possible outcome of taking a multifunction approach, even if an individual's problem behavior was *never* going to acquire multiple functions, would be that one helps a person with a disability expand his or her verbal repertoire beyond the absolute minimum required to decrease problem behavior.

Human Rights

The Big Four aligns with the United Nations Convention on the Rights of the Child (United Nations, 1990). Regardless of the presence or absence of problem behavior, learning these four skill sets is one portion of a worldwide agreement about fundamental rights that should be afforded to children everywhere: to have a voice, to have love and affection, to play and recreate, and to learn to be a useful member of society and develop skills. The rights are further extended to children with special needs in that they should be afforded special care to achieve these rights. Behavior analysts who work in early intervention settings may be ethically obligated to consider these areas when designing comprehensive programs.

Conclusion

The current approach to problem behavior is evidence based and empirically validated and considered recommended practice. However, ABA is a science, and a hallmark of science is constant evolution and progression (Baer, 2001; Leaf et al., 2016). As such, we should hope that within our science, as we accumulate information, our approach to socially important problems will evolve (Leaf et al., 2016). In this article, we suggest that the practice arm of our field is ready for the next step in this evolutionary process with respect to the assessment and treatment of problem behavior. By synthesizing the data from empirical evaluations of SFAs, FBAs, and function-based treatment, our field can begin to inform proactive and preventative interventions with respect to problem behavior. The empirical base helps to inform four essential repertoires that should be the core of early interventions for all children at risk for the development of problem behavior: (a) safely, effectively, and respectfully communicating likes and dislikes in ways that are understood by others and do not result in harm to self or others; (b) safely, effectively, and pleasantly gaining the attention and affection of others in ways that are understood by others and do not offend or hurt others; (c) joyfully engaging in activities alone and with others in ways that increase in number, duration, and complexity and do not cause harm to

self or others; and (d) the developing coping skills that allow the child to safely, effectively, and diplomatically negotiate adversity. It is entirely possible that some early interventions for children at risk for problem behavior already proactively target and successfully develop these repertoires. Our hope is that our proposal is considered by those not engaged in such preventative approaches and that it will result in an increase in the acquisition of prosocial behaviors, expedited and enhanced treatment, access to favorable learning environments, and fewer problem behaviors.

All of the recommendations made in this article are based on and derived from the hundreds of articles that have been published on function-based assessment and treatment, as well as recommended practice in the field of early childhood intervention. The effectiveness of the Big Four repertoires in preventing the development of problem behavior has not been directly researched. If done in the manner that most prevention research is currently conducted, this would require randomized comparison groups of children who do and do not receive the Big Four interventions. Such experimental designs are typically not in the domain of ABA single-case research methodologies. Although more research in this vein is clearly needed, we propose that these preventive strategies, derived from the assessment and treatment literature, are worth implementing now and need not wait for future between-groups research. The foundation laid by functional assessment and analysis research can inform the goals and practices of behavior analysts today: to improve the quality of life for the children and families we serve.

Compliance and Ethical Standards

Conflict of Interest   None of the authors have any conflicts of interest with the information presented within this article.

Ethical Approval   This article does not contain any studies with human or animal participants performed by any of the authors.

References

Ala'i-Rosales, S., Zueg, N., & Baynam, T. (2008). The development of interests in children with autism: A method to establish baselines. *Behavioral Development Bulletin, 14*, 3–16. https://doi.org/10.1037/h0100502.

Anderson, C., Law, J. K., Daniels, A., Rice, C., Mandell, D. S., Hagopian, L., & Law, P. A. (2012). Occurrence and family impact of elopement in children with autism spectrum disorders. *Pediatrics, 130*(5), 870–877. https://doi.org/10.1542/peds.2012-0762.

Baer, D. M. (2001). A small matter of proof. In W. T. O'Nonohue, D. A. Henderson, S. C. Hayes, J. E. Fisher, & L. J. Hayes (Eds.), *A history of behavioral therapies: Founders' personal histories* (pp. 253–266). Reno, NV: Context Press.

Baker, M. J. (2000). Incorporating the thematic ritualistic behaviors of children with autism into games: Increasing social play interactions

with siblings. *Journal of Positive Behavior Interventions, 2*, 66–84. https://doi.org/10.1177/109830070000200201.

Bartak, L., & Rutter, M. (1976). Difference between mentally retarded and normally intelligent autistic children. *Journal of Autism and Childhood Schizophrenia, 6*, 109–120. https://doi.org/10.1007/BF01538054.

Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty years of research on the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 46*(1), 1–21. https://doi.org/10.1002/jaba.30.

Becirevic, A., Critchfield, T. S., & Reed, D. D. (2016). On the social acceptability of behavior-analytic terms: Crowdsourced comparisons of lay and technical language. *The Behavior Analyst, 39*(2), 305–317. https://doi.org/10.1007/s40614-016-0067-4.

Behavior Analyst Certification Board. (2014). *Professional and ethical compliance code for behavior analysts*. Littleton, CO: Author.

Biglan, A., Flay, B. R., Embry, D. D., & Sandler, I. N. (2012). The critical role of nurturing environments for promoting human well-being. *Journal of Abnormal and Social Psychology, 67*(4), 257–271. https://doi.org/10.1037/a0026796.

Bloom, S. E., Iwata, B. A., Fritz, J. N., Roscoe, E. M., & Carreau, A. B. (2011). Classroom application of a trial-based functional analysis. *Journal of Applied Behavior Analysis, 44*(1), 19–31. https://doi.org/10.1901/jaba.2011.44-19.

Bosch, S., & Fuqua, R. W. (2001). Behavioral cusps: A model for selecting target behaviors. *Journal of Applied Behavior Analysis, 34*, 123–125. https://doi.org/10.1901/jaba.2001.34-123.

Campbell, F. A., & Ramey, C. T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development, 65*(2), 684–698. https://doi.org/10.2307/1131410.

Carr, E. G. (1977). The motivation of self-injurious behavior: A review of some hypotheses. *Psychological Bulletin, 54*, 800–816. https://doi.org/10.1037/0033-2909.84.4.800.

Carr, E. G. (1994). Emerging themes in the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 27*(2), 393–399. https://doi.org/10.1901/jaba.1994.27-393.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18*, 111–126. https://doi.org/10.1901/jaba.1985.18-111.

Carr, E. G., & McDowell, J. J. (1980). Social control of self-injurious behavior of organic etiology. *Behavior Therapy, 11*(3), 402–409. https://doi.org/10.1016/S0005-7894(80)80056-6.

Carr, E. G., Newsom, C. D., & Binkoff, J. A. (1976). Stimulus control of self-destructive behavior in a psychotic child. *Journal of Abnormal Child Psychology, 4*(2), 139–153. https://doi.org/10.1007/BF00916518.

Cihon, J. H., Weinkauf, S. M., & Taubman, M. (2017). Using the teaching interaction procedure to teach social skills for individuals diagnosed with autism spectrum disorder. In J. B. Leaf (Ed.), *Handbook of social skills and autism spectrum disorder* (pp. 313–324). Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-319-62995-7_18.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Cooper, S. A., Smiley, E., Allan, L. M., Jackson, A., Finlayson, J., Mantry, D., & Morrison, J. (2009). Adults with intellectual disabilities: Prevalence, incidence and remission of self-injurious behaviour and related factors. *Journal of Intellectual Disability Research, 53*, 200–216. https://doi.org/10.1111/j.1365-2788.2008.01060.x.

Delprato, D. J. (1981). The constructional approach to behavioral modification. *Journal of Behavior Therapy and Experimental Psychiatry, 12*(1), 49–55. https://doi.org/10.1016/0005-7916(81)90029-X.

DiCarlo, C. F., Schepis, M. M., & Flynn, L. (2009). Embedding sensory preference into toys to enhance toy play in toddlers with disabilities.

Infants and Young Children, 22, 188–200. https://doi.org/10.1097/IYC.0b013e3181abe1a1.

Didden, R., Sturmey, P., Sigafoos, J., Lang, R., O'Reilly, M. F., & Lancioni, G. E. (2012). Nature, prevalence, and characteristics of challenging behavior. In J. Matson (Ed.), *Functional assessment for challenging behaviors* (pp. 25–44). New York, NY: Springer.

Division for Early Childhood. (2014). DEC recommended practices in early intervention/early childhood special education 2014. Retrieved from http://www.dec-sped.org/recommendedpractices

Dixon, M. R., Rehfeldt, R. A., & Randich, L. (2003). Enhancing tolerance to delayed reinforcers: The role of intervening activities. *Journal of Applied Behavior Analysis, 36*(2), 263–266. https://doi.org/10.1901/jaba.2003.36-263.

Dominick, K. C., Davis, N. O., Lainhart, J., Tager-Flusberg, H., & Folstein, S. (2007). Atypical behaviors in children with autism and children with a history of language impairment. *Research in Developmental Disabilities, 28*, 145–162. https://doi.org/10.1016/j.ridd.2006.02.003.

Dooley, P., Wilczenski, F. L., & Torem, C. (2001). Using an activity schedule to smooth school transitions. *Journal of Positive Behavior Interventions, 3*, 57–61. https://doi.org/10.1177/109830070100300108.

Drager, K., Light, J., & McNaughton, D. (2010). Effects of AAC interventions on communication and language for young children with complex communication needs. *Journal of Pediatric Rehabilitation Medicine, 3*, 303–310. https://doi.org/10.3233/PRM-2010-0141.

Ducharme, J. M., & Worling, D. E. (1994). Behavioral momentum and stimulus fading in the acquisition and maintenance of child compliance in the home. *Journal of Applied Behavior Analysis, 27*, 639–647. https://doi.org/10.1901/jaba.1994.27-639.

Dunlap, G., Johnson, L. F., & Robbins, F. R. (1990). Preventing serious behavior problems through skill development and early intervention. In A. C. Repp & N. N. Singh (Eds.), *Perspectives on the use of nonaversive and aversive interventions for persons with developmental disabilities* (pp. 273–286). Sycamore, IL: Sycamore Publishing.

Dunlap, G., & Robbins, F. R. (1991). Current perspectives in service delivery for young children with autism. *Comprehensive Mental Health Care, 1*, 177–194.

Dunlap, G., Strain, P. S., Fox, L., Carta, J. J., Conroy, M., Smith, B. J., Kern, L., Hemmeter, M. L., Timm, M. A., Mccart, A., Sailor, W., Markey, U., Markey, D. J., Lardieri, S., & Sowell, C. (2006). Prevention and intervention with young children's challenging behavior: Perspectives regarding current knowledge. *Behavioral Disorders, 32*, 29–45. https://doi.org/10.1177/019874290603200103.

Ellis, E. M., Ala'i-Rosales, S. S., Glenn, S. S., Rosales-Ruiz, J., & Greenspoon, J. (2006). The effects of graduated exposure, modeling, and contingent social attention on tolerance to skin care products with two children with autism. *Research in Developmental Disabilities, 27*(6), 585–598. https://doi.org/10.1016/j.ridd.2005.05.009.

Fahmie, T. A., Iwata, B. A., & Mead, S. C. (2016). Within-subject analysis of a prevention strategy for problem behavior. *Journal of Applied Behavior Analysis, 49*(4), 915–926. https://doi.org/10.1002/jaba.343.

Fahmie, T. A., Macaskill, A. C., Kazemi, E., & Elmer, U. C. (2018). Prevention of the development of problem behavior: A laboratory model. *Journal of Applied Behavior Analysis, 51*(1), 25–39. https://doi.org/10.1002/jaba.426.

Falcomata, T. S., Roane, H. S., Feeney, B. J., & Stephenson, K. M. (2010). Assessment and treatment of elopement maintained by access to stereotypy. *Journal of Applied Behavior Analysis, 43*(3), 513–517. https://doi.org/10.1901/jaba.2010.43-513.

Favell, J. E., McGimsey, J. F., & Schell, R. M. (1982). Treatment of self-injury by providing alternate sensory activities. *Analysis and*

Intervention in Developmental Disabilities, 2(1), 83–104. https://doi.org/10.1016/0270-4684(82)90007-6.

Fischetti, A. T., Wilder, D. A., Myers, K., Leon-Enriquez, Y., Sinn, S., & Rodriguez, R. (2012). An evaluation of evidence-based interventions to increase compliance among children with autism. *Journal of Applied Behavior Analysis, 45*(4), 859–863. https://doi.org/10.1901/jaba.2012.45-859.

Fisher, W. W., Thompson, R. H., Hagopian, L. P., Bowman, L. G., & Krug, A. (2000). Facilitating tolerance of delayed reinforcement during functional communication training. *Behavior Modification, 24*, 3–29. https://doi.org/10.1177/0145445500241001.

Fox, L., Dunlap, G., Hemmeter, M. L., Joseph, G., & Strain, P. (2003). The teaching pyramid: A model for supporting social competence and preventing challenging behavior in young children. *Young Children, 58*, 48–53.

Frey, J., & Kaiser, A. P. (2011). The use of play expansions to increase the diversity and complexity of object play in young children with disabilities. *Topics in Early Childhood Education, 31*, 99–111. https://doi.org/10.1177/0271121410378758.

Gardner, A. W., Spencer, T. D., Boelter, E. W., DuBard, M., & Jennett, H. K. (2012). A systematic review of brief functional analysis methodology with typically developing children. *Education and Treatment of Children, 35*(2), 313–332. https://doi.org/10.1353/etc.2012.0014.

Ghaemmaghami, M., Hanley, G. P., & Jessel, J. (2016). Contingencies promote delay tolerance. *Journal of Applied Behavior Analysis, 49*(3), 548–575. https://doi.org/10.1002/jaba.333.

Goldiamond, I. (1974). Toward a constructional approach to social problems: Ethical and constitutional issues raised by applied behavior analysis. *Behavior and Social Issues, 11*, 108–197. https://doi.org/10.5210/bsi.v11i2.92.

Goldstein, H., Kaczmarek, L. A., & Hepting, N. H. (1996). Indicators of quality in communication intervention. In S. L. Odom & M. E. McLean (Eds.), *Early intervention/early childhood special education: Recommended practices* (pp. 197–221). Austin, TX: Pro-Ed.

Green, C. W., & Reid, D. H. (1999). Reducing indices of unhappiness among individuals with profound multiple disabilities during therapeutic exercise routines. *Journal of Applied Behavior Analysis, 32*(2), 137–147. https://doi.org/10.1901/jaba.1999.32-137.

Hanley, G. P. (2012). Functional assessment of problem behavior: Dispelling myths, overcoming implementation obstacles, and developing new lore. *Behavior Analysis in Practice, 5*(1), 54–72. https://doi.org/10.1007/BF03391818.

Hanley, G. P., Heal, N. A., Tiger, J. H., & Ingvarsson, E. T. (2007). Evaluation of a classwide teaching program for developing preschool life skills. *Journal of Applied Behavior Analysis, 40*(2), 277–300. https://doi.org/10.1901/jaba.2007.57-06.

Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*, 147–185. https://doi.org/10.1901/jaba.2003.36-147.

Hanley, G. P., Jin, C. S., Vanselow, N. R., & Hanratty, L. A. (2014). Producing meaningful improvements in problem behavior of children with autism via synthesized analyses and treatments. *Journal of Applied Behavior Analysis, 47*(1), 16–36. https://doi.org/10.1002/jaba.106.

Hemmeter, M. L., Ostrosky, M., & Fox, L. (2006). Social and emotional foundations for early learning: A conceptual model for intervention. *School Psychology Review, 35*, 583–601.

Hume, K., Loftin, R., & Lantz, J. (2009). Increasing independence in autism spectrum disorders: A review of three focused interventions. *Journal of Autism and Developmental Disorders, 39*, 1329–1338. https://doi.org/10.1007/s10803-009-0751-2.

Hume, K., & Odom, S. (2007). Effects of an individual work system on the independent functioning of students with autism. *Journal of Autism and Developmental Disorders, 37*, 1166–1180. https://doi.org/10.1007/s10803-006-0260-5.

Individuals With Disabilities Education Act Amendments of 1997. (2003). 20 U.S.C. §§ 1400 *et seq.* (amended 2004); 34 C.F.R. §§ 300.1 *et seq*.

Individuals With Disabilities Education Improvement Act of 2004. (2004). P. L. No. 108-446, 118 Stat. 2647 (amending 20 U.S.C. §§ 1400 *et seq.*).

Iwata, B. A. (2017, March). *Vicarious reinforcement and punishment effects: Worth the effort?* Symposium conducted at the 35th Annual Western Regional Conference on Behavior Analysis, Anaheim, CA.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities, 2*, 3–20. https://doi.org/10.1016/0270-4684(82)90003-9.

Iwata, B. A., Pace, G. M., Dorsey, M. F., Zarcone, J. R., Vollmer, T. R., Smith, R. G., Rodgers, T. A., Lerman, D. C., Shore, B. A., Mazaleski, J. L., Goh, H. L., Cowdery, G. E., Kalsher, M. J., McCosh, K. C., & Willis, K. D. (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis, 27*, 215–240. https://doi.org/10.1901/jaba.1994.27-215.

Jarmolowicz, D. P., Kahng, S. W., Ingvarsson, E. T., Goysovich, R., Heggemeyer, R., & Gregory, M. K. (2008). Effects of conversational versus technical language on treatment preference and integrity. *Intellectual and Developmental Disabilities, 46*(3), 190–199. https://doi.org/10.1352/2008.46:190-199.

Kaiser, A. P., & Roberts, M. Y. (2011). Advances in early communication and language intervention. *Journal of Early Intervention, 33*, 298–309. https://doi.org/10.1177/1053815111429968.

Kanne, S. M., & Mazurek, M. O. (2011). Aggression in children and adolescents with ASD: Prevalence and risk factors. *Journal of Autism and Developmental Disorders, 41*, 926–937. https://doi.org/10.1007/s10803-010-1118-4.

Kelly, J. A., St. Lawrence, J. S., Hood, H. V., & Brasfield, T. L. (1989). Behavioral intervention to reduce AIDS risk activities. *Journal of Consulting and Clinical Psychology, 57*, 60–67. https://doi.org/10.1037/0022-006X.57.1.60.

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. https://doi.org/10.1901/jaba.1995.28-261.

Leaf, J. B., Leaf, R., McEachin, J., Taubman, M., Ala'i-Rosales, S., Ross, R. K., Smith, T., & Weiss, M. J. (2016). Applied behavior analysis is a science and, therefore, progressive. *Journal of Autism and Developmental Disorders, 46*(2), 720–731. https://doi.org/10.1007/s10803-015-2591-6.

Leaf, J. B., Oppenheim-Leaf, M. L., Leaf, R., Courtemanche, A. B., Taubman, M., McEachin, J., Sheldon, J. B., & Sherman, J. A. (2012). Observational effects on the preferences of children with autism. *Journal of Applied Behavior Analysis, 45*, 473–483. https://doi.org/10.1901/jaba.2012.45-473.

Lee, Y. Y., Sugai, G., & Horner, R. H. (1999). Using an instructional intervention to reduce problem and off-task behaviors. *Journal of Positive Behavior Interventions, 1*, 195–204. https://doi.org/10.1177/109830079900100402.

Lifter, K., Mason, E. J., & Barton, E. E. (2011). Children's play: Where we have been and where we could go. *Journal of Early Intervention, 33*, 281–297. https://doi.org/10.1177/1053815111429465.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3–9. https://doi.org/10.1037/0022-006X.55.1.3.

Lovaas, O. I., Freitag, G., Gold, V. J., & Kassorla, I. C. (1965). Experimental studies in childhood schizophrenia: Analysis of self-destructive behavior. *Journal of Experimental Child Psychology, 2*(1), 67–84. https://doi.org/10.1016/0022-0965(65)90016-0.

Luczynski, K. C., & Hanley, G. P. (2013). Prevention of problem behavior by teaching functional communication and self-control skills to preschoolers. *Journal of Applied Behavior Analysis, 46*(2), 355–368. https://doi.org/10.1002/jaba.44.

Lutzker, J. R., Frame, R. E., & Rice, J. M. (1982). Project 12-ways: An ecobehavioral approach to the treatment and prevention of child abuse and neglect. *Education and Treatment of Children, 5*, 141–155.

Lutzker, J. R., & Rice, J. M. (1988). Project 12-ways: Measuring outcome of a large in-home service for treatment and prevention of child abuse and neglect. *Child Abuse & Neglect, 8*, 519–524. https://doi.org/10.1016/0145-2134(84)90034-6.

Mace, F. C., & Knight, D. (1986). Functional analysis and treatment of severe pica. *Journal of Applied Behavior Analysis, 19*(4), 411–416. https://doi.org/10.1901/jaba.1986.19-411.

Martin, P. L., & Foxx, R. M. (1973). Victim control of the aggression of an institutionalized retardate. *Journal of Behavior Therapy and Experimental Psychiatry, 4*(2), 161–165. https://doi.org/10.1016/0005-7916(73)90063-3.

McLean, M. E., & Odom, S. L. (1996). Establishing recommended practices in early intervention/early childhood special education. In S. L. Odom & M. E. McLean (Eds.), *Early intervention/early childhood special education: Recommended practices* (pp. 1–22). Austin, TX: Pro-Ed.

Michael, J., Palmer, D. C., & Sundberg, M. L. (2011). The multiple control of verbal behavior. *The Analysis of Verbal Behavior, 27*(1), 3–22. https://doi.org/10.1007/BF03393089.

Neef, N. A., & Peterson, S. M. (2007). Functional behavior assessment. In J. O. Cooper, T. E. Heron, & W. L. Heward (Eds.), *Applied behavior analysis* (2nd ed., pp. 500–524). Upper Saddle River, NJ: Pearson.

Northup, J., Wacker, D., Sasso, G., Steege, M., Cigrand, K., Cook, J., & DeRaad, A. (1991). A brief functional analysis of aggressive and alternative behavior in an outclinic setting. *Journal of Applied Behavior Analysis, 24*(3), 509–522. https://doi.org/10.1901/jaba.1991.24-509.

Odom, S. L., McLean, M. E., Johnson, L. J., & LaMontagne, M. J. (1995). Recommended practices in early childhood special education: Validation and current use. *Journal of Early Intervention, 19*, 1–17. https://doi.org/10.1177/105381519501900101.

Oliver, A. C., Pratt, L. A., & Normand, M. P. (2015). A survey of functional behavior assessment methods used by behavior analysts in practice. *Journal of Applied Behavior Analysis, 48*(4), 817–829. https://doi.org/10.1002/jaba.256.

Parsons, M. B., Reid, D. H., Bentley, E., Inman, A., & Lattimore, L. P. (2012). Identifying indices of happiness and unhappiness among adults with autism: Potential targets for behavioral assessment and intervention. *Behavior Analysis in Practice, 5*(1), 15–25. https://doi.org/10.1007/BF03391814.

Paterson, C. R., & Arco, L. (2007). Using video modeling for generalizing toy play in children with autism. *Behavior Modification, 31*, 660–681. https://doi.org/10.1177/0145445507301651.

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. https://doi.org/10.1901/jaba.2006.158-05.

Richards, C., Oliver, C., Nelson, L., & Moss, J. (2012). Self-injurious behaviour in individuals with autism spectrum disorder and intellectual disability. *Journal of Intellectual Disability Research, 56*, 476–489. https://doi.org/10.1111/j.1365-2788.2012.01537.x.

Richman, D. M., & Lindauer, S. E. (2005). Longitudinal assessment of stereotypic, proto-injurious, and self-injurious behavior exhibited by young children with developmental delays. *American Journal on Mental Retardation, 110*(6), 439–450. https://doi.org/10.1352/0895-8017(2005)110[439:LAOSPA]2.0.CO;2.

Rincover, A., & Devany, J. (1982). The application of sensory extinction procedures to self-injury. *Analysis and Intervention in Developmental Disabilities, 2*(1), 67–81. https://doi.org/10.1016/0270-4684(82)90006-4.

Roane, H. S., & Derosa, N. M. (2014). Reduction of emergent dropping behavior during treatment of elopement. *Journal of Applied Behavior Analysis, 47*(3), 633–638. https://doi.org/10.1002/jaba.136.

Robertson, R. E. (2015). The acquisition of problem behavior in individuals with developmental disabilities as a behavioral cusp. *Behavior Modification, 1*(40), 1–21. https://doi.org/10.1177/0145445515572185.

Rolider, A., Axelrod, S., & Van Houten, R. (2009). Don't speak behaviorism to me: How to clearly and effectively communicate behavioral interventions to the general public. *Child and Family Behaviour Therapy, 20*(2), 39–56. https://doi.org/10.1300/J019v20n02_03.

Rosales-Ruiz, J., & Baer, D. M. (1997). Behavioral cusps: A developmental and pragmatic concept for behavior analysis. *Journal of Applied Behavior Analysis, 30*(3), 533–544. https://doi.org/10.1901/jaba.1997.30-533.

Skinner, B. F. (1953). *Science and human behavior*. New York, NY: Macmillan.

Slaton, J. D., Hanley, G. P., & Raftery, K. J. (2017). Interview-informed functional analyses: A comparison of synthesized and isolated components. *Journal of Applied Behavior Analysis, 50*(2), 252–277. https://doi.org/10.1002/jaba.384.

Smith, B. J., Strain, P. S., Snyder, P., Sandall, S. R., McLean, M. E., Ramsey, A. B., & Sumi, W. C. (2002). DEC recommended practices: A review of 9 years of EIIECSE research literature. *Journal of Early Intervention, 25*(2), 108–119. https://doi.org/10.1177/105381510202500208.

Smith, G. J., McDougall, D., & Edelen-Smith, P. J. (2006). Behavioral cusps: A person-centered concept for establishing pivotal individual, family, and community behaviors and repertoires. *Focus on Autism and Other Developmental Disabilities, 21*, 223–229. https://doi.org/10.1177/10883576060210040301.

Stover, J., Bertozzi, S., Gutierrez, J., Walker, N., Stanecki, K. A., Greener, R., Gouws, E., Hankins, C., Garnett, G. P., Salomon, J. A., Boerma, J. T., de Lay, P., & Ghys, P. D. (2006). The global impact of scaling up HIV/AIDS prevention programs in low- and middle-income countries. *Science, 311*, 1474–1476. https://doi.org/10.1126/science.1121176.

Taubman, M. T., Leaf, R. B., & McEachin, J. (2011). *Crafting connections: Contemporary applied behavior analysis for enriching the social lives of persons with autism spectrum disorder*. New York, NY: DRL Books.

Thomason-Sassi, J. L., Iwata, B. A., Neidert, P. L., & Roscoe, E. M. (2011). Response latency as an index of response strength during functional analyses of problem behavior. *Journal of Applied Behavior Analysis, 44*(1), 51–67. https://doi.org/10.1901/jaba.2011.44-51.

Tiger, J. H., Hanley, G. P., & Bruzek, J. (2008). Functional communication training: A review and practical guide. *Behavior Analysis in Practice, 1*, 16–23. https://doi.org/10.1007/BF03391716.

United Nations. (1990). United Nations convention on the rights of the child. *United Nations Treaties*. Retrieved on August 17, 2017, from https://treaties.un.org/doc/Publication/UNTS/Volume%201577/v1577.pdf

Wacker, D. P., Berg, W. K., Harding, J. W., Derby, K. M., Asmus, J. M., & Healy, A. (1998). Evaluation and long-term treatment of aberrant behavior displayed by young children with disabilities. *Journal of Developmental and Behavioral Pediatrics, 19*, 260–266. https://doi.org/10.1097/00004703-199808000-00004.

Weiss, M. J., & Zane, T. (2010). Three important things to consider when starting intervention for a child diagnosed with autism. *Behavior*

Analysis in Practice, 3(2), 58–60. https://doi.org/10.1007/BF03391768.

Wolery, M., & Sainato, D. M. (1996). General curriculum and intervention strategies. In S. L. Odom & M. E. McLean (Eds.), *Early intervention/early childhood special education: Recommended practices* (pp. 125–158). Austin, TX: Pro-Ed.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11*(2), 203–214. https://doi.org/10.1901/jaba.1978.11-203.

Wolf, M. W., Risley, T., & Mees, H. (1964). Application of operant conditioning procedures to the behaviour problems of an autistic child. *Behaviour Research and Therapy, 1*, 305–312. https://doi.org/10.1016/0005-7967(63)90045-7.