Review

A review of interventions to reduce challenging behavior in school settings for students with autism spectrum disorders

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Abstract

This review evaluates research on the treatment of challenging behavior in school settings for students with autism spectrum disorders (ASD). Electronic database searches were carried out to identify studies published between 1995 and 2005. Twenty-six studies were identified. A variety of procedures were implemented in these studies to decrease challenging behavior in classrooms. These procedures were classified into four groups: (a) antecedent manipulations, (b) change in instructional context, (c) differential reinforcement, and (d) self-management techniques. The results of these studies indicated that all four classes of procedures were generally effective in reducing challenging behavior. These results are discussed in relation to four issues: (a) the characteristics of the participants, (b) assessment procedures carried out prior to intervention, (c) the feasibility of classroom treatment, and (d) the social validity of intervention procedures. Surprisingly, the effectiveness of a procedure did not seem to be related to completion of a prior functional behavior assessment (FBA). Also, the reported measures of social validity in the studies reviewed here have elicited positive reports from stakeholders, but the utility of these measures, as they have been conceptualized, is questioned. The findings of this review suggest future research directions that are also examined.

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1. Introduction

Challenging behaviors such as aggression, noncompliance, self-injury, and stereotypy are common to school age children with ASD (Baghdadli, Pascal, Grisli, & Aussiloux, 2003; Kiernan & Kiernan, 1994; McClintock, Hall, & Oliver, 2003; Murphy, Hall, Oliver, & Kissi-Debra, 1999). Without appropriate intervention, challenging behaviors tend to persist in people with ASD and related developmental disabilities (Murphy et al., 2005; Oliver, Murphy, & Corbett, 1987). Serious and chronic problem behavior can endanger a student's access to educational and social opportunities (Reichle, 1990). Researchers have also documented the negative effects of challenging behavior on teacher's efforts at instruction (Carr, Taylor, & Robinson, 1991). Special educators and teaching staff who work with students with ASD have reported higher levels of emotional burnout when they have been exposed to challenging behavior that they are not able to deal with effectively (Hastings & Brown, 2002).

Much of the responsibility for the treatment of challenging behavior for students with ASD has been placed on schools for two reasons. First, for some students, classrooms are the primary and often singular source of intervention for challenging behavior. Second, the Individuals with Disabilities Education Act (IDEA) requires schools to complete a FBA to identify the variables that maintain challenging behavior and to develop a behavioral intervention plan (BIP) for students who risk a change in their educational placement due to their problematic behavior (IDEA Amendments, 1997; IDEA, 1990; IDEA Improvement Act, 2004).

Recent reviews have evaluated the challenging behavior intervention literature for children with ASD under 8 years (Horner, Carr, Strain, Todd, & Reed, 2002), and under 6 years (Conroy, Dunlap, Clarke, & Alter, 2005; Odom et al., 2003). We are not aware of any literature reviews that have focused specifically on the treatment of challenging behavior in classrooms. Also, we are not aware of any literature reviews that have examined the treatment of the challenging behaviors of students with ASD between the ages 8–21 years. These last pieces of evidence represent a gap in what is known about the classroom treatment of students with ASD who engage in challenging behavior.

Researchers and clinicians interested in the treatment of challenging behavior in classrooms face several challenges that are unique to the setting. First, teachers often take on the role of interventionist when they encounter a student with challenging behavior, but many teachers lack the necessary knowledge, resources, or time to conduct a FBA and develop an effective BIP. Second, interventions to reduce challenging behavior must be designed to fit within classroom routines and expectations. Third, the researcher and interventionist must overcome the distractions that are common to classrooms, but generally absent from experimental settings, such as other students and unpredictable activity transitions.

We also know little about the classroom treatment of challenging behavior for students ages 8–21 years. One might expect that those treatments that are effective for younger children or adults will produce similar outcomes for this population, but there may be unexpected difficulties in applying similar strategies. For instance, the increased physical size and strength of older students may preclude the use of treatments that are effective for younger children.

Research studies aimed at decreasing the challenging behavior of students with ASD are heterogeneous in terms of intervention procedures, taking into account the characteristics and educational settings of individual participants. The outcomes have been generally favorable and have suggested effective assessment and intervention strategies. The present paper was aimed at providing a comprehensive review of challenging behavior intervention research conducted in school settings for students with ASD, ages 3–21 years.

2. Method

We included studies in this review based on five criteria. Each study: (a) included participants ages 3–21 years with a diagnosis of ASD; (b) utilized a single subject design; (c) was published in a peer reviewed journal between 1995 and 2005; (d) applied an intervention in an effort to reduce challenging behavior; and (e) took place within the context of a classroom. Studies which focused exclusively on the assessment of challenging behavior were excluded from this review as were studies that did not include two or more data points for each baseline and treatment phase. Electronic searches were completed using ERIC, PschINFO, and MEDLINE. Additionally, we examined the reference sections of included studies for possible additions to the review. A total of 26 studies were identified that met the inclusion criteria. The studies were classified into four categories depending on the nature of the intervention procedure. These categories illustrate the basic types of interventions that have been used to reduce challenging behavior. The type of intervention category was determined after first reading the entire study and then focusing on the independent variable and the procedures used to apply it. Depending on the study procedures, interventions were classified into one of four categories. The four categories were (a) antecedent manipulations, (b) change in instructional context, (c) differential reinforcement, and (d) self-management.

We classified a study as an antecedent manipulation if the procedure focused on addressing environmental conditions occurring prior to the occurrence of challenging behavior. These included changes to the student's environment or in a student's overall wellness. Studies were classified as change in instructional context if they involved changes in the instructional context to reduce challenging behavior (e.g., making a task easier, manipulating contingencies following instruction, or modifying the delivery of instruction). The differential reinforcement category included procedures that differentially reinforced alternative behavior (DRA) or differentially reinforced other behavior (DRO). DRO involves reinforcing students following a period of time when they did not engage in the target behavior. We classified an intervention as self-

management if the study included procedures that attempted to decrease challenging behavior by increasing a student's independent task completion, their independent transition through a classroom schedule, or focused on teaching students to self-monitor their challenging behavior.

For each evaluated study, Table 1 describes the following five variables: (a) the number of participants with ASD included in the study; (b) the participant's age or age ranges of participants; (c) the type of intervention; (d) the experimental design; and (e) the findings of the intervention. We reported findings as the authors have reported them. These findings included positive, mixed, and inconclusive. No study reported negative findings. Positive meant that all of the participants experienced a decrease in challenging behavior from baseline levels following intervention. Mixed meant that, although one or more participants had a decrease in their challenging behavior; one or more additional participants did not experience a decrease in their challenging behavior in one or more settings. Inconclusive meant that the data did not lend a clear analysis of whether the treatment was effective in decreasing challenging behavior.

The remainder of the paper is organized into the three sections of (a) results, (b) discussion, and (c) concluding remarks. The results section presents an overview of the treatment outcomes of the research studies according to their intervention category. Within each intervention category, two studies are described in detail to illustrate the procedures that typify that particular intervention category. All studies are summarized in Table 1 so that the reader can refer back to them as needed. The discussion section evaluates the outcomes of the 26 studies in regard to the (a) effectiveness of interventions based on the characteristics of participants, (b) the implementation of a prior FBA, (c) the feasibility of treating challenging behavior in classrooms, and (d) the measures utilized to evaluate the social validity of interventions. The final section (i.e., concluding remarks and future research) offers suggestions for future research.

3. Results

3.1. Overview of studies

3.1.1. Antecedent manipulations

Ten studies employed interventions that manipulated antecedent conditions to treat challenging behavior (Agosta, Graetz, Mastropieri, & Scruggs, 2004; Brownell, 2002; Buggey, 2005; Conroy, Asmus, Sellers, & Ladwig, 2005; Keeling, Smith Myles, Gagnon, & Simpson, 2003; Kuoch & Mirenda, 2003; Kuttler, Smith Myles, & Carlson, 1998; Prupas & Reid, 2001; Scattone, Wilczynski, Edwards, & Rabian, 2002; Schmit, Alper, Raschke, & Ryndak, 2000). Interventions in this category included social stories, video modeling, exercise, and a variety of cue card strategies. Each of the studies reported positive results. However, one study reported results that would suggest the intervention was less effective than reported (Brownell, 2002). Brownell's (2002) study evaluated the use of musically adapted social stories as positive, but reported that changes in challenging behavior was difficult to detect for half of the participants. In another study, the amount of improvement appeared to vary dependent on the baseline levels of the student's behavior (Scattone et al., 2002). All three participants demonstrated reduced challenging behavior following the introduction of a social story, but the amount of improvement varied across participants. One participant exhibited rather low levels of challenging behavior during baseline assessment and during intervention his behavior was similarly low, but became more stable.

Social stories™ (Gray & Garand, 1993), for example, are a type of antecedent intervention used to teach appropriate social skills. The stories are written in a child's perspective and use

Table 1
Studies listed according to categories with number (n) and age of participants (given in years), type of intervention, experimental design, target behavior(s) and findings

Studies	n	Age	Intervention	Design	Target behavior(s)	Findings
(a) Antecedent manipulations						
Agosta et al. (2004)	1	6	Social story	ABCA	Screaming	Positive
Brownell (2002)	4	6–9[a]	Musical social story	ABAC/ACAB	Inappropriate talk; not following directions; shouting	Positive
Buggey (2005)	3	6–8	Video modeling	MB across participants	Tantrum; pushing	Positive
Conroy, Asmus, et al. (2005)	1	6	Visual cue cards	AT/ABB	Stereotypy	Positive
Keeling et al. (2003)	1	10	Power card strategy	MB across games	Whining; screaming	Positive
Kuoch and Mirenda (2003)	2	5, 6	Social story	ABA/ACABA	Hands in pants; making noises; throwing up; cheating, inappropriate touching; negative comments	Positive
Kuttler et al. (1998)	1	12	Social story	ABAB	Tantrums	Positive
Prupas and Reid (2001)	2	5, 9	Single vs. multiple freq. exercise	ABA	Stereotypy	Positive
Scattone et al. (2002)	3	7, 15	Social story	MB across participants	Chair tipping; inappropriate staring; shouting	Positive
Schmit et al. (2000)	1	6	Photo of activity delivered as transition cue	MB across transitions	Tantrum	Positive
(b) Change in instructional context						
Heckaman et al. (1998)	4	6–9	LTM[b] prompt vs. PTD[c] & low vs. high effort tasks	AT across participants	Yelling; screaming; whining; aggression; off task behavior; disruptive behavior; SIB[d]	Positive
O'Reilly et al. (2005)	1	12	Schedule of embedded instruction	ABAB	SIB[d]	Positive
Orr et al. (1998)	1	11	Rhythmic entrainment[e]	ABAB	Screaming; head jerking	Inconclusive
Peck Peterson et al. (2001)	1	10	Choice of R+[f] following working alone	AB	Off task behavior; throwing pencil; ripping paper	Positive
Schilling and Schwartz (2004)	4	3, 4	Sitting on therapy ball	ABAB/BAB	Out of seat behavior	Positive

Table 1 (*Continued*)

Studies	*n*	Age	Intervention	Design	Target behavior(s)	Findings
(c) Differential reinforcement						
Braithwaite and Richdale (2000)	1	7	FCT[g] + extinction	ABCD	SIB[d] aggression	Positive
Durand (1999)	2	9, 11	AAC[h] device	MB across participants	Aggression; SIB[d]	Positive
Frea et al. (2001)	1	4	PECS[i]	MB across play centers	Aggression; tantrums	Positive
Hirsch and Smith Myles (1996)	1	10	DRA[j] "pica box"	ABAB	Pica	Positive
Kennedy et al. (2000)	5	9–17	FCT[g]	MB across conditions	Stereotypy	Positive
Nuzzolo-Gomez et al. (2002)	3	4–7	DRA[j] (play)	MB across students	Stereotypy	Positive
Schindler and Horner (2005)	3	4, 5	FCT[g]	MB across settlings	Aggression; screaming & tantruming, aggression & throwing objects	Positive
Taylor et al. (2005)	1	6	FR-1[k] vs. DRO[l]	ABCBC	Vocal stereotypy	Mixed
(d) Self-management						
Dooley et al. (2001)	1	3	Activity schedule	ABC	Aggression; crying; screaming	Positive
Mancina et al. (2000)	1	12	Self-ID[m] using pen, paper, watch alarm, visual cues & self R+[f] w/tangible	MB across tasks	Inappropriate vocalizations	Mixed
Massey and Wheeler (2000)	1	4	Photo activity schedule	MB across tasks	Aggression; destructive behavior; tantrum; noncompliance; stereotypy	Mixed

[a] Age of participants is given as an age range.
[b] Least to most.
[c] Progressive time delay.
[d] Self-injurious behavior.
[e] Metered music playing in background.
[f] Reinforcement.
[g] Functional communication training.
[h] Augmentative and alternative communication.
[i] Picture exchange communication system.
[j] Differential reinforcement of alternative behavior.
[k] Fixed reinforcement schedule of 1
[l] Differential reinforcement of other behavior.
[m] Self-identification.

short sentences to describe a social situation. Sentences are included in the story that talk about the appropriate behavior for the situation, and explain how others feel about the child's behavior (Reynhout & Carter, 2006).

Scattone et al. (2002) created individualized social stories^TM for three students with autism who engaged in socially inappropriate behaviors. One student, 15 years of age, often inappropriately stared at females during recess. The other students were both 7 years of age and tipped chairs backwards onto two legs or shouted during math instruction. Students read their social stories^TM aloud to teaching staff just before the activity where they usually engaged in challenging behavior. One student could not read, so the teacher read his story to him. The success of the intervention differed across the students, but all three students experienced a reduction in disruptive behavior. One student decreased his level of chair tipping from a mean of 50% of intervals to a mean of 17% of intervals. The 15-year-old student stared less frequently at female classmates: his level of staring decreased from a mean of 66.9% of intervals in baseline to a mean of 18.3% during intervention. The third student's shouting decreased from a mean of 16% of intervals in baseline to a mean of 5.1% during intervention.

Schmit et al. (2000) evaluated the use of a photographic cuing package during transition times for a 6-year-old student with autism who engaged in tantrums. The student's tantrums consisted of screaming, aggression, falling to the ground, and refusing to move from the floor. Immediately before a transition from one activity or physical location to another, the student was verbally cued by the experimenter and was presented with the corresponding photo prompt of the upcoming activity. Data were collected during transitions within the classroom, from the outdoor playground to the classroom, and from the classroom to the library. The student's frequency of tantrums during transitions within the classroom decreased from a mean of 2.83 in baseline to a mean of .23 with the use of the photo prompts. During transitions from the playground to inside the classroom, his tantrums decreased from a mean of 2.62 in baseline to a mean of .84 during intervention. His tantrums were eliminated during transitions from the classroom to the library. During maintenance assessment, the student's tantrums also decreased during transitions from the playground to the classroom and from one activity to another within the classroom. Transitions from the classroom to the library continued to be free of tantrums.

3.1.2. Change in instructional context

Five studies attempted to decrease challenging behavior by changing the instructional context (Heckamann, Alber, Hooper, & Heward, 1998; O'Reilly, Sigafoos, Lancioni, Edrisinha, & Andrews, 2005; Orr, Smith Myles, & Carlson, 1998; Peck Peterson, Caniglia, & Royster, 2001; Schilling & Schwartz, 2004). Interventions in this category included prompting strategies, embedded instruction, therapy balls as seats, rhythmic entrainment, and allowing a student to choose between two types of reinforcement. Target behaviors included, among others, aggression, generally disruptive behavior, off task behavior, self-injury, and screaming. With the exception of one study that reported inconclusive data (Orr et al., 1998), all the studies reported decreases in challenging behavior during intervention. Orr et al. (1998) reported erratic behavior during intervention, which continued throughout much of the study. They hypothesized that the intervention may have worked for the student during periods of less stress, but failed to work when she was more stressed.

O'Reilly et al. (2005) customized the delivery of classroom instruction for a 12-year-old student with autism who engaged in self-injurious behavior. Based on the findings of a functional analysis, they designed an instructional schedule that capitalized on the times when the student

engaged in less challenging behavior. During the functional analysis, the student engaged in high levels of self-injury during the demand condition, low levels of self-injury during the play condition, and did not self-injure at all during the attention condition. Academic demands were embedded between conditions identified by the functional analysis as times of less self-injury. A graduate student implemented this adapted schedule in the student's special education classroom. The use of the modified instructional schedule resulted in significant decreases in self-injury and increased engagement. During phases without the instructional schedule, the student self-injured during 100% of the intervals. When the modified instructional schedule was in place, the student's self-injury was eliminated in 50% of the intervals. These outcomes maintained during 3 and 5 months follow up checks.

Schilling and Schwartz (2004) evaluated the use of therapy ball seats during instruction for four preschool students with autism, ages 3–4 years, who engaged in various out of seat behaviors that disrupted instruction. One student assumed awkward positions such as standing on tiptoes, instead of sitting in his chair. The second student avoided sitting properly on his bench by standing or kneeling atop it. A third student sat in his chair, but placed his upper body and head beneath the tabletop. The fourth student had great difficulty sitting attentively on his carpet square during circle time and rolled around on the floor, faced away from the teacher during instruction, and often left the area. Each of the children were provided with an inflatable ball in lieu of a chair and sat on it during activities chosen by their teacher. The activities were art, tabletop play with a peer, small group time, and circle time, for the first, second, third, and fourth student, respectively. With the ball, each of the students sat for longer periods of time and exhibited increased engagement. When the therapy balls were withdrawn and the usual seat returned, each student spent less time sitting appropriately and demonstrated reduced engagement. Teaching staff who completed a satisfaction survey were supportive of the use of the therapy ball as a seat to reduce out of seat behavior.

3.1.3. Differential reinforcement

Eight studies examined the use of differential reinforcement of other behavior to bring about a decrease in challenging behavior (Braithwaite & Richdale, 2000; Durand, 1999; Frea, Arnold, & Vittimberga, 2001; Hirsch & Smith Myles, 1996; Kennedy, Meyer, Knowles, & Shukla, 2000; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002; Schindler & Horner, 2005; Taylor, Hoch, & Weissman, 2005). Five studies in the differential reinforcement category used functional communication training (FCT) (Braithwaite & Richdale, 2000; Durand, 1999; Frea et al., 2001; Kennedy et al., 2000; Schindler & Horner, 2005). Other studies used the picture exchange system, differentially reinforced play behaviors, and compared a fixed reinforcement schedule of 1 (FR-1) to DRO.

The word "functional" in FCT refers to the process of using information about what social consequence(s) maintain the student's challenging behavior, so that a functionally equivalent, appropriate response can be chosen and taught. All but one study in this category (Taylor et al., 2005) reported positive results. Taylor et al. (2005) reported mixed results with DRO being much more effective than FR-1 at decreasing vocal stereotypy.

Braithwaite and Richdale (2000) taught a 7-year-old boy with autism and intellectual disability, who engaged in self-injurious and aggressive behavior, to verbally ask for a preferred item, or to ask for help on an academic task (e.g., "I want slinky, please"). A prior FBA indicated that his challenging behaviors occurred when he wished to access preferred items or escape from demanding situations. The experimenter differentially reinforced the student's verbal requests and ignored any occurrences of challenging behavior (DRA). The communication responses

were taught by the experimenter in both the student's special education and inclusive classrooms. The FCT intervention eliminated the student's challenging behavior.

Nuzzolo-Gomez et al. (2002) differentially reinforced appropriate toy play for three students, ages 4–7 years, with autism, who engaged in stereotypy. The participant's stereotypic behaviors were body rocking, finger-flicking, hand clapping, hand flapping, object mouthing, and vocal noises. Students were taught to self-initiate toy play by the experimenter. The occurrence of stereotypy was ignored. Data collection took place during times when the children were allowed to choose freely among various activities and learning centers. During the toy play intervention, the stereotypy of all three students decreased and their levels of toy play increased.

3.1.4. Self-management

Three studies explored the use of a self-management strategy to decrease challenging behavior (Dooley, Wilczenski, & Torem, 2001; Mancina, Tankersley, Kamps, Kravits, & Parrett, 2000; Massey & Wheeler, 2000). Dooley and colleagues reported positive results from the use of an activity schedule based on the picture exchange communication system to reduce aggression, crying, and screaming. The remaining two studies, which are described below, reported mixed results.

Mancina et al. (2000) evaluated the effects of teaching a self-management strategy to a 12-year-old girl with autism and moderate intellectual disability who engaged in multiple topographies of vocal stereotypy (echolalia, humming, tongue clucking, and whistling). The effects of the self-management strategy were measured over leisure, prevocational, and reading activities. The student was taught first by researchers and then by her classroom teacher to self-monitor her vocal stereotypy using paper and pencil, a digital watch set with a recurrent alarm, and visual cue cards placed on her desk. During the self-management strategy, the authors found that the student's inappropriate vocalizations decreased across all settings. During baseline, vocalizations occurred from 76% to 100% of intervals. During the self-management intervention, vocalizations decreased to less than 50% of intervals during leisure activities. During prevocational activities, vocalizations decreased to less than 20% of intervals. Vocalizations also decreased to less than 50% of intervals in reading activities. When the teacher implemented the self-management strategy, vocalizations were eliminated during leisure and prevocational tasks. When the teacher implemented the self-management strategy during reading, vocalizations occurred from 0% to 60% of intervals. Despite these positive changes, the student achieved limited independence with the self-management procedure and required gestural prompts to use the self-management system.

Massey and Wheeler (2000) evaluated the effects of a photographic activity schedule on the aggressive, destructive, noncompliant, stereotypical, and tantrum behaviors of a 4-year-old preschool student with autism. The student's teacher used graduated guidance in a most-to-least prompting hierarchy to teach him the use of his schedule across leisure, lunchtime, and work times in his inclusive classroom. During lunch, the student's challenging behaviors decreased from a baseline mean of 9.5% of intervals to an intervention mean of 3.3% intervals. During baseline assessment of lunchtime, the student remained on task a mean of 54.7% of sessions. When the schedule was used, the student remained on task a mean of 91.3% of sessions. During the work condition, his challenging behaviors decreased from a mean of 15% of sessions to an intervention mean of 1.3% of sessions. During baseline assessment, the student did not engage in challenging behaviors during leisure activities. Paradoxically, when the schedule was used in the leisure condition, the student engaged in challenging behaviors a mean of 5.5% of sessions. However, the student's engagement during leisure activities increased. The student's occurrence

of challenging behaviors during maintenance assessment was a mean of 0%; 2.75%; and 2% of sessions during work, leisure, and lunch, respectively. During maintenance assessment, the students level of engagement was similar to intervention levels in each condition.

4. Discussion

4.1. How effective were the interventions?

A majority of the studies reported decreases in challenging behavior and attributed these to the intervention (85% of studies). Of these studies, ten studies reported elimination of the challenging behavior(s) of at least one student during intervention in at least one condition (Braithwaite & Richdale, 2000; Buggey, 2005; Durand, 1999; Frea et al., 2001; Keeling et al., 2003; Kuttler et al., 1998; Massey & Wheeler, 2000; Scattone et al., 2002; Schilling & Schwartz, 2004; Schmit et al., 2000). Antecedent manipulations, changes in instructional context, differential reinforcement, and self-management strategies each appear to be effective in reducing diverse topographies of challenging behavior. Behavioral topographies addressed in the literature have included: aggression; cheating; hands in pants; inappropriate staring or touching; inappropriate talk or vocalizations; making negative comments; noncompliance; out of seat behavior; pica; property destruction; screaming; self-injurious behavior; spitting; stereotypy; and tantrums. The top four groups of challenging behaviors most often targeted for intervention were: (a) screaming, yelling, shouting, or crying (fifteen studies); (b) stereotypy (fourteen studies); and (c) noncompliance and aggression (eleven studies each). The most common treatment chosen to treat screaming, yelling, shouting, or crying was a social story[TM]. Differential reinforcement, including DRA, DRO, and FCT, was most often utilized to treat stereotypy. Noncompliance and aggression were most often treated by changing the instructional context or implementing FCT. These and other treatments were effective in reducing these challenging behaviors, but we can only make limited conclusions concerning the permanency of any treatment gains. Follow up and/or maintenance assessment was conducted in a minority of studies, but these few studies have reported continued decreased challenging behavior (Buggey, 2005; Kuoch & Mirenda, 2003; Schmit et al., 2000).

In addition, the findings of some individual studies have suggested a less than clear picture of the effectiveness of interventions to decrease challenging behavior(s). Some studies have reported less than positive findings and others, while reporting positive findings, have provided data that could be considered in a less positive light. One study (Orr et al., 1998) reported inconclusive findings and three others (Mancina et al., 2000; Massey & Wheeler, 2000; Taylor et al., 2005) reported mixed findings. Orr et al. (1998) reported inconclusive findings, because the student's challenging behaviors were erratic during both the intervention and baseline phases. Additionally, one of the studies that reported positive findings suggested that readers exercise caution in interpreting the positive data trend (Peck Peterson et al., 2001). The effects of the choice intervention on the student's off task behavior and property destruction were not immediately apparent and the authors suggested that there was a chance that the decrease in challenging behavior was due to a variable besides the intervention. The authors also suggested that readers cautiously interpret the data, because the data had a high degree of variability and was collected in a short amount of time (Peck Peterson et al., 2001).

Furthermore, of the studies reporting positive findings, some did not support their findings with unequivocal data. For instance, Agosta et al. (2004) and Kuoch and Mirenda (2003) reported decreased challenging behavior during intervention, but when the treatment was removed during

the reversal phase, the level of challenging behavior remained constant. If the behavioral decrease was due to the intervention, we may expect the behavior to increase once again when the treatment is withdrawn. A failure to obtain a return to higher levels of challenging behavior may point to an improvement, which results from a different variable. For instance, maturation or a resolution of discomfort from a common illness may lead to similar decreases in challenging behavior. Other studies reported a downward trend in the baseline data immediately prior to the beginning of intervention data collection (Conroy, Asmus, et al., 2005; Nuzzolo-Gomez et al., 2002), which may render positive intervention data inconclusive.

We have additional concerns about the reported effectiveness of interventions. In some studies, authors have reported positive findings when the student still engaged in what might be considered socially inappropriate levels of challenging behavior. For instance, one student experienced reductions in his target behavior, but still shouted approximately 15–20 times in an hour during the last intervention phase (Brownell, 2002). The effectiveness of a classroom intervention might be better defined to include the elimination of the challenging behavior(s) or a reduction in the behavior that results in a socially acceptable level of challenging behavior.

Along the same lines, an intervention may result in decreased challenging behavior, but this same intervention might not be enjoyable for the student. This dislike of an intervention might result in secondary challenging behavior. One study reported descriptive findings that indicate the student's happiness during the intervention (Agosta et al., 2004). For instance, Agosta et al. (2004) reported that the student requested to repeat the social story. Brownell (2002), however, reported that a student whined and whimpered in protest when asked to participate in the intervention.

Other studies have reported issues that may require special considerations not fully explored in the literature. For instance, the treatment of older children (10–14 years) may present unique difficulties to research and teaching staff. Older children are larger in size and physically stronger than their younger peers, which could presumably lead to increased severity and seriousness of behavior. In addition, learning history can make the successful elimination of challenging behavior difficult. However, the reviewed studies that included older students reported positive treatment outcomes and only two studies mentioned difficulties related to the size of the older student (Kuttler et al., 1998; Orr et al., 1998). Orr et al. (1998) reported that their 11-year-old, but adult-sized student (5 ft.7 in. and 170 pounds) required several adults to calm her down when she had a tantrum. To prevent dangerous escalations, their intervention measured precursor challenging behavior. Kuttler et al. (1998) also mentioned difficulty managing the tantrums of a 12-year-old student and similarly measured precursor challenging behavior.

Kuttler et al. (1998) successfully reduced the student's challenging behavior to low levels during lunchtime and eliminated it during his morning class work time. Clearly, significant barriers to the successful treatment of the challenging behavior of older students can exist, but they have been infrequently reported in the literature.

4.2. The effectiveness of interventions derived from functional behavior assessments

Past research has found that the use of a FBA increases the likelihood of treatment success (Derby et al., 1992; Horner et al., 2002). Therefore, it is surprising that 13 of the 26 studies did not conduct any type of functional behavioral assessment prior to choosing an intervention to treat challenging behavior in this review. The remaining 13 studies did complete some variation of a functional behavioral assessment, including an analogue assessment (Conroy, Asmus, et al., 2005; Durand, 1999; Frea et al., 2001; Hirsch & Smith Myles, 1996; Kennedy et al., 2000;

O'Reilly et al., 2005; Orr et al., 1998; Peck Peterson et al., 2001; Taylor et al., 2005), ABC charts (Braithwaite & Richdale, 2000), interviews, and observations (Agosta et al., 2004; Braithwaite & Richdale, 2000; Dooley et al., 2001; Schindler & Horner, 2005).

Interestingly, there did not seem to be a difference in overall effectiveness for those studies that included a FBA from those that did not. Each of the thirteen studies that did not conduct a FBA employed strategies that are usually chosen without determining the possible function served by the student's challenging behavior. These studies implemented interventions like power card strategies (Keeling et al., 2003), self-management interventions (Mancina et al., 2000), social stories (Brownell, 2002; Kuoch & Mirenda, 2003; Kuttler et al., 1998; Scattone et al., 2002), sensory integration (Schilling & Schwartz, 2004), transitional schedules (Massey & Wheeler, 2000; Schmit et al., 2000), and video self-modeling (Buggey, 2005). The utility of functional assessments for these treatments is unknown.

Other studies in this group utilized treatments dependent on the information provided by a FBA. The most often utilized treatment in this group was FCT (Braithwaite & Richdale, 2000; Durand, 1999; Kennedy et al., 2000; Schindler & Horner, 2005). Other treatments included PECS (Frea et al., 2001), instructional modification based on the social consequences maintaining a student's behavior (O'Reilly et al., 2005), and giving a student a choice between two social consequences that maintained their behavior (Peck Peterson et al., 2001).

For those studies that did conduct some variation on a FBA, the chosen treatment appeared to match the social function of the challenging behavior 83% of the time. In four of these studies, the challenging behavior was hypothesized to be maintained by automatic reinforcement (Conroy, Asmus, et al., 2005; Hirsch & Smith Myles, 1996; Orr et al., 1998; Taylor et al., 2005), and treatments were not directly related to the function of the child's behavior. When a FBA did not elucidate the social consequence(s) maintaining a student's challenging behavior, practitioners and researchers looked to several types of treatments not directly based on a social consequence (e.g., attention, escape, and tangible). The hypothesized sensory stimuli maintaining the student's behavior has been used to compete with challenging behavior, or has been utilized to reinforce appropriate behavior. For example, Orr et al. (1998) found a student's screaming to be automatically reinforced and chose rhythmic entrainment as a treatment that might have met the student's need for auditory input. Despite attempts to provide the hypothesized stimuli maintaining the student's challenging behavior, Orr et al. (1998) reported inconclusive findings. Taylor et al. (2005) compared a fixed time schedule of reinforcement (FT-1 min) to DRO and reported mixed findings. Toys correlated with low levels of stereotypy (auditory toys) were selected as the reinforcers for the nonoccurrence of stereotypy. The DRO procedure greatly decreased the student's stereotypy. The fixed time schedule of reinforcement was not successful. Other researchers have identified acceptable times for self-stimulatory behavior and have taught a student to recognize such an opportunity (Conroy, Asmus, et al., 2005).

In light of these findings, teachers and researchers who work in classrooms may have valid reasons to choose treatments that are not dependent on the completion of a FBA. First, popular interventions, such as social stories[TM], are easy to create, and do not require extensive assessment, which can delay treatment.

Second, it is possible that some types of treatments do not require the kind of information that a FBA can provide. For instance, if a teacher has decided upon an activity schedule to treat the aggressive behaviors of a student that occur during transitions, it is unlikely that the use of a FBA will add to the success of the intervention. However, we cannot overlook the possibility that common cognitive interventions like social stories[TM] may be created to address the function of

the student's challenging behavior. Social stories[TM] generally provide students with personalized, but still somewhat generic models of appropriate behavior. For example, if a student hits other students, his or her story may include the phrase, ''Barbara keeps her hands to her self during circle time.'' This phrase does not address the possible functions of hitting and if social stories[TM] do address a function of a challenging behavior within the story, it is not usually due to the completion of an assessment. In the example presented above, hitting could serve the function of obtaining a tangible item that a peer is holding, obtaining a peer or teacher's attention, or to escape from circle time. If the function was determined by a functional assessment, a communication response could be taught to students through the use of the social story. In our example, Barbara could be taught to ask her peer for a turn with a preferred toy, to raise her hand to ask the teacher a question, or to ask for permission to leave circle time before instruction is completed. Of course, social stories often serve to regulate a student's behavior during rule-governed activities when student participation is non-negotiable. For these types of activities, the function served by a student's challenging behavior may be of less interest to the teacher.

Third, treatments like social stories[TM], and video self-modeling may be as effective as interventions derived from a FBA, because these strategies address a core deficit of autism spectrum disorders. In general, students with autism have difficulties relating to other persons socially (Murray, 1996; Matson & Swiezy, 1994). For example, they may have trouble understanding how another person is feeling, or may not have the skills necessary to initiate conversations. They may fail to recognize subtle social behaviors, such as appropriate eye contact, or maintaining appropriate personal space. Part of the success of social stories[TM] and video self-modeling could be explained by the presentation of appropriate social skills in a student's perspective. Other effective strategies, like activity schedules, may decrease challenging behavior, because they tell a student what activity is next and assist a child to independently move through their classroom routine. So, activity schedules may address an abnormal insistence on sameness, which is a common symptom of autism.

4.3. Feasibility of conducting interventions in classrooms

Most of the intervention phases of these studies were implemented in a special education classroom with a teacher and one or more paraprofessionals present (Agosta et al., 2004; Braithwaite & Richdale, 2000; Brownell, 2002; Dooley et al., 2001; Durand, 1999; Heckaman et al., 1998; Hirsch & Smith Myles, 1996; Kuoch & Mirenda, 2003; Kuttler et al., 1998; Mancina et al., 2000; Nuzzolo-Gomez et al., 2002; O'Reilly et al., 2005; Orr et al., 1998; Peck Peterson et al., 2001; Prupas & Reid, 2001; Scattone et al., 2002; Schilling & Schwartz, 2004; Schindler & Homer, 2005; Schmit et al., 2000). Some interventions were implemented in inclusive settings with same age typically developing peers (Braithwaite & Richdale, 2000; Buggey, 2005; Conroy, Asmus, et al., 2005; Kuoch & Mirenda, 2003; Massey & Wheeler, 2000). Treatments were carried out during a variety of everyday classroom routines, such as circle time, as students moved through learning centers, small and large group instruction, and during mealtimes. The interventionist was equally as likely to be either the experimenter or the teacher. Paraprofessionals worked alongside teachers and/or researchers to implement the interventions in six studies (Buggey, 2005; Conroy, Asmus, et al., 2005; Dooley et al., 2001; Hirsch & Smith Myles, 1996; Orr et al., 1998; Scattone et al., 2002) and another study had the teacher implement the intervention during follow up (O'Reilly et al., 2005). Several interventions were conducted entirely in an empty classroom for one or more participants, and did not assess generalization to other settings (Heckaman et al., 1998; Keeling et al., 2003; Kennedy et al., 2000). The Keeling

et al. (2003) intervention consisted of instructing a girl to react appropriately to losing a variety of games and was carried out in an empty room to minimize distractions. The Kennedy et al. (2000) study also mentioned the distraction free environment offered by the empty classroom. For unstated reasons, the intervention in Heckaman et al. (1998) was carried out in an empty room for one of four participants.

Many of the reviewed studies (14 studies) successfully utilized some degree of teacher and/or paraprofessional participation in data collection and intervention. When FBA interviews were carried out, teachers were always involved. However, when an analogue FBA was utilized, graduate level researchers were typically in charge. Teachers carried out an analogue FBA in only two studies (Durand, 1999; Taylor et al., 2005).

The generally restricted roles given to teachers, during the assessment process, may indicate that teachers do not have a strong knowledge base in behavioral assessment, feel uncomfortable with conducting behavioral assessments, or simply do not have the time to conduct such assessments. It may also reflect an unwillingness of researchers to give up the expert role they play in conducting behavioral assessments, or a lack of confidence in the teacher's knowledge of behavioral principles and assessment skills. Also, training teachers to conduct a functional analysis may take more time than researchers have available or want to spend on a single intervention. Despite the aforementioned issues, research has demonstrated the ability of teachers to assess and treat challenging behavior in a school setting (Northup et al., 1994).

This review also provides evidence that teachers can successfully carry out an experimental FBA and develop an effective treatment based on their findings. Durand (1999) systematically instructed the teachers in the completion of the functional analysis as part of the intervention. Teachers participated in a 3-day (18 hr) workshop that among other treatment topics, introduced teachers to the concepts underlying FBA, and how to conduct both a Motivation Assessment Scale (MAS) (Durand & Crimmons, 1992) and a brief functional analysis (Durand & Crimmins, 1988). Following the workshop, all assessments and treatments were implemented by the teachers.

4.4. Social validity of interventions

Since Wolf (1978) brought the idea of social validity to the behavior analysis literature, there has been a proliferation of studies incorporating some type of social validity measure in their design. The term ''social validity'' refers to a stake holder's satisfaction with a treatment and the feasibility of carrying out the treatment (Schwartz & Baer, 1991). With a few notable exceptions, social validity has been determined for behavioral interventions through the use of questionnaires or informal observation. The social validity of various treatments can vary dependent on the type of intervention, the severity of the behavior, and the past experiences, knowledge, and culture of the student's family and teacher. Consideration of the contextual fit of a treatment is a necessary component of designing a good intervention plan for students who engage in challenging behavior. An intervention that fits well within a teacher's classroom schedule and is judged to be socially acceptable will have greater success than a treatment that the teacher feels is harmful for the student or interrupts the daily classroom routine.

Formal measures of the social validity of interventions were reported by a minority of studies. Four of the 26 studies shared positive Likert type survey results from parents and teaching staff (Massey & Wheeler, 2000; Scattone et al., 2002; Schilling & Schwartz, 2004; Schindler & Horner, 2005). Nine other studies gave informal reports of positive feedback from the same groups (Agosta et al., 2004; Buggey, 2005; Conroy, Asmus, et al., 2005; Dooley et al., 2001; Keeling et al., 2003; Kuoch & Mirenda, 2003; Mancina et al., 2000; Prupas & Reid, 2001; Schmit

et al., 2000). Informal reports of satisfaction were obtained by experimenters directly asking stakeholders questions about the treatment. No studies reported that teachers or parents were unhappy with the intervention, but it is unlikely that a negatively assessed intervention would be published.

Schwartz and Baer (1991) have suggested that the real goal of measuring social validity is not to determine how satisfied consumers are with a treatment, but to determine when a consumer does not like a treatment. In this way, researchers can predict when participants might drop out of the study or fail to implement treatments with the necessary fidelity (Schwartz & Baer, 1991). Teachers who do not agree with treatments may complain to higher up administrative staff, may influence parents to withdraw students from the study, or may choose not to follow treatment protocol when the researcher is not present. Current methods used to evaluate the social validity of treatments for challenging behavior have too often been subjective, lacking psychometric standards, and have offered indiscriminately positive results. Likert type questionnaires, such as those used in the studies reviewed here, may include questions that are likely to result in positive feedback. For instance, a questionnaire might ask how satisfied a consumer is with a treatment, precluding any opportunity for negative report. Also, researchers who informally ask consumers face-to-face whether they are satisfied with the treatment may receive false positive answers, because the consumer wants to please them (Schwartz & Baer, 1991). Another caveat of the social validity questionnaires evaluated in this review is that they only report the social validity of the intervention for the student and his or her family and teachers. Thus, when the social validity of an intervention is reported, it may not generalize well to students with a different diagnosis and abilities. This limitation may be overcome if consumers from the larger community, such as parents of other children with disabilities, typically developing peers, and general education teachers, were asked about the social validity of the intervention.

5. Concluding remarks and future research

A number of treatments have been evaluated for challenging behaviors of students with ASD in classrooms. These treatments have included antecedent manipulations, changes in instructional context, differential reinforcement, and self-management. This review suggests that the treatments utilized have effectively decreased or eliminated a variety of challenging behaviors across many ages. Also, the studies reviewed here do point to the feasibility of conducting challenging behavior intervention research in classrooms, as most of the interventions were implemented, and data were collected in busy classroom settings. Teachers were often actively involved in the studies as an interventionist. An interesting discovery made in the course of examining the reviewed literature is that the effectiveness of an intervention could not be predicted by the presence or absence of a prior FBA. We also discovered two studies which demonstrated that teachers can carry out a FBA in the classroom, and implement effective treatments based on the assessment findings. Additionally, the social validity measures reported in this review have offered indiscriminately positive reports, which are of questionable use to further research. Several research questions have emerged from this body of evidence.

First, perhaps the most important finding of this review is that half of the interventions did not conduct any type of FBA prior to designing an intervention and yet most of the interventions (73%) reported equally positive findings. We have suggested that treatments which focus on the core deficits of ASD may be as effective as treatments that focus on the function of the behavior as determined by a FBA. Nevertheless, the utility of conducting a FBA prior to designing interventions using social stories and activity schedules has not been evaluated. Future research

should examine the effectiveness of social stories and other interventions such as self-management, or picture schedules, when linked with a FBA. Many of the successful interventions reported in this review may share core characteristics. Distilling such core treatment variables may be helpful in determining more robust and effective treatments. Future research could also examine these types of interventions for possible shared characteristics. If shared characteristics were discovered, they may prove helpful in determining the variables that contribute to a successful intervention. The length of assessment and treatment can be an important consideration for teachers who are dealing with a student's disruptive or dangerous behavior and future research should evaluate the effectiveness of treatments which do not require a lengthy assessment phase.

Second, research conducted by Durand (1999) and Taylor et al. (2005) has demonstrated the ability of teachers to carry out an experimental FBA in the classroom with limited training and support. This finding may suggest that researchers in applied behavior analysis may have prematurely declared the classroom an impossible setting for conducting a FBA. It may also encourage researchers who are interested in more directly involving teachers in classroom research to explore optimal practices for training teachers to conduct FBA and develop effective treatments.

Finally, researchers have long called for greater scrutiny of the current conceptualization of social validity in special education research and the methods used to assess it (Fawcett, 1991; Finney, 1991; Hawkins, 1991; Schwartz & Baer, 1991). One way the social validity of treatments for challenging behavior in school settings may be better evaluated is by allowing larger and more varied groups of possible consumers to examine actual examples of the challenging behaviors of students during baseline and treatment. Other researchers have developed intriguing and promising ways to obtain meaningful reports of social validity.

These researchers have shown video vignettes of the treatment of people with disabilities or actors playing this role to consumers (Hastings, Boulton, Monzani, & Tombs, 2004; Lancioni et al., 2002). Others have provided consumers with written case studies of potential scenarios (Jones & Lungaro, 2000; Miltenberger & Lumley, 1997). Such methods may mitigate some of the shortcomings of the current social validity research described earlier. These methods should be used to examine the social validity of classroom assessments and interventions to treat the challenging behaviors of students with ASD.

Acknowledgments

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