

Functional Behavior Assessment in Schools: Current Status and Future Directions

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Abstract Functional behavior assessment is becoming a commonly used practice in school settings. Accompanying this growth has been an increase in research on functional behavior assessment. We reviewed the extant literature on documenting indirect and direct methods of functional behavior assessment in school settings. To discern best practice guidelines and directions for future research, we evaluated studies to identify the (a) type of FBA used, (b) participant characteristics, (c) settings in which functional behavior assessments commonly were conducted, and (d) trends in the use of various methods of functional behavior assessment over time.

Keywords Functional behavior assessment · School · Challenging behavior

Introduction

Functional behavior assessment (FBA) is an umbrella term for various methods used to identify environmental variables that evoke and maintain problem behavior. Although once used primarily in clinical settings, FBAs are becoming more commonplace in schools. The increase can be attributed, at least in part, to federal mandates (IDEA 2004) requiring that an FBA can be conducted in certain circumstances. Further, a large amount of research documents the effectiveness of various methods of FBA for developing hypotheses about the operant function of

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problem behavior and for developing effective interventions (e.g., Heckaman et al. 2000; Reid and Nelson 2002).

Although the logic of FBA is applicable across populations, recent reviews of the literature suggest that FBAs are used most often with individuals with intellectual disability. In the most recent review of the literature—focusing exclusively on experimental methods of FBA and across multiple settings—Beavers et al. (2013) reported that only 21.5 % of studies included individuals without intellectual disabilities. The three reviews of FBA in school settings to date suggest that individuals with intellectual disability are common participants in school-based research on FBAs (Ellis and Magee 2004; Ervin et al. 2001; Kates-McElrath et al. 2007). Ellis and Magee (2004) reviewed only publications reporting a specific type of FBA (variations in the model first described by Iwata et al. 1982/1994). Kates-McElrath et al. (2007) reviewed articles published between 1992 and 2002, but reported only 11 publications (our own review resulted in 85 publications in that time frame, suggesting their range was more restricted). Ervin et al. (2001) conducted a comprehensive (including indirect and direct methods of FBA published in any peer-reviewed journal) review of school-based FBA research published through 1999. They reported that over 70 % of study participants were diagnosed with mental retardation [sic]. This was a universal finding across reviews. The relative dearth of research on FBA with typically developing students has led some to question the extent to which the broader base of research on FBA might be applicable to school settings and to call for more research on school-based FBA, especially with typically developing children (Anderson and St. Peter 2013; Sasso et al. 2001; Scott and Barrett 2004).

Over a decade has passed since Ervin et al.'s (2001) review of the literature, and FBA continues to be used widely in schools (Fox and Davis 2005); thus, an updated review of the literature seems warranted. Further, although Ervin et al.'s review was comprehensive, they did not identify the types of non-experimental and experimental FBAs conducted—information that might prove useful to researchers and practitioners alike. To this end, we conducted a systematic review of peer-reviewed studies on all methods of school-based FBA focused on problem behavior published through 2013. We included studies that likely were part of Ervin et al.'s review, so additional variables might be examined across those studies. We use the results of this review to offer guidelines for practitioners based on the FBA literature and conclude with possible directions for future research to address current gaps in the school-based FBA literature.

Method

Studies were identified via title and abstract searches of *PsycINFO*, *ERIC*, *Medline*, and *PubMD*. We used the keywords *functional assessment*, *functional behavior assessment*, *functional analysis*, *behavioral assessment*, *descriptive analysis*, and *structural analysis*. We restricted our search to peer-reviewed articles in English published up to and including 2013. For all articles meeting inclusion criteria (described next), we reviewed the reference section to identify additional articles

that might meet inclusion criteria. Two reviewers independently conducted both steps of this search—first, the electronic search and second, a review of references of including articles—and results were compared and combined to ensure that all potentially relevant articles were included. Inclusion criteria were then applied to all identified studies.

Inclusion Criteria

Included studies were those in which (a) a functional behavior assessment (b) of problem behavior (c) was conducted in a school setting for at least one participant in the study, and (d) behavior was measured and reported for each participant. All studies were coded by one of the authors of this study. For studies with more than one participant, we coded each participant who met inclusion criteria (i.e., FBA of problem behavior conducted in a school setting) and excluded any participants who did not meet criteria.

Functional Behavior Assessment

We defined functional behavior assessment as a pre-intervention assessment conducted to develop a hypothesis about environmental variables that evoked or maintained problem behavior. Thus, studies demonstrating or suggesting a relation between an environmental event and problem behavior solely as a function of intervention were excluded. We included indirect, non-experimental, and experimental methods of FBA.

Indirect methods included those in which information was gathered via an informant, rather than observing the individual emit the target response and included interviews, checklists, and rating scales. Non-experimental methods of FBA were coded as assessments in which information about environment–behavior relations was gathered via direct observation, but environmental variables were not manipulated in an experimental manner. This included descriptive functional assessment (ABC recording), scatter plot, and structural analysis (described later under “FBA types”). Experimental methods of FBA (referred to throughout as functional analysis) were defined as per the guidelines set forth by Hanley et al. (2003) and Beavers et al. (2013), and thus included studies in which some environmental variable was manipulated across at least two experimental conditions.

Problem Behavior

Problem behavior included any response targeted for a reduction in the frequency, intensity, or duration of occurrence. Problem behaviors targeted in school settings often threaten the safety or disrupt the learning of the student or others. We excluded responses that were purely academic in nature (e.g., words read incorrectly).

School Setting

We defined school as public or private agencies providing educational services to individuals between the ages of 5 and 21. We excluded daycare and preschool settings from the review as preschool is not mandated in all states and because preschools are not viewed as part of the public education system in all states. We also excluded inpatient hospital and residential settings from the analysis unless the description of the setting made it clear that the FBA was conducted in a school context within those institutions. Some studies (Anderson and Long 2002) included FBAs conducted in multiple settings. In these cases, we coded only information related to FBAs conducted in schools.

Responding Measured and Reported for Each Participant

We included studies in which data were collected via direct observation or via the report of others. We excluded studies that were reviews of the literature, provided data summarized across groups of participants, or did not report at least one FBA outcome (descriptive or numeric) for individual participants. Studies reporting results for some but not all FBAs (e.g., reported results for direct but not indirect FBA) were included.

Parameters of Functional Behavior Assessment Coded

As expected, there was a great deal of variation across studies with respect to participant and setting characteristics and the types of FBAs conducted. We coded studies meeting our inclusion criteria across the following features.

Participant and Setting Characteristics

We coded participant based on age and grade level. There was a broad range of labels used to indicate the disability or diagnoses of study participants; some articles indicated psychiatric labels such as anxiety or conduct disorder; others used educational labels such as emotionally disturbed or other health impaired. We coded participant diagnoses as none, intellectual disability [excluding autism spectrum disorder (ASD)], ASD, psychiatric disorder, emotional disturbance or emotional/behavior disturbance, specific learning disability, and other health impaired. For participants with multiple diagnoses, we took a hierarchical approach to determining a “primary” diagnosis. First, a diagnosis of intellectual disability or ASD superseded other diagnoses (for individuals with a diagnosis of both intellectual disability and ASD, autism was the primary diagnosis). This resulted in two broad groupings, those with ASD or intellectual disability and those without (referred to throughout the manuscript as typically developing). For typically developing students who had multiple diagnoses (e.g., oppositional defiant disorder, and emotional or behavioral disturbance), psychiatric diagnoses were coded as the primary diagnosis. For individuals with multiple educational labels, the hierarchy

we used was emotional or behavioral disorder, learning disability, and finally, other health impaired.

Setting was not coded for indirect methods. For direct methods, we coded the location in which the FBA was conducted.

Problem Behavior

We used descriptions provided by study authors to code problem behavior in one or more of the following categories: bizarre vocalizations (e.g., talking to someone that was not present), defiance/verbal aggression (e.g., threats), disruption/property destruction (e.g., throwing objects, banging objects, knocking over furniture), elopement (e.g., leaving an area or room without permission), inappropriate sexual behavior (e.g., making gestures indicative of sexual behavior), inappropriate vocalizations (e.g., making a comment that was rude or off topic), noncompliance (failure to follow instructions), off-task (e.g., engaging in some behavior other than assigned tasks), out of seat, perseverative speech (e.g., repeating the same word or phrase), physical aggression, (e.g., low peer interactions, teasing, bullying), screaming or crying, self-injury, stereotypy, talking out of turn (e.g., talking when the expectation is to be quiet), tantrums, and problem behavior (scored when the authors indicated the target response as some generic label such as problem behavior or aberrant behavior and did not provide an operational definition). Authors often grouped topographically distinct responses under a common label such as “off task,” or “problem behavior.” For example, Roberts et al. (2001) recorded the dependent variable in their study as “off task” and included such diverse behaviors as out of seat, calling out, making inappropriate noises, arguing, hitting, kicking, and pushing. In such cases we coded the target behaviors separately, based on topography—so as to better understand the range of behaviors included in school-based FBA.

Individual Conducting FBA

For all direct methods of FBA, we coded who led the conduct of the FBA (e.g., determined type of FBA to be used, conditions to be conducted, led data collection, and analysis), who gathered data (conducted the interview for indirect assessments, collected data in direct assessments), and who interacted with or worked with the student during direct assessments. We differentiated between researchers and teachers, specialists, or other school-based personnel. This information was coded based on authors’ descriptions of how the FBA was conducted. In the majority of studies, authors used generic terms (e.g., the therapist provided attention) or passive voice (e.g., attention was provided). Unless the authors explicitly noted that procedures were designed or implemented by educators or included educators in the “Participants” section, we assumed procedures were carried out by researchers. We collected data on these variables to learn more about the extent to which documentation exists illustrating the feasibility of embedding FBA within the context of a school. We also included this variable based on research, suggesting that different response patterns may emerge depending on who conducts the FBA (English and Anderson 2006).

FBA Types

We differentiated between indirect methods of FBA, non-experimental FBAs, and experimental FBAs. Each category of FBA contained additional subcategories defined next. We used the author's label of the type of FBA (e.g., scatter plot) and, if further description was available, confirmed that the description matched our definition of the label. In the few instances when there was a mismatch, we used our definition of FBA type. For these publications, the senior author and either the second or third author reviewed the manuscript independently and assigned a code based upon the methods used in the study. For example, if the authors labeled the study a functional analysis but only descriptive data were collected, we would have coded the study "descriptive assessment."

Indirect FBA For all indirect methods of FBA, we coded the specific type of interview or rating scale when this information was provided. Although we attempted to code the environment–behavior relations derived from indirect assessments, this proved nearly impossible as in many cases results were not provided. When results were given, they generally included an extensive list of "possible" antecedent and consequent variables affecting problem behavior or a ranking of a range of possible variables affecting responding.

Non-experimental FBA We defined non-experimental methods of FBA as (1) involving direct observation and recording of environmental variables and problem behavior and an absence of manipulation of two or more environmental variables. Non-experimental methods of FBA included descriptive assessment (ABC recording), scatter plot recording, and structural analyses.

Descriptive Assessment Descriptive assessment was defined as the coding of problem behavior and environmental events that preceded or followed the response (Bijou et al. 1968). We coded three kinds of descriptive assessments: ABC recording, scatter plots, and structural analysis. *ABC recording* was scored when authors made no attempt to modify or structure environmental variables and collected data on the occurrence of problem behavior and events that preceded or followed responding. We had hoped to define this category more rigorously based on temporal contiguity of variables to problem behavior; however, this information was provided in only a small minority of studies. Typically, study authors simply indicated that descriptive assessment was used and provided little or no additional information about how coding took place. We defined *scatter plot* (Touchette et al. 1985) as the scoring of problem behavior within predetermined intervals or blocks of time. *Structural analysis* (e.g., Anderson and Long 2002; Dolezal and Kurtz 2010; Stichter et al. 2004) was coded when data were systematically collected across two or more predetermined contexts or antecedent conditions (e.g., group work in math, didactic reading instruction, attention deprivation). In a structural analysis, data are collected when those contexts are in place and not when they are absent; however, specific directives for delivery of antecedent variables such as the

frequency of prompts are not provided, and contingency manipulations are not programmed. Multiple observations are conducted in each condition, often within an alternating treatments design. Data are collected on the occurrence of problem behavior and environmental variables—typically scored independently of one another. Because stimuli are not manipulated systematically, a structural analysis is considered non-experimental.

Experimental FBA Experimental methods of FBA were those that included two or more conditions within which one or more environmental variables were manipulated in a systematic manner. Models of FBA are included, and their descriptions are in Table 1. We first categorized experimental methods as either ABC or AB functional analyses, based on whether consequences were manipulated in the assessment. Next, for ABC analyses, we coded variations in the model (brief, latency, precursor, and trial-based functional analyses; see Table 1 for definitions) and then differentiated between those using the model first described by Iwata et al. (1982/1994)—referred to throughout as “standard” and those that were individualized. “Standard” functional analysis was scored when study authors indicated the functional analysis conditions were conducted as described by Iwata et al. (see Betz and Fisher 2011 for an in-depth discussion of experimental conditions). In FBAs coded as standardized, little or no additional information was provided regarding stimuli used in the various conditions (e.g., what the individual was prompted to do in the demand condition). For example, Berg et al. (2007) provided the following description of the standard ABC functional analysis used in their study, “Functional analyses (Iwata et al. 1982/1994) included tests for attention, escape, tangible...and ignore and a control condition. All sessions lasted 5 min, and no more than two sessions of one condition were conducted during each day’s assessment” (p 547). In contrast, “individualized” functional analyses incorporated test conditions and/or stimulus materials that were described in detail and were idiographic. For example, Preciado, Horner, and Baker (2008) conducted test conditions for social-positive (attention) and social-negative (escape) reinforcements; however, the putative establishing operations in each condition were reading assignments at the participant’s frustrational level versus those at the participant’s mastery level—reading level was assigned based on participant’s scores on a norm-referenced reading fluency measure.

Operant Function by Diagnosis, Topography, and Antecedent Variables

We used the study author’s descriptions of antecedent and consequent variables to classify putative establishing operations and reinforcers. For antecedent variables, we used the following categories: attention deprivation, demand, tangible removed, alone, and undifferentiated (demand included seven cases in which transitions were identified as a putative establishing operation in descriptive FBA). The following consequent variables were used based on author’s descriptions: attention, escape, tangible, sensory, undifferentiated, and multiple. In the majority of cases (there were eight exceptions across four studies), authors identified “sensory” (also automatic

Table 1 Types of experimental functional analyses used

Model	Description	Number of studies	Number of cases
<i>AB functional analysis</i>			
	Two or more test conditions manipulating only putative establishing operations or discriminative stimuli	31	70
<i>ABC functional analysis</i>			
	Multiple observations per test condition		
	Three or more observations conducted per test condition		
	Individualized	39	81
	Standard	73	202
<i>Brief functional analysis</i>			
	One observation per test condition followed by a contingency reversal in the condition(s) in which elevated responding occurred and then a return to the test condition(s)		
	Individualized	7	18
	Standard	4	15
<i>Latency functional analysis</i>			
	Test conditions continue until problem behavior or a set time (e.g., 5 min) is reached		
	Standard	1	1
<i>Precursor functional analysis</i>			
	Responses hypothesized to reliably precede problem behavior serve as the dependent variables		
	Standard	4	11
<i>Trial-based functional analysis</i>			
	Test conditions are presented as trials consisting of 1-min segments in which (a) the putative establishing operation is absent—control, and (b) the putative establishing operation and reinforcer for problem behavior are present—test		
	Standard	5	18

Conditions in individualized analyses were those in which stimuli and/or contextual variables were designed for a given participant, whereas conditions in standard analyses were modeled after the conditions described by Iwata et al. (1982/1994). The later often are referred to as an analog functional analysis

or nonsocial) as the hypothesized function when responding was differentially elevated in an alone condition or verified via an extended alone/control comparison. Authors labeled outcomes as undifferentiated when response patterns did not differ across conditions. In the eight exceptions to this, authors labeled undifferentiated outcomes as indicative of an automatic reinforcing function. Attention included peer and adult attention, and escape included the two cases of experimental analysis in which escape to attention was identified as the function. If an author identified more than one antecedent–consequent relation for a given topography, we counted each outcome separately. For example, if authors suggested that self-injury might be

(a) evoked by attention deprivation and maintained by attention, and (b) evoked by demands and maintained by escape, this was counted as two outcomes. If authors suggested that a given topography was evoked by a single establishing operation (e.g., demands) but maintained by more than one consequence (e.g., attention and escape), this was coded as multiple. We scored “not identified” if the authors did not identify the putative reinforcer.

Inter-Rater Agreement

We evaluated inter-rater agreement by having a second individual independently read and code 26.8 % of articles. We then compared score sheets on an item-by-item basis. For each parameter scored, we divided the number of agreements (same category or subcategory scored) by the sum of agreements plus disagreements and multiplied the result by 100. Agreement on participant characteristics (age, gender, diagnoses, response topographies included in the FBA, use of operational definitions, whether intervention was conducted) was 97.9 % (range 94.7–100 %).

For indirect assessments, mean agreement on type of indirect assessment used and name was 98.7 % (range 92.9–100 %). For direct methods, agreement on parameters of the FBA (type, setting, and who conducted the assessment) was 97.2 % (range 93.3–100 %).

Results and Discussion

We identified a total of 501 published articles using the search criteria described above. Using the inclusion criteria we established, 268 publications were excluded. Thus, a total of 233 articles were included in our review. Across these 233 articles, there were a total of 640 participants. In the review that follows, publication refers to a published article, participant refers to individuals who received an FBA, and case refers to a given FBA. For example, if a participant received two different FBAs, then this would result in two cases. Finally, outcome refers to an environment–behavior relation identified by study authors.

Publication Trends Over Time

Functional behavior assessments conducted in school settings have been published in a total of 50 journals (for a list of journals publishing FBA articles, contact the first author). The first study documenting FBA in schools was published in 1981 and describes an individualized AB functional analysis (Weeks and Gaylord-Ross 1981). The number of school-based FBA publications appearing per year has been increasing somewhat steadily since 1991 (Fig. 1). Prior to 1991, the mean number of publications was 1.0 per year. The mean number of publications per year jumped to 7.3 between 1991 and 2001 and to 11.9 between 2002 and 2013.

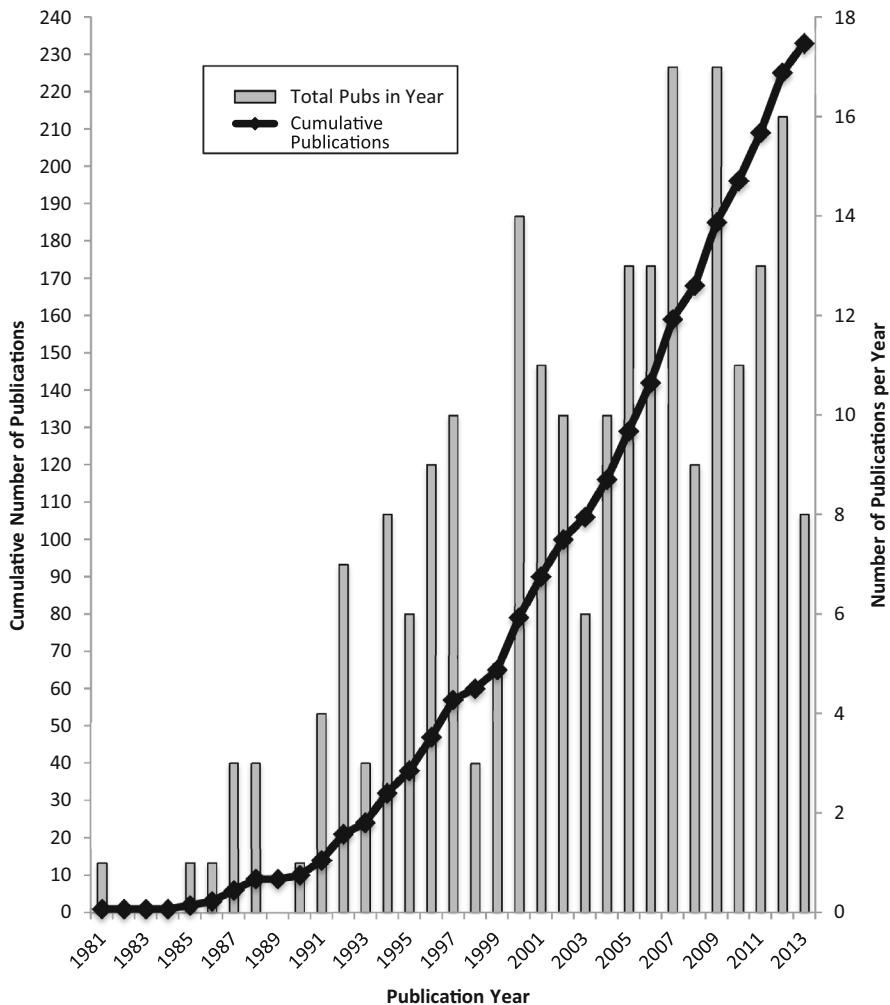


Fig. 1 Cumulative publications over time (*top panel*) and a number of publications including indirect, direct, and experimental methods of FBA (*bottom panel*)

Participants

Participant characteristics are depicted in Table 2. The majority of study participants (68.3 %) were male. Study participants necessarily were 21 years of age or under, and most were in 8th grade or lower (between the ages of 5 and 14). Ninety percent of participants either had no diagnosis or a single diagnosis. Based on primary diagnosis and as shown in Table 2, well over half (63.3 %) of study participants were diagnosed with ASD or some form of intellectual disability. Remaining participants either had no educational or psychiatric diagnosis (14.7 %), had a psychiatric diagnosis (8.0 %), or an educational diagnosis of emotional or behavioral disorder (10.5 %), learning disability (1.9 %), or other health impaired (1.4 %).

Table 2 Participant characteristics

	Number of participants	Percentage of sample
Gender		
Female	128	20.0
Male	437	68.3
Not reported	75	11.7
Age		
Ages 5–7 or kindergarten to 1st grade	169	26.4
Ages 8–10 or 2nd through 4th grades	143	22.3
Ages 11–14 or 5th through 8th grades	198	30.9
Ages 15–18 or 9th through 12th grades	60	9.4
Ages 19 or older	20	3.1
Not reported	50	7.8
Diagnosis or classification		
Intellectual disability	203	31.7
ASD	202	31.6
No diagnosis	94	14.7
Emotional or behavioral disorder	67	10.5
Psychiatric (DSM) diagnosis	51	8.0
Learning disability	12	1.9
Other health impaired or health problem	9	1.4
Not reported	2	0.3

We examined topographies of problem behavior included in FBAs. In our analysis, there were 41 cases of problem behaviors that did not align with our predefined categories (categorized as “other”). Examples included motoric or vocal tics (e.g., Watson et al. 2005), and talking about gang involvement (Penno et al. 2000). Although distinctions were present between individuals with autism or intellectual disability and other participants, distinctions *within* those groups were fairly minimal. Thus, we collapsed all cases into one of two groups: individuals with autism or intellectual disability, and individuals without autism or intellectual disability, which we termed “typically functioning” (the complete data set is available from the first author). Results of this analysis are depicted in Fig. 2, which depicts topographies included for 10 or more participants. Some topographies were more likely to be included in FBAs for students with autism or intellectual disability. These included self-injury, elopement, stereotypy, physical aggression, tantrums, or inappropriate vocalizations. For example, self-injury was included in the FBA for 174 participants. Of those, 93.7 % were individuals with autism or intellectual disability. In contrast, talking out of turn, defiance or verbal aggression, off-task, out of seat, and “problem behavior” were most frequently targeted for typically developing students.

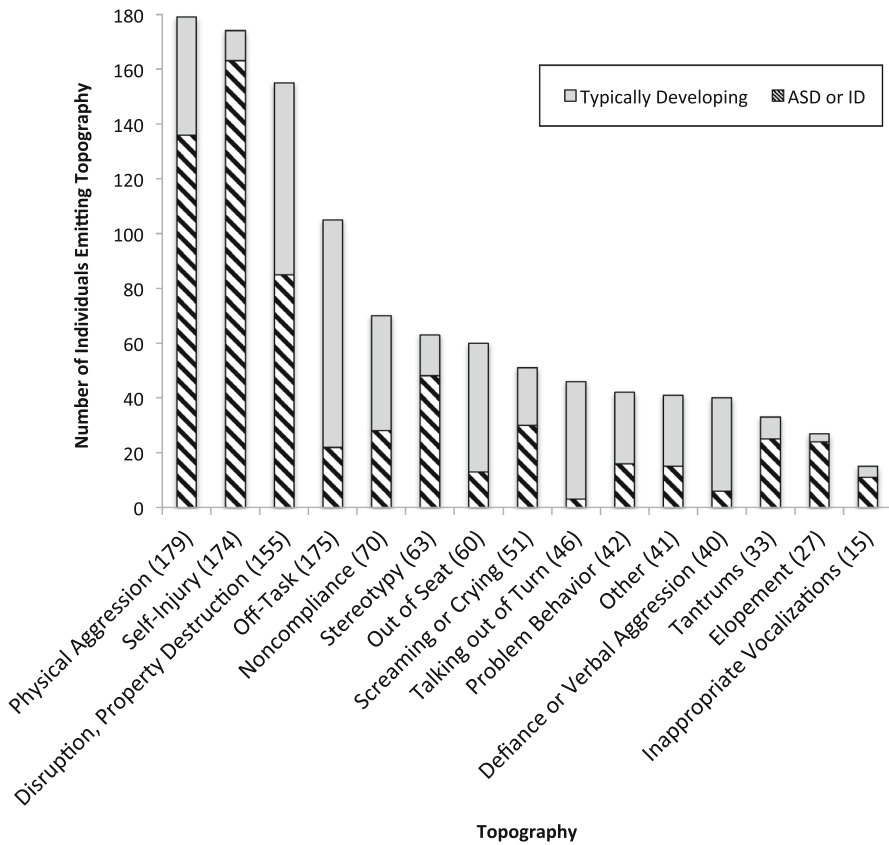


Fig. 2 Number of cases in which a given topography was included for individuals with autism or intellectual disability versus typically developing individuals. Total number of cases in which a given topography was identified is shown in parentheses. This figure includes only topographies included in an FBA for 10 or more participants

Functional Behavior Assessment Used

Of publications reviewed, 56.7 % included an indirect analysis, 49.4 % included non-experimental methods of observation (descriptive assessment, structural analysis, scatter plot), and 63.1 % included experimental analysis. A majority (56.7 %) of publications ($n = 132$) reported more than one type of FBA. Only eight publications (3.4 %) included indirect assessment as the sole FBA data source; 16 (6.9 %) included only non-experimental methods of observation; and 77 (33.0 %) included only experimental analyses. Of the 115 publications reporting descriptive FBA, 92 (80.0 %) reported that an indirect assessment preceded the descriptive assessment. Fifty-nine (40.1 %) of the 147 publications using functional analyses reported a preceding indirect FBA, and 38 publications (25.9 %) reported a preceding descriptive FBA. Although we did not code the order in which multiple assessments were conducted, we noted that, in virtually all cases, less rigorous

methods preceded more intensive methods. For example, interviews always preceded descriptive or experimental analyses, and descriptive analyses always preceded experimental analyses.

Indirect Methods of Functional Behavior Assessment

Table 3 depicts the indirect assessments used (citations for indirect assessments are in the “Appendix”). Indirect methods of FBA were reported in a total of 132 publications (56.7 %). Durand and Crimmins published the first article describing indirect FBA in 1988, describing the Motivation Assessment Scale. The Functional Assessment Interview Form (O’Neill et al. 1997) is the most frequently reported indirect FBA, appearing in 34.1 % of studies reporting an indirect assessment. The Motivation Assessment Scale (Durand & Crimmins 1988) was the most frequently used rating scale, reported in 14.4 % of studies reporting indirect assessment. In the vast majority of cases, interviews were administered to teachers; students were interviewed in 22 cases (16.6 %).

Prior to 1999, indirect FBA was documented only occasionally in published studies, averaging 2.1 publications per year between 1988 and 1998. Indirect FBA

Table 3 Indirect analyses reported

Indirect assessment	Number of publications	Percentage of publications reporting indirect FBA	Percentage of total sample
Interview		<i>n</i> = 132	<i>n</i> = 233
Functional assessment interview form	45	34.1	19.3
Preliminary functional assessment survey	22	16.7	9.4
Student-assisted functional assessment	15	11.4	6.4
Functional assessment checklist for teachers and staff (FACTS)	9	6.8	3.9
Student-guided functional analysis interview form	7	5.3	3.0
Functional assessment and intervention system	1	0.8	0.4
Functional assessment informant record for teachers	1	0.8	0.4
Problem identification interview	1	0.8	0.4
Setting event identification interview	1	0.8	0.4
Teacher functional behavior assessment checklist	1	0.8	0.4
Rating scale			
Motivation assessment scale	19	14.4	8.2
Problem behavior questionnaire	6	4.5	2.6
Functional assessment screening tool (FAST)	5	3.8	2.1
Questions about behavioral function	2	1.5	0.9
Aberrant behavior checklist	1	0.8	0.4

Percentages do not equal 100 % because many studies used more than one measure, and many studies did not use any indirect measures

has become more prevalent over the years; however between 1999 and 2013, an average of 7.3 publications per year have included indirect FBA (a 71 % increase).

Direct Methods of Functional Behavior Assessment

Direct methods of FBA (descriptive FBA and functional analysis) were reported in 222 publications across a total of 716 cases. Of the 115 publications in which a descriptive FBA was used, 88.7 % included ABC recording, 13.9 % a structural analysis, and 5.0 % a scatter plot. Across these 115 publications, there were 300 cases in which a direct method of FBA was used. Trends for descriptive methods of FBA are depicted in the middle panel of Fig. 3. The first descriptive assessment was reported in 1987 (Durand and Crimmins 1987). Between 1987 and 1998, descriptive FBA appeared in an average of 1.8 publications per year; this increased to 6.2 per year between 1999 and 2013, a 70 % increase.

Functional analysis accounted for the majority of publications reporting FBA (reported in 147 publications, 63.1 %). The number of publications reporting a given type of functional analysis as well as the number of cases receiving that type of FBA is reported in Table 1. Trends across time are depicted in the bottom panel of Fig. 3. An average of 2.7 publications per year included functional analysis between 1981 and 1998; between 1999 and 2013, there were an average of 6.5 publications per year (58 % increase).

Trends across time for different methods of functional analysis are depicted in Fig. 4. The AB variation (top panel) appeared in the literature 26 times between 1981 and 1999 (an average of 1.4 publications per year); therefore, this variation has been reported only sporadically, once in 2003, 2004, 2006, and 2007. Publications reporting AB functional analysis account for 21.1 % of all functional analysis publications.

ABC functional analyses accounted for 82.3 % of publications reporting functional analysis. Of ABC analyses, the most frequently reported method was the standard, functional analysis (second panel), accounting for 60.3 % of publications with ABC analyses. First reported in Day et al. (1988), this method was reported only occasionally until 1996; in this time span, there were a total of seven publications (mean of 1 per year). Between 1997 and 2013, however, there have been 62 publications reporting standard ABC analyses, an average of 3.9 per year.

Individualized ABC analyses accounted for the second largest proportion of publications with ABC analyses, 32.2 % (third panel). The first individualized analysis was published by Mace and Knight (1986). Between 1986 and 1997, there was an average of one publication per year, and between 1998 and 2013, this increased slightly to two publications per year. Use of individualized analysis has been variable over time; in some years, multiple publications have appeared and in other years, there have been none or a single publication. There is no clear trend in the use of individualized procedures.

Variations in standard ABC analysis (Fig. 4, bottom panel) include the brief (accounting for 6.1 % of variations), latency (0.8 %), precursor (3.3 %), and trial-based analyses (4.1 %). Northup et al. (1994) published the first article describing a

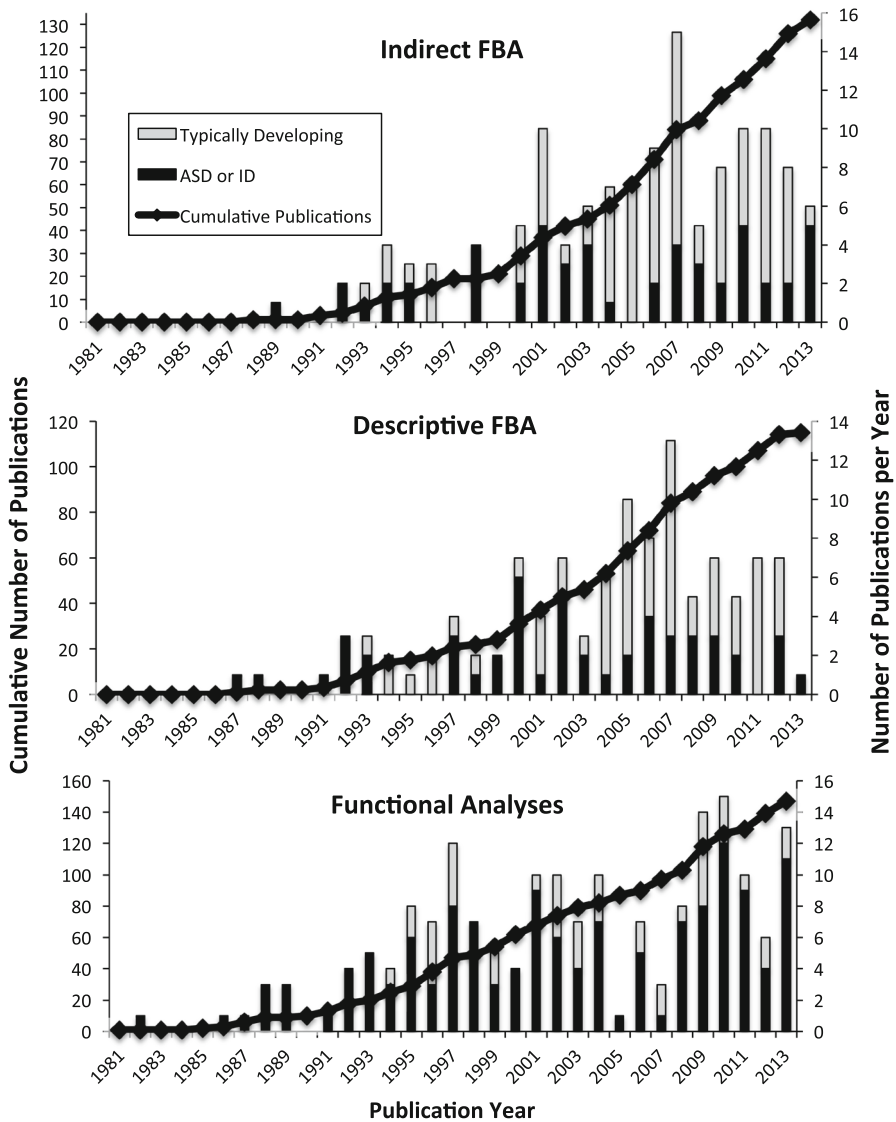


Fig. 3 Cumulative publications over time (line) and publications per year (bar) reporting indirect FBA (top panel), descriptive FBA (middle panel), and functional analyses (bottom panel). Instances in which a publication included typically developing participants and participants with autism or intellectual disability were coded twice; there were two, four, and 11 such publications for indirect, descriptive, and experimental FBA, respectively

variation on ABC analysis in 1994, reporting the results of a brief functional analysis. As shown in the bottom panel of Fig. 4, variations were published only occasionally prior to 2008 (mean .6 times per year between 1994 and 2008) but have been appearing more steadily since that time, published 12 times between 2008 and 2013 (mean 2.4 times per year).

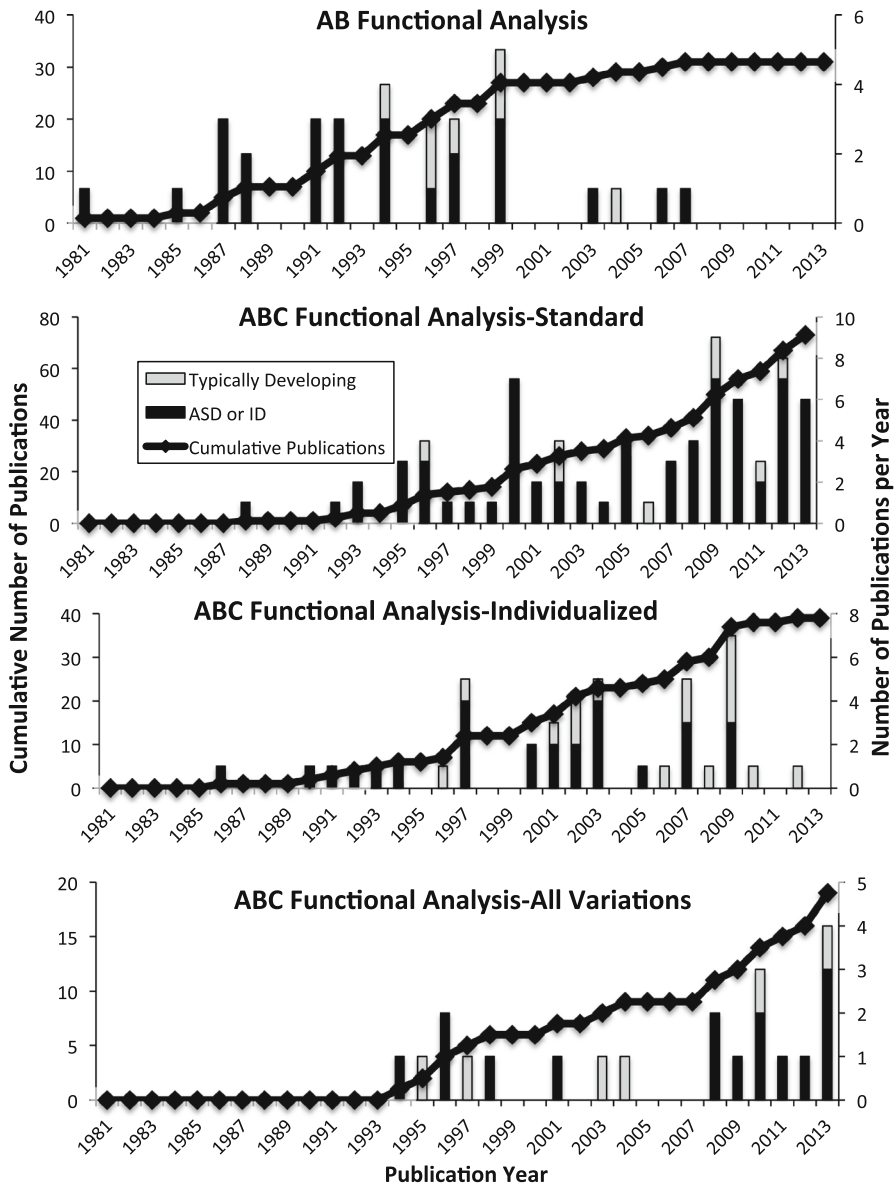


Fig. 4 Cumulative publications over time (line) and publications per year (bar) reporting ABC individualized (top panel), standard (second panel), individualized (third panel), and variations on ABC standard (bottom panel). Instances in which a publication included typically developing participants and participants with autism or intellectual disability were coded twice; there were seven instances for standard ABC functional analysis and one instance for combined, a trial-based functional analysis

Setting of FBA Figure 5 depicts the setting in which FBAs were conducted. The setting in which the FBA was conducted varied depending on the type of FBA. As shown in the top panel of Fig. 5, descriptive FBAs were more likely to be conducted

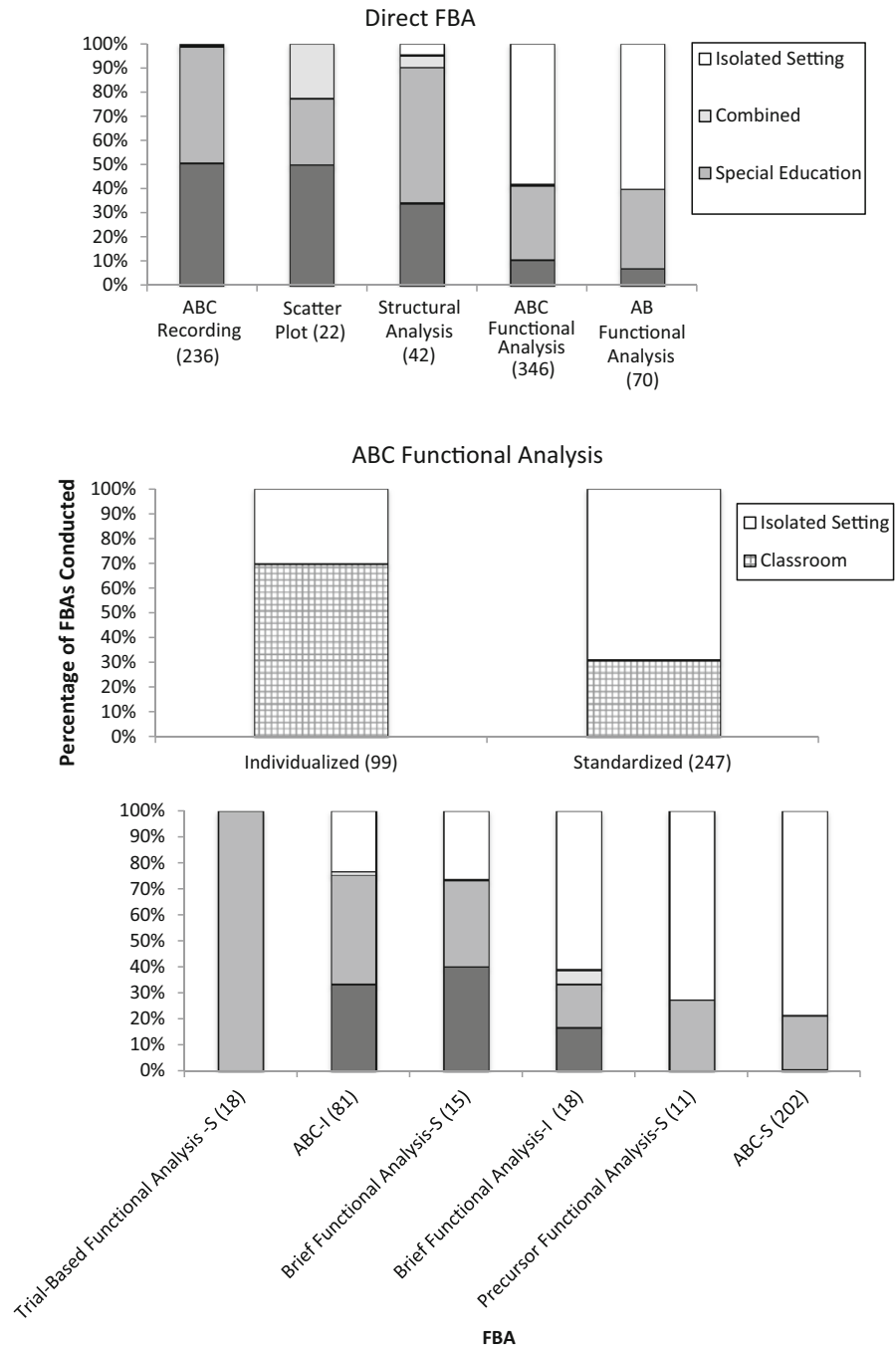


Fig. 5 Setting of FBA. I—individualized and S—standardized. The number in parentheses indicates the number of cases with which various types of FBA was conducted. The top panel depicts the setting of all direct methods of FBA. The middle panel depicts experimental analyses, and the bottom panel shows variations in ABC analyses

in classroom settings—general education, special education, or combined, than were experimental methods. All of the ABC recordings and scatter plots and 95.2 % of structural analyses were conducted in classrooms. In contrast, under half of functional analyses, 42.2 % of ABC functional analyses and 40 % of AB functional analyses were conducted in classrooms.

We examined the use of ABC functional analysis across settings. The middle panel of Fig. 5 depicts the setting in which individualized and standard ABC functional analyses were conducted. The majority of individualized analyses, 69.7 %, were conducted in classrooms, but less than half (30.8 %) of standard functional analyses were conducted in classrooms. The bottom panel of Fig. 5 examines settings in which each type of ABC functional analysis was conducted.¹ The trial-based functional analysis was designed for use specifically in classrooms (Sigafoos and Sagers 1995). As such, it is unsurprising that 100 % of analyses were conducted in classrooms, all of which were special education. Over half of individualized ABC analyses (76.5 %) and standard brief analyses (73.3 %) were conducted in classrooms. In contrast, the majority (78.2 %) of standard functional analyses were conducted in classrooms, and this was true as well of those analyses that targeted precursor responses (72.7 %). Less than half (38.9 %) of individualized brief functional analyses were conducted in classrooms.

Individual(s) Conducting FBA Across methods of FBA, researchers always directed the conduct of the FBA—selecting the type of FBA to be conducted, how many observations to be conducted, analyzing the data, etc. Teachers or other school personnel collected data during 24.7 % of all ABC recordings and just under half (45.5 %) of scatter plots, whereas researchers collected data on 100 % of the structural analyses and the experimental methods of functional analyses.

Figure 6 depicts who worked with the student when the FBA was being conducted. As shown in the top panel, teachers worked with students during the vast majority of descriptive assessments: 100 % of ABC recording and scatter plots and 92.9 % of structural analyses. In contrast, researchers were more likely to work with students during experimental analyses; 70.0 % of AB functional analyses and 75.7 % of ABC functional analyses were conducted with researchers interacting with participants during experimental conditions. There was some variation in who worked with participants during experimental conditions across the various types of experimental ABC analyses (Fig. 6, bottom panel), although clear patterns were not evident.

Participant Diagnosis and Type of FBA Descriptive FBAs were more likely to be conducted with typically developing individuals; 77.3, 61.4, and 59.5 % of scatter plots, descriptive analyses, and structural analyses, respectively, were conducted with typically developing students (top panel, Fig. 7). In contrast, experimental analyses were more likely to be conducted with students with autism or intellectual

¹ The latency functional analysis variation reported by Davis et al. (2013) was used with only a single participant, an 8-year-old boy with intellectual disability, and is not included—this analysis was conducted in an empty classroom.

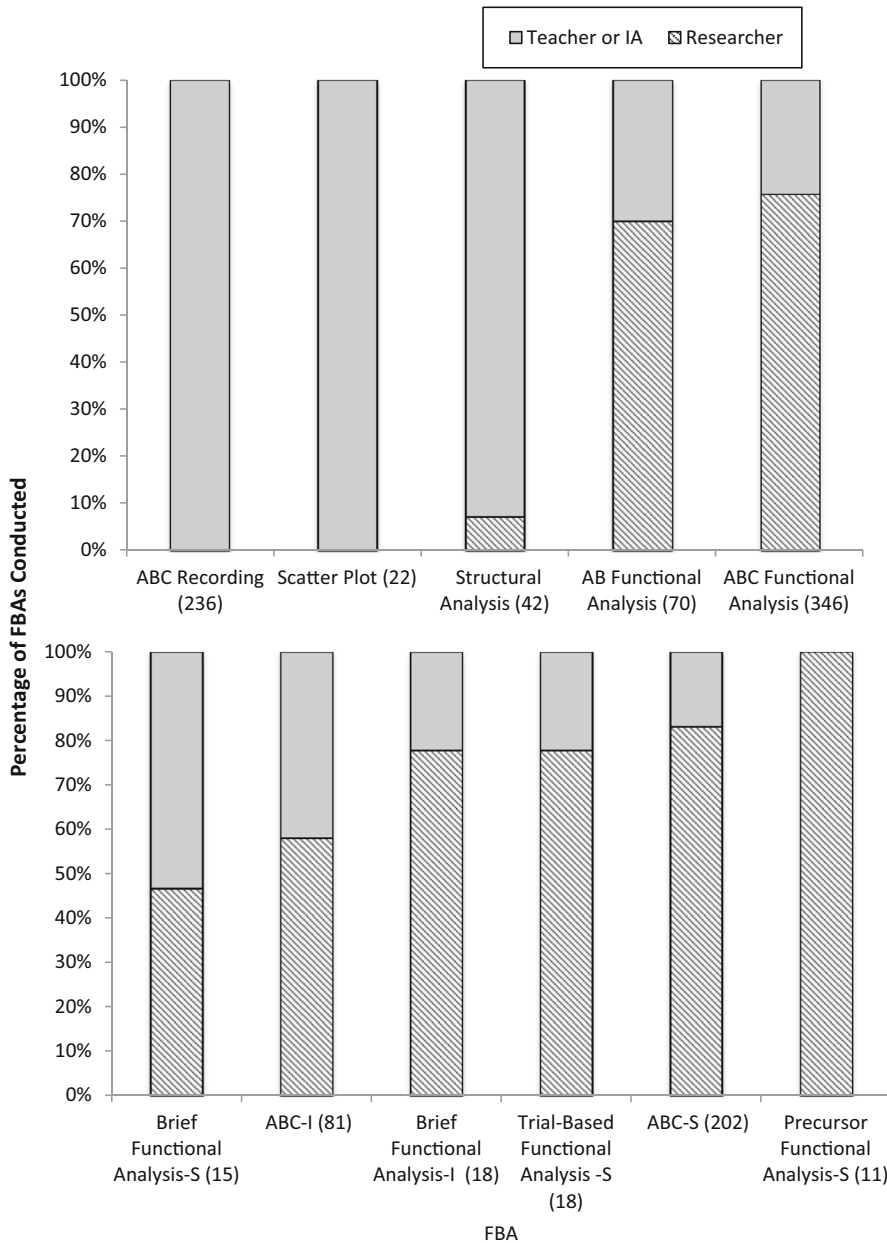


Fig. 6 Who interacted with the student during the FBA. The *number in parentheses* indicates the number of cases with which various types of FBA was conducted. The *top panel* depicts all direct FBAs, and the *bottom panel* focuses on variations in ABC analysis

disability; only 20.8 % of students who participated in ABC functional analyses and 21.4 % of those participated in an AB functional analysis were typically developing.

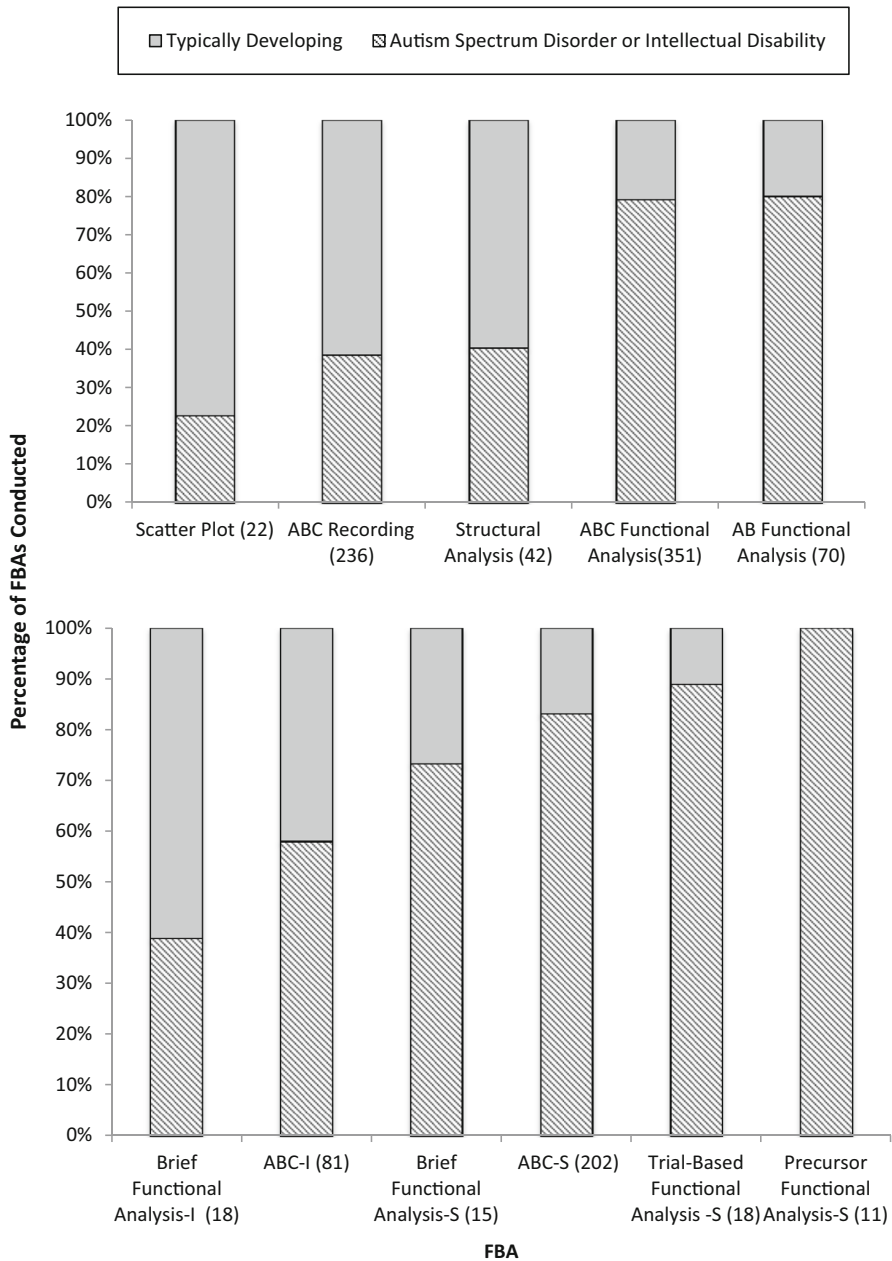


Fig. 7 Relation between disability and type of FBA conducted. The *number in parentheses* indicates the number of cases with which various types of FBA was conducted. The *top panel* depicts all direct methods of FBA, and the *bottom panel* depicts variations in ABC functional analysis

The bottom panel of Fig. 7 depicts variations in ABC functional analysis. Of experimental ABC methods, only the individualized brief functional analysis was more often conducted with typically developing students. Standardized assessments were more often conducted with students with disabilities. Typically developing students accounted for 26.7, 16.8, 11.1, and 0 %, respectively, of participants for whom a standard brief, multi-observation, trial-based, or precursor functional analysis was conducted.

We examined whether the types of FBA used with participants who were typically developing versus those with autism or intellectual disability varied over time (Fig. 3). Prior to 1993, all study participants had a diagnosis of autism or intellectual disability. In 1993, Dunlap et al. reported the results of indirect FBA and structural analysis with five children diagnosed with emotional or behavioral disorder. Indirect FBA is used more often with typically developing students; 58.3 % of publications of indirect FBA included typically developing students, and this trend has become more pronounced since 2000. A similar pattern is evident with descriptive assessment. In the 20-year span between 1993 and 2013, there were only 8 years in which more descriptive assessments were reported with students with autism or intellectual disability than for typically developing students.

Functional analyses (bottom panel, Fig. 3) have been conducted predominately with students with autism or intellectual disability, and this trend has remained constant over time. There have been only two years, 2004 and 2006, when experimental analyses were reported more often with typically developing children (the same number of publications [4] was reported for each group in 2002) than with typically developing students. Further, although the mean number of publications per year for children with autism or intellectual disability has increased over the years (average of 1.3 between 1981 and 1991, 5.3 between 1992 and 2002, and 6.9 between 2003 and 2013), the number of publications for typically developing children has remained fairly constant (1.6 publications between 1992 and 2002, and 2.3 between 2003 and 2013). There were no publications with typically developing children prior to 1994.

In general, this pattern remains across types of functional analyses (Fig. 4). AB functional analyses (top panel) have been used about equally often with both populations since 1994. Although the use of AB functional analyses with typically developing students has remained fairly constant, this method tends to be used more with students with disabilities, and this has not changed over time. The vast majority of publications using standard ABC functional analysis focus on students with autism or intellectual disability—since 2002, there have been only seven publications reporting results for typically developing students. Variations in this methodology began appearing in the literature in 1994. Since that time, there have been 15 publications with students with autism or intellectual disability and six with typically developing students.

Direct FBA: Environment–Behavior Relations

We examined hypotheses derived regarding the relation between problem behavior, its antecedents, and its consequences. Relations were examined by topography, by

identified establishing operation, and by disability. We were not able to analyze indirect FBA data in this way as hypothesis statements were reported only infrequently.

Topography and Possible Reinforcement Function

Differentiated results (excluding the 12.3 % of functional analyses and 37.7 % of descriptive FBA for which results were not reported) were reported for 86.9 % of functional analyses and 95.1 % of descriptive FBA. Table 4 depicts the operant function identified by publication authors and analyzed across topographies. For functional analysis, social-negative reinforcement was the identified reinforcer for the majority of cases in functional analyses, accounting for 33.3 % of topographies; social-positive reinforcement (attention) was identified second most often, accounting for 18.8 % of topographies. This finding was flipped for descriptive FBA; social-positive reinforcement accounted for the majority of topographies (35.9 %), and social-negative reinforcement accounted for 25.6 % of topographies. Problem behavior was hypothesized to be maintained by more than one reinforcer for only 7.7 % of topographies in functional analysis, whereas 14.6 % of topographies were hypothesized to be maintained by multiple reinforcers in descriptive FBA. Study authors generally analyzed operant function across topographies of problem behavior. For example, self-injury might consist of head banging and hand biting. Of the 416 cases of functional analysis and 300 cases of descriptive FBA, a single topography was the focus of the analysis in 77 (18.5 %) and 22 (7.3 %) of cases, respectively. There were 22 cases of functional analysis and eight descriptive assessment cases in which multiple topographies were analyzed separately to determine function. Thus, there were 99 cases of functional analysis (23.7 %) and 30 descriptive FBA cases (10 %) in which operant function was analyzed separately for identified topographies. As multiple response topographies were analyzed together in the majority of FBAs, it is difficult to draw conclusions regarding the relation between a specific topography and operant function.

Establishing Operation and Function

Figure 8 shows the relation between identified establishing operations and operant function for descriptive FBA and functional analysis. Results were not reported for 52 cases of descriptive FBA and 14 cases of experimental FBA, and those data are omitted. Further, there were 133 hypothesized environment–behavior relations derived from descriptive FBA cases (45 %) that were not categorized, as the putative establishing operation did not fit into one of the defined categories. Some examples include being alone in a room ($n = 2$), completed work and at desk ($n = 1$), free choice time with peers ($n = 1$), loud cafeteria ($n = 1$), and low noise ($n = 1$). There were 392 antecedent–behavior–consequent relation outcomes identified for functional analyses and 212 for descriptive FBA.

Patterns of antecedent–consequent relations were similar across the two types of FBA. When attention deprivation was the identified establishing operation, attention was the presumed (descriptive) or identified reinforcer in the vast majority of environment–behavior relations across assessment types. For functional analysis, in

Table 4 Functional analysis outcome summary

Topography	Social negative	Social-positive attention	Social-positive tangible	Automatic	Undifferentiated	Multiple	Little/no response	Not identified
Bizarre vocalizations	0 (0)	1 (0)	0 (0)	0 (1)	0 (0)	1 (0)	0 (0)	1 (1)
Defiance or verbal aggression	0 (1)	1 (1)	3 (0)	0 (0)	0 (0)	0 (3)	1 (0)	0 (3)
Disruption/property destruction	10 (5)	4 (10)	3 (0)	0 (0)	1 (0)	1 (2)	0 (0)	1 (4)
Elopement	0 (0)	2 (1)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Inappropriate vocalizations	5 (0)	3 (0)	0 (0)	1 (0)	2 (0)	2 (0)	1 (0)	0 (0)
Inappropriate sexual behavior	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)
Non-compliance	5 (0)	2 (6)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0)	0 (3)
Off-task	4 (14)	6 (11)	0 (0)	0 (0)	0 (1)	0 (2)	0 (0)	4 (13)
Other	3 (3)	8 (9)	0 (0)	1 (0)	2 (1)	0 (4)	3 (0)	0 (13)
Out of seat	1 (3)	1 (9)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)
Perseverative speech	1 (0)	1 (0)	1 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)
Physical aggression	37 (12)	15 (11)	11 (2)	0 (0)	0 (1)	2 (5)	2 (0)	5 (6)
Problem behavior	72 (22)	37 (26)	13 (6)	7 (0)	13 (6)	16 (20)	5 (1)	33 (48)
Screaming or crying	2 (0)	1 (3)	2 (0)	0 (0)	2 (0)	0 (0)	0 (0)	0 (0)
SIB	22 (9)	6 (5)	5 (1)	10 (3)	9 (4)	7 (2)	4 (0)	7 (12)
Stereotypy	1 (1)	0 (0)	0 (0)	14 (3)	10 (0)	8 (0)	0 (0)	6 (0)
Talking out of turn	1 (0)	5 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)
Tantrums	1 (2)	0 (3)	2 (0)	0 (0)	0 (0)	0 (2)	0 (0)	3 (1)
Total number	165 (69)	93 (101)	41 (9)	33 (7)	41 (13)	38 (41)	18 (1)	61 (106)
Percentage of sample	33.3 (25.6)	18.8 (35.9)	8.3 (3.2)	6.7 (2.6)	8.3 (4.6)	7.7 (14.6)	3.6 (4)	12.3 (37.7)

Numbers outside of parentheses are from functional analyses. Numbers within parentheses are from descriptive FBA

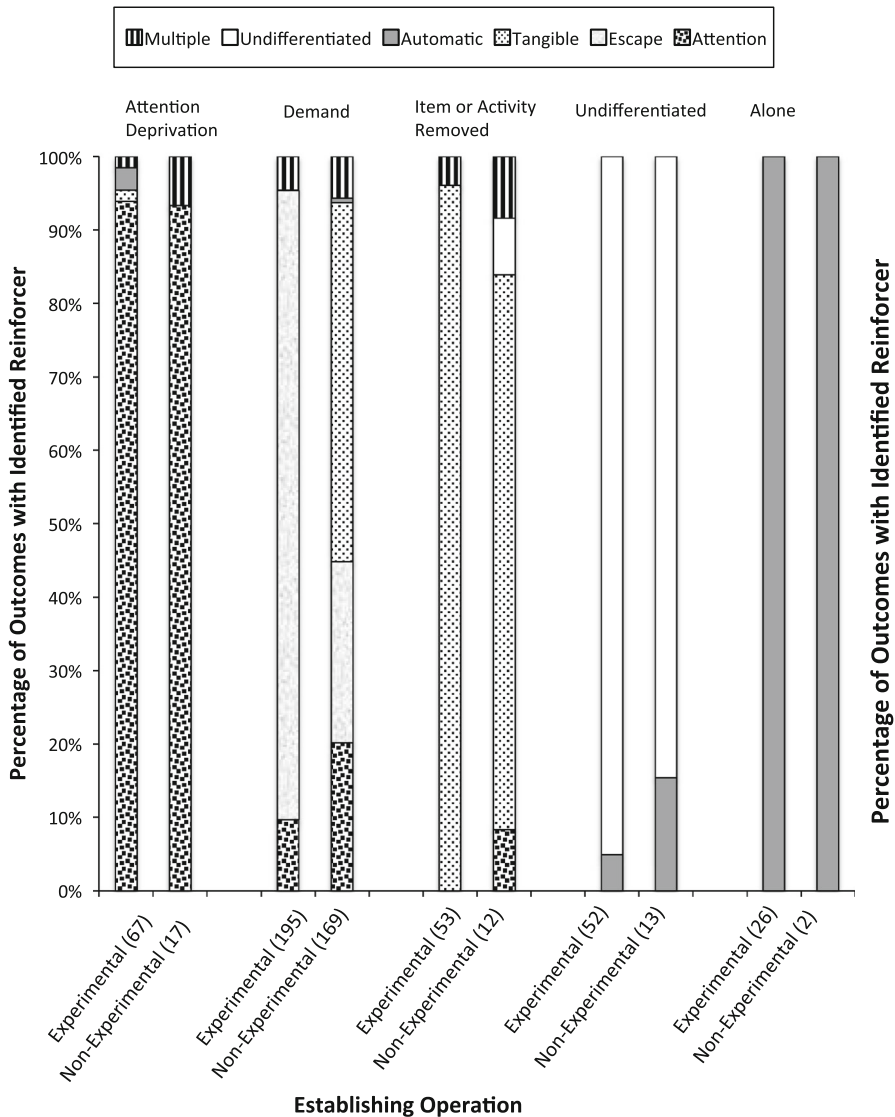


Fig. 8 Percentage of outcomes with an identified reinforcer for each identified establishing operation. The number in parentheses indicates the number of outcomes

the presence of demands, escape was the identified reinforcer in the majority of outcomes. In the 19 (9.7 %) of outcomes in which demands were the establishing operation and attention was the identified reinforcer, the functional analysis was individualized such that the test condition was some sort of instructional context and the delivered consequence was a form of adult attention. For example, Banda and Sokolosky (2012) conducted test conditions for escape and attention during independent spelling (a task during which the participant frequently emitted

problem behavior). Both conditions included identical antecedent demands. However, the task was terminated for 30 s upon on problem behavior in the test for escape, whereas the teacher provided brief verbal redirections (e.g., “talk quietly”) following problem behavior in the test for attention. In descriptive assessment, when demands were identified as the establishing operation, attention was the identified reinforcer in 39.6 % of outcomes in descriptive assessment.

Across assessments, removal of preferred activities or items was hypothesized to establish the return of those activities as reinforcing in the majority of outcomes (96.1 % of functional analysis and 81.8 % of descriptive FBA outcomes). There were only 12 descriptive FBA outcomes for which tangible removal was the putative establishing operation; of those outcomes, attention was identified as a reinforcer once in a structural analysis conducted by Anderson and Long (2002). In this assessment, the authors documented that, when a preferred activity ended, caregivers responded to problem behavior by providing attention; the preferred activity was never returned following problem behavior.

Diagnosis and Function

Finally, we examined the relation between diagnosis and operant function across descriptive FBA and functional analysis. These results are shown in Fig. 9. Excluded here are cases for which no function was identified by the authors. The top panel depicts results from functional analyses across 389 outcomes for students with autism or intellectual disability and 100 outcomes for typically developing students. For students with autism or intellectual disability, escape was identified as the reinforcer for problem behavior in the majority of cases (31.6 %), whereas escape and attention were identified about equally often for typically developing children in 35.0 and 42 % of outcomes, respectively. Patterns were less clear in descriptive assessment (bottom panel), in part because the majority of outcomes for students with autism or intellectual disabilities were not identified (37.7 %). For typically developing students, attention was identified in the majority of outcomes (33.8 %). However, 27.3 % of outcomes were not identified by authors.

General Discussion

We analyzed publication trends in school-based FBA through 2013 to learn more about the types of FBA reported in this literature, the population with which various methods of FBA were conducted, and the parameters of those FBAs. Indirect assessments were reported in well over half of publications (56.7 %), and descriptive FBA was used less often, in 49.3 % of publications. Publications including functional analysis made up the majority, 63.1 % of publications. This review identified a number of interesting patterns and trends, some of which align with prior reviews and others of which either were not previously identified or differ in some way. These include (a) methods of FBA used to document operant function, (b) topographies included in the FBA, (c) operant function identified, and (d) relation between the type of FBA conducted and environment and participant characteristics.

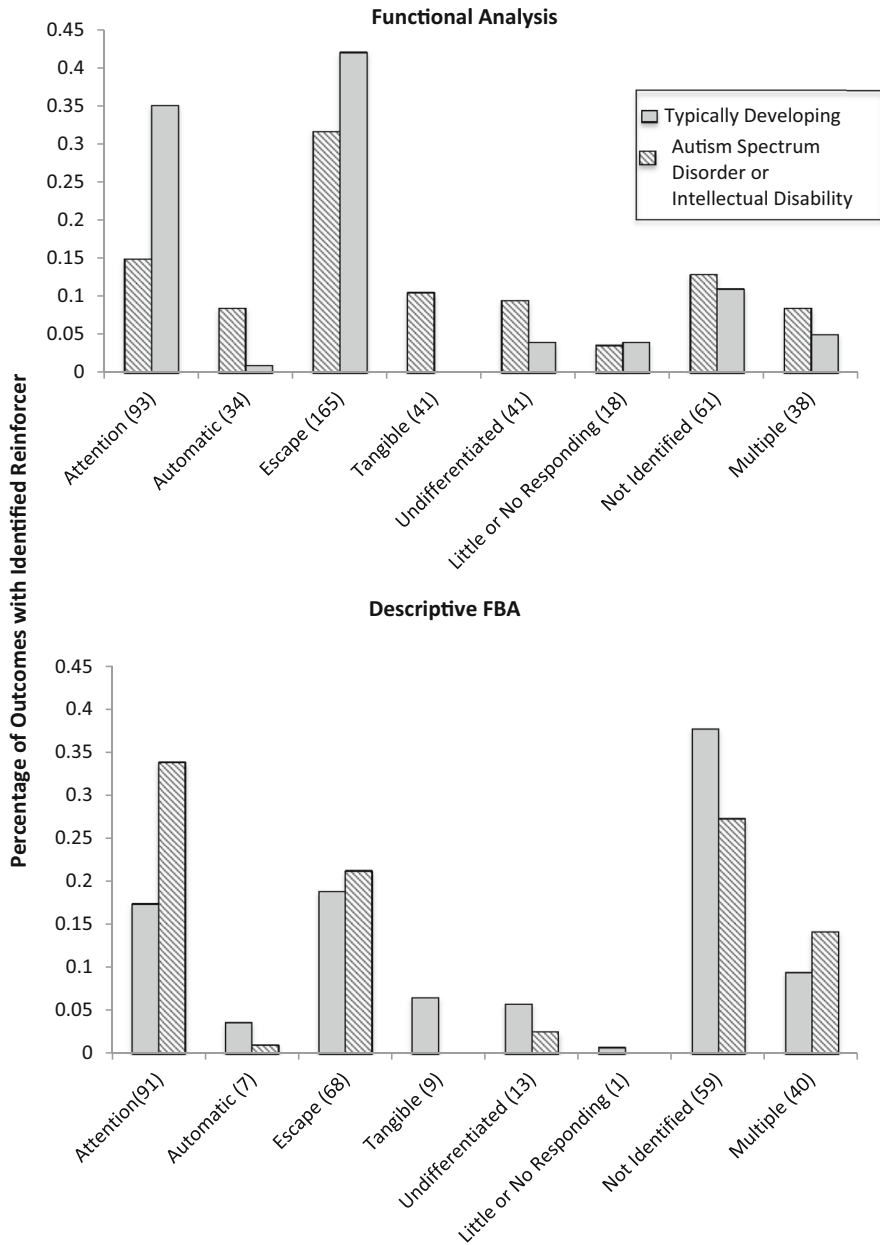


Fig. 9 Percentage of outcomes for which a given function was obtained. If more than one function was obtained with a participant, it was counted as two cases. The number in parentheses indicates the number of outcomes with a given function

Methods of FBA Used

The majority of cases in this review participated in more than one type of FBA, with indirect methods used alone in only a small minority of cases. The vast majority of descriptive assessments (80 %) were preceded by an indirect FBA. Ervin et al. (2001) did not report information regarding the use of multiple assessments, so it is not clear whether this has changed over time. In our review, 40.1 % of publications reporting functional analysis also reported results of an indirect FBA and 25.9 % reported results of a descriptive FBA. These percentages are markedly higher than those reported by Beavers et al. (2013). Beavers et al., building off the initial review by Hanley et al. (2003), reported that 10.1 % of studies reporting functional analysis also used an indirect assessment and 14.3 % used a descriptive FBA. Our findings suggest that school-based researchers find some value in non-experimental methods of FBA, perhaps to operationally define problem behavior or identify variables to be included in more rigorous methods of FBA. We did not analyze the order with which assessments were conducted or the rationale given for each assessment but we noted anecdotally that indirect methods tended to precede descriptive FBA and that descriptive FBA tended to precede functional analysis. When multiple functional analyses were conducted, follow-up analyses tended to be designed to clarify the results of initial analyses that were ambiguous. The use of multiple methods of FBA, particularly using indirect or descriptive methods to guide the conduct of functional analysis, follows recent recommendations for best practice (e.g., Anderson and St. Peter 2013; Hanley 2012; Mueller et al. 2011).

Given the frequently described difficulties in conducting a standard functional analysis in schools (e.g., Blood and Neel 2007; Ervin et al. 2001; McKenney et al. 2013), we were somewhat surprised to see that individualized methods of FBA were not used more often. In individualized FBA, conditions are designed to mimic the situations a student typically experiences. It thus seems plausible to design conditions to be conducted within the classroom context with a minimum of disruption. In the standard functional analysis; for example, the programmed consequence in the demand condition is the removal of instructional materials. This is not a consequence we have observed in classrooms; more typical consequences and ones that could be tested easily within an individualized analysis are withholding prompting for some period of time (e.g., Kamps et al. 2006), providing attention or assistance for a set period of time (e.g., Sprague and Horner 1992), or manipulating peer attention following problem behavior (e.g., Lewis and Sugai 1996). For example, Kamps et al. (2006) conducted three different test conditions, all in the context of ongoing instruction in a general education classroom. Conditions included contingent teacher attention (restating the classroom rules), contingent escape (telling the student to turn the work in if it was too difficult and providing no additional prompts to work for a set amount of time), and contingent peer attention (peers were taught to look at the student and whisper to her).

Difficulties in conducting standard functional analysis may, in part, explain the recent increase in use of variations in this method. For example, brief functional

analyses can be conducted in a relatively short amount of time, precursor analyses may be conducted without ever occasioning the target problem behavior (an important consideration of the target behavior is dangerous or very disruptive), and trial-based analyses are time-limited and designed to fit the classroom context. More research is needed in examining the utility of individualized functional analyses and variations on functional analysis that may be viable alternatives to standard analysis. As discussed below, such research is particularly needed in classroom settings and with typically developing students.

Topography of Problem Behavior

We included a broad range of categories for problem behavior, with a total of 20 categories. Ervin et al. (2001) included only nine categories of problem behavior, and Beavers et al. (2013) included 13. We included all 13 of the categories used by Beavers et al., adding inappropriate vocalizations, defiance or verbal aggression, inappropriate sexual behavior, off-task, out of seat, perseverative speech, and talking out of turn. All these topographies were more likely to be emitted by typically developing students, and some, in particular off-task, out of seat, and talking out of turn, are relatively unique to the classroom context. We chose to exclude FBAs targeting desired behavior unless the FBA also targeted problem behavior; it is possible that inclusion of those studies might have affected our results.

In our study, there were only a small number of participants (6.4 %) for whom the form of the target behavior was not articulated. In these cases, authors used a generic label such as aberrant or inappropriate behavior. Across methods of FBA however, only 26 % of participants received an FBA focused on a single response or had results analyzed separately for each response. FBAs focused on multiple topographies of problem behavior presume that these topographies serve the same operant function; however, many studies have shown that different topographies of problem behavior can serve different functions, and that the inclusion of multiple topographies can mask the function of responses (e.g., Asmus et al. 2003; Derby et al. 1994; Richman et al. 1999). Although analyzing different topographies separately may require more time, doing so likely will result in a more accurate FBA.

Operant Function of Problem Behavior

We analyzed the relation between topography and function separately for each topography identified by the authors. For example, if an FBA was focused on out of seat and inappropriate vocalizations (e.g., Bessette and Wills 2007), then the environment–behavior relation identified by the authors was recorded separately for each response. This could have skewed results, as some topographies may not have been observed in the FBA. We chose this method of data analysis to remain consistent with the most recent reviews of the literature (Beavers et al. 2013; Hanley et al. 2003).

The majority of FBAs in our review were interpreted by study authors as identifying an operant function—95 % of descriptive FBA and 88 % of functional analyses. These proportions are slightly lower than those reported by Beavers et al. (2013), who reported 94 % differentiated outcomes across their review. It is not clear what accounted for the higher percentage of undifferentiated functional analysis outcomes in our review. Whereas most undifferentiated outcomes in reviews conducted by Beavers et al. and Hanley et al. (2003) were accounted for by self-injury, the majority of undifferentiated outcomes in our review occurred for the generic “problem behavior.” This provides further evidence that more research is needed examining whether different topographies of problem behavior are sensitive to different environment–behavior relations.

In our review, 3 % of outcomes in functional analyses and 14.6 % of outcomes from descriptive FBA were identified as multiply maintained. Ervin et al. (2001) did not report results of FBAs; however, our percentages of multiply maintained outcomes are considerably lower than those reported by Beavers et al. (2013)—who reported that 18.9 % of all functional analysis outcomes indicated that the target response was multiply maintained. This result most likely is due to differing methods of coding data. In our analysis, if authors provided more than one hypothesis statement (antecedent–behavior–consequence relation) for a given topography, we counted each one separately, to better allow analysis of the full environment–behavior relation. In contrast, Hanley et al. (2003) and Beavers et al. appeared to code behavioral function by topography only—thus, a given topography with two different establishing operations and consequences would have been coded as multiple in their analyses—in the current study, we counted these as two separate relations. If we had analyzed data focused on topography only, then 17.5 % of functional analysis outcomes would have been identified as multiply maintained. This value more closely approximates the 18.9 % reported by Beavers and colleagues.

Standard functional analyses often include a test for social-positive reinforcement in the form of access to items or tangibles. Our results, combined with those of other studies, suggest that this condition should be included thoughtfully. Recent reviews by Beavers et al. (2013) and Hanley et al. (2003) document a tangible function for a minority of cases—11 % across reviews—and our findings were similar. For students with autism or intellectual disability, tangible reinforcement was identified as a reinforcer for only 10.9 % of cases in functional analysis and 6.2 % in descriptive FBA. A tangible function was never identified for typically developing students. In a study evaluating the possibility of false-positive outcomes in the tangible condition, Rooker et al. (2011) documented that an arbitrary response (pressing a switch or touching a card) with no prior reinforcement history was sensitive to tangible reinforcement. They went on to document that responses with another history of reinforcement (in this case automatic) would occur at higher rates in a tangible condition in which highly preferred items were made contingent relative to either an alone condition or a tangible condition in which naturally occurring stimuli followed the response. Other studies have documented sensitivity to tangible reinforcement in a functional analysis; yet, a tangible consequence was rare if ever observed to follow problem behavior in descriptive assessments (e.g.,

English and Anderson 2006; Shirley et al. 1999; Galiatsatos and Graff 2003). These data suggest that a tangible condition might not be included in a functional analysis unless there is evidence (from an interview or observation) that tangible positive reinforcement is a real possibility. Further, results obtained by Rooker et al. suggest that if a tangible condition is used, then the stimuli tested should be those that follow problem behavior in the child's school.

Relation Between Type of Assessment and Participant/Environment Characteristics

To our knowledge, no prior studies have examined the relation between setting and type of FBA conducted, participant characteristics and type of FBA conducted, or the type of FBA conducted and who is involved with the FBA. Across methods of FBA, as experimental rigor increased, the proportion of that method of FBA conducted with typically developing students decreased. Thus, although the majority of scatter plots, descriptive analyses, and structural analyses were conducted with typically developing students, only 23.8 % of cases of functional analyses—both ABC and AB models—were conducted with typically developing students. Unfortunately, this has changed little over time; although there is an increasing trend in publications per year of functional analysis for students with autism or intellectual disability, the number of such publications for typically developing students has remained low.

Rigor of FBA is also related to the setting in which the FBA was conducted and who worked with the student during the FBA. Descriptive methods were most likely to be conducted in classrooms and with teachers or other educators, whereas functional analyses were more likely to be conducted in isolated settings and by researchers. This no doubt reflects the difficulty in conducting more rigorous functional analyses—there is a need to precisely control variables, and those working with students must be trained, requiring additional time. Still, if functional analysis is to be used widely in schools, there is a need for research examining (a) the utility of functional analysis with typically developing students, (b) feasibility of conducting functional analysis in classroom settings, and (c) feasibility and value of including teachers in the functional analysis.

In conclusion, it is important to keep in mind that the actual practice of FBA in schools is substantively different than what is reported in the literature. As described earlier, all the FBAs in this review were guided by researchers; when educators guide the conduct of FBA, the methods used as well as the outcomes derived are quite different. Blood and Neel (2007) conducted a review of implementation of FBA and support planning in a midsized school district and found, not surprisingly, that educators relied primarily on interviews and rating scales when conducting FBAs, and that those FBAs were not used to develop hypotheses about environment relations. Thus, this review provides a snapshot of the state of research using FBA in schools, not the actual practice of school-based FBA.

Appendix

Indirect assessment	Citation
<i>Interview</i>	
Functional assessment interview form	Dunlap et al. (1991)
Preliminary functional assessment survey	O'Neill et al. (1997)
Student-assisted functional assessment	Kern et al. (1994)
Functional assessment checklist for teachers and staff (FACTS)	March et al. (2000)
Student-guided functional analysis interview form	Reed et al. (1997)
Functional assessment and intervention system	Stoiber (2004)
Functional assessment informant record for teachers	Edwards (2002)
Problem identification interview	Sugai and Tindal (1993)
Setting event identification interview	Conroy (1999)
Teacher functional behavior assessment checklist	Stage et al. (2002)
<i>Rating scale</i>	
Motivation assessment scale problem behavior questionnaire	Durand and Crimmins (1992)
Problem behavior questionnaire	Kratochwill and Bergan (1990)
Functional assessment screening tool (FAST)	Iwata (1995)
Questions about behavioral function	Paclawskyj et al. (2000)
Aberrant behavior checklist	Aman et al. (1985)

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