IDIOSYNCRATIC VARIABLES USED IN FUNCTIONAL ANALYSES: A REVIEW (2011 - 2020)

by

OLIVIA THOMPSON

(Under the Direction of JOEL RINGDAHL)

ABSTRACT

Prior to developing an individualized treatment program, clinicians commonly utilize a functional analysis (e.g., Iwata et al., 1982/1994) to assess the specific function(s) of their client's behaviors. Functional analyses can result in inconclusive outcomes when the conditions tested do not effectively replicate establishing operations relevant to the client's behavior. To avoid this issue, researchers and clinicians have adapted the functional analysis process to incorporate idiosyncratic variables that render relevant establishing operations in an attempt to evoke target behavior. Schlichenmeyer et al. (2013) provided a review of the functional analysis literature that described how idiosyncratic variables were used to individualize the behavioral assessment. The purpose of the current project was to provide a review of the recent functional analysis literature with a specific focus on idiosyncratic environmental manipulations in functional analysis conditions throughout the past decade (2011 - 2020) and evaluate the quality and rigor of each study.

INDEX WORDS: functional analysis, idiosyncratic variables, behavior, assessment

IDIOSYNCRATIC VARIABLES USED IN FUNCTIONAL ANALYSES: A REVIEW

(2011 - 2020)

by

OLIVIA THOMPSON

B.S., University of Georgia, 2016

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment

of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2020

IDIOSYNCRATIC VARIABLES USED IN FUNCTIONAL ANALYSES: A REVIEW

(2011 - 2020)

by

OLIVIA THOMPSON

Major Professor:	Joel Ringdahl
Committee:	Kevin Ayres
	Rachel Cagliani

Electronic Version Approved:

Ron Walcott
Dean of the Graduate School
The University of Georgia
December 2020

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

A functional analysis is the gold standard for assessing behavior in the field of applied behavior analysis (Saini et al., 2020). The significance of functional analyses rests on research suggesting that treatment improves when it is planned around the variables maintaining behavior (Newcomer & Lewis, 2004). The term functional analysis (FA) refers to the technology used to assess which environmental variables maintain behavior (Iwata et al., 1990). However, the specific FA that was conducted by Iwata et al. (1994) has become synonymous with the term and is the most widely used FA format (Schlinger, 2017).

For many studies, the same conditions and protocols described in that seminal Iwata et al. (1994) article are replicated exactly when researchers and practitioners conducted a functional analysis. However, in certain cases over the past three decades, experimenters have made idiosyncratic alterations to functional analysis conditions to more effectively evoke and maintain the target behavior (Hanley et al., 2003; Schlichenmeyer et al., 2013). Researchers utilized the foundational program of the FA conducted by Iwata et al. (1994) and modified it as needed, so that instead of completely abandoning a method that has worked well for several decades, they improved upon it as the field continues to advance (Baer et al., 1987). Currently, there is not a systematic method for determining when or how to include idiosyncratic variables in a FA, so FAs are individualized for the participant based on the behavior analyst's understanding of the participant's behavior and the conclusions the researchers derive from pre-functional analysis (pre-FA) assessments. Unfortunately, the behavior analyst's decision-making process is not

always straightforward, as it can be affected by many variables, such as their expertise, time, and resources (Hagopian et al., 2013). Researchers have explored various options of how to improve the individualization of the FA process, but they also need to maintain the efficiency and accuracy of the assessment (Beavers et al., 2013) which would be a benefit of a standard systematic procedure for individualizing the assessments.

The purpose of the current review is to consolidate, evaluate, and describe the variety of idiosyncratic variables that have been included in published functional analysis literature in the past decade. While idiosyncratic variables are, by definition personalized to an individual, the breadth of this catalogue of such variables may benefit clinicians if and when they look to modify a functional analysis to clarify inconclusive results.

CHAPTER 2

METHOD

To update the Schlichenmeyer et al. (2013), the first author followed their methods, which were based off of the methods described by Hanley et al. (2003). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram was used to display the study selection process used in this review (Moher et al., 2009). Figure 1 displays the refinement process of identification, screening, eligibility, and inclusion of the articles in my search. Articles were identified from 2011 - 2020 in the search of the all the database providers found through University of Georgia (UGA) Libraries using the keywords *function, analysis,* and *behavioral assessment*. An additional search was conducted of the databases found through UGA Libraries, using the keywords *functional analysis of behavior* and *behavioral assessment* not *systematic review* nor *meta-analysis.* Articles were excluded that were neither published in peer review journals, nor in English. The search was further refined using the subject tool found in the advanced search on UGA Libraries website, articles were filtered out that did not have the subject of behavioral assessment or functional assessment.

To narrow the search, titles and abstracts were screened to check if the article met inclusion criteria. Inclusion criteria was based on Schlichenmeyer et al. (2013), therefore only articles that used idiosyncratic variables in a standard functional analysis were included. This review defines *standard functional analysis* as the commonly used pretreatment experimental analysis that was described in Iwata et al. (1994). This review defines *idiosyncratic variables* as environmental manipulations in the functional analysis that are based on individualized details of

participants. Idiosyncratic manipulations included in this review were alterations made to the Iwata et al. (1994) functional analysis conditions based on participant's pre-FA assessments (e.g., type of demands or attention). Functional analysis alterations excluded from this review are the use of preference assessments of non-edible tangible conditions and general changes to the FA protocols (e.g., session length or order of conditions).

The search process identified 21 articles that fit the criteria for this review. Those 21 articles were coded in three ways. The first coding process, displayed in Table 1, was based on the process described by Schlichenmeyer et al. (2013; Table 1 p. 341). This table listed the various stimulus parameters, defined as idiosyncratic antecedents and consequences assessed, and in which articles those parameters were found. A study was coded as having a test for social-negative reinforcement if the condition included removal of a stimulus contingent on the occurrence of the target behavior. A study was coded as having a test for social-positive reinforcement if the condition included the presentation of a stimulus contingent on the occurrence of the target behavior.

The second coding process, displayed in Table 2, focused on the participant and setting characteristics of each study. Table 2 and Table 3 both denote the number of participants in each category out of the total 175 participants who took part in the 21 studies included in this review. The final coding process, displayed in Table 3, analyzes the functional analysis characteristics. Table 2 and Table 3 extended the coding process of the Schlichenmeyer et al. (2013) article by further analyzing the characteristics of the articles included in this review.

The quality and rigor of each study were evaluated under the categories found in Table 4. These categories were developed from the What Works Clearinghouse (WWC) Standards Handbook 4.0 (U.S. Department of Education, 2017). To be identified as an eligible Single Case

Design, studies needed to have an individual case as the unit of intervention administration and studies also needed FA control conditions to compare with the test conditions. To meet *WWC Pilot SCD Standard*s, the articles in this review needed inter-assessor agreement (IAA) on at least 20% of the data points in each FA. The articles also needed to include at least three attempts to demonstrate effect within the FA, which means that there should be at least five data points per FA condition (test and control) and no more than two data points per phase. The articles were evaluated as meeting *WWC Pilot SCD Standards* and WWC eligibility based on a two-point score for each category, as seen in Table 4.

The data from the articles in this review were evaluated using the six features for visual analysis stated in the WWC Standards Handbook 4.0, to determine the quality of data and to determine if there was enough compelling evidence to demonstrate a causal relation. The level and trend were assessed on their stability within conditions of the FA. The variability was assessed on its consistency within conditions of the FA. Immediacy of the effect, overlap, and consistency of data was compared across FA conditions. The conditions that researchers reported to maintain the behavior of participants should have an immediate change in levels of behavior between the test and control conditions, because this would provide evidence for the behavioral effect of the independent variable manipulation in the test condition. The data of the test and control conditions were scored on the overlap of their data paths, because if the data paths overlapped regularly, there was a less a convincing demonstration of an effect. Finally, the data was also analyzed across conditions to assess whether the data patterns were consistent. If data patterns were not consistent across conditions, the behavior was not predictable in that FA, which made a causal relation less likely. The visual analysis was evaluated on a six-point score. The maximum score available for the quality and rigor of articles in this review was ten points,

and the total scores received by each article is shown in Table 4. In articles that conducted both an initial FA and a modified FA, the modified FA was the one scored, because it incorporated the idiosyncratic variables of concern for the purpose of this review.

CHAPTER 3

RESULTS

The present review identified 21 articles that fit inclusion criteria and passed the screening process, as shown in Figure 1. The demographics of these participants are described in more detail in Table 2. Clear majorities are held within each demographic category. Most of the participants were male (81.7%), children (61.1%), diagnosed with ASD, pervasive developmental disorder (PDD), or multiple diagnoses (68%), with multiple problem behaviors as their target behaviors (93.1%).

Across these articles, 22 idiosyncratic variables were used to modify the functional analyses. Table 1 displays these variables and in which articles they were used. In total, the experimenters in all of the articles in the current review analyzed the behavior of 175 participants. The stimulus parameters were organized into five categories based on the conditions in which the idiosyncratic variables were used. The five categories will be described in the order found in Table 1: social-negative reinforcement, automatic-negative reinforcement, social-positive reinforcement, combined conditions, and contextual variables.

Social-Negative

The social-negative reinforcement condition of an FA refers to the removal of a stimulus, which in turn results in the maintenance or increase in the levels of a behavior. This review found that the most common modification to this condition was to identify highly or less aversive academic tasks (23.8% of the articles; n = 5). Call et al. (2016) and Hodnett et al. (2018) assessed the aversiveness of a task with a demand assessment (Call et al. 2009) that measured the

latency to problem behavior after a demand was presented. The demands with the shortest latency to problem behavior were hypothesized to be the most aversive to the participant. Greer et al. (2020) and Healy et al. (2013) identified demands as non-preferred through interviews with caregivers and teachers and through direct observations. Roscoe et al. (2015) interviewed the participants' educators to identify demands and tasks that participants frequently came into contact with and that usually evoked problem behavior. The educators selected five demands for each participant: three academic, and two daily living tasks, which fits into the next category of idiosyncratic variable discussed in this review. The previously mentioned articles that use social-negative conditions with academic tasks, found that using more aversive tasks would expose an escape function for the target behavior, whereas a less aversive task was not as likely to provide the same establishing operations (EO) for escape (Call et al., 2016; Greer et al., 2020; Healy et al., 2013; Hodnett et al., 2018; Roscoe et al., 2015)

Another way that researchers in this review used idiosyncratic variables to modify the social-negative condition, was that pre-FA interviews and observations were used to identify aversive tasks other than academic tasks. Roscoe et al. (2015) identified two daily living demands for each participant such as, sit down, put on coat, brush teeth, set table, and jumping jacks. The interviewees reported that the participants frequently came into contact with these tasks and that they usually evoked problem behavior. Other non-academic aversive tasks found in this review were, asking the participant to finish a drink (Radstaake et al., 2013) prompting the participant to transition somewhere (Hall et al., 2018). The drink condition from Radstaake et al. (2013) was conducted in a similar format to the standard FA social-negative reinforcement condition. The participant was continuously presented with the demand to finish her drink, and if noncompliance was exhibited, the therapist used least-to-most prompt procedures to complete

the demand. If the participant engaged in the target behavior, she was allowed a break from the demand, but had to remain in her seat. Hall et al. (2018) conducted the transition condition by terminating an activity that participants were engaged with, and asking that they move on to a new activity. This condition also used least-to-most prompts to complete the demand. If the participant engaged in the target behavior, they were given a 20-s break from the transition.

In addition to the removal of demands, several studies (19%; n = 4) have also evaluated the behavioral effect of removing other aversive stimuli. For example, researchers hypothesized that the removal of continuous attention (i.e., social escape) would maintain the target behavior of participants diagnosed with Fragile X Syndrome (Hall et al., 2018; Machalicek et al., 2014). A social escape function was determined for six of the 22 participants in Hall et al. (2018), and three of the 12 participants in Machalicek et al. (2014). Another aversive stimulus that was identified through pre-FA assessments was the interruption of participants' activities (Cariveau et al., 2019; Hanley et al., 2014). In these studies, researchers created a social-negative reinforcement condition that involved researchers terminating an activity that the participant was involved with, and then prompting them to engage in another activity. As in the other social-negative reinforcement conditions, upon the occurrence of the target behavior, the aversive stimulus of the interruption was removed and the participant was allowed to resume the original activity. In both studies (Cariveau et al., 2019; Hanley et al., 2014), the participants that were exposed to the interruption of activities condition, engaged in elevated rates of problem behavior, therefore it was concluded that their behavior was partly maintained by escape from interruption of activities. Both of these participants engaged in multiply-maintained problem behavior (Cariveau et al., 2019; Hanley et al., 2014).

Automatic-Negative

Scheithauer et al., (2015) used idiosyncratic variables in an automatic-negative reinforcement condition. In this article the researchers assessed SIB and self-restraint (Scheithauer et al., 2015). The researchers in this article conducted three FAs for one participant. The initial FA assessed the participant's SIB while the therapists ignored self-restraint, and it was inconclusive because of the variable levels of SIB and self-restraint across all conditions. The second FA also assessed the function of SIB, but while therapists blocked her self-restraint. The researchers' hypothesis that SIB was automatically maintained was supported by the high levels of SIB that persisted in the ignore condition. In the third and final FA, researchers assessed the function of the participant's SIB after fitting her with arm splints. The researchers hypothesized that the SIB effects were aversive to the participant, and that the self-restraint was maintained by automatic-negative reinforcement. The researchers explained that the arm splints decreased the force of the SIB, which they believed led to a decrease in self-restraint because of the minimal aversive effects from the SIB (Scheithauer et al., 2015).

Social-Positive

The social-positive reinforcement condition of an FA refers to the presentation of a stimulus, which results in the maintenance or increase in the levels of a behavior. Many studies used the same foundation of the attention condition described in Iwata et al. (1994), and some articles (33.3%; n = 7) described modifications made to the antecedents and consequences based on their participants' individualized behaviors. In the Iwata et al. (1994) attention condition (labeled, "social disapproval"), the therapist ignored the participant by diverting their attention to another activity, such as reading. An alternative antecedent event that several studies used (14.3%; n = 3), was that instead of the therapist *diverting* their attention, therapists *divided* their attention, which means that they engaged with another individual in the room (Radstaake et al.,

2013; Schmidt et al., 2017; Torres-Viso et al., 2018). In all of these studies, this specific alteration to the attention condition was decided upon based on information gathered from the caregivers and observations. Radstaake et al. (2013) and Schimdt et al. (2017) did not identify an attention function based on the divided attention condition. Torres-Viso et al. (2018) did conclude that the participant engaged in problem behavior that was maintained by gaining access to attention when it was divided.

Machalicek et al. (2014) varied from the Iwata et al. (1994) attention condition as described in Iwata et al. (1994) by including a preferred tangible item during the attention condition. This procedure differs from the Iwata et al. (1994) attention condition, which included a variety of toys whose preference was unknown. Researchers usually provide the participant with a low preferred item so that it does not act as a competing stimulus to the attention function, which could result in a false-negative result (see Ringdahl et al., (2002) for a demonstration). Machalicek et al. (2014) did not clearly indicate a reason for altering the condition in this way. However, even with the preferred items present, three of the 12 participants engaged in their target behavior during the attention condition, which indicated an attention function for their behavior.

As previously mentioned, the type of attention provided in the Iwata et al. (1994) attention test condition was a statement of social disapproval and a brief instance of physical contact. Several studies in the current review (14.3%; n = 3) modified the attention condition by altering the type of attention provided, based on information gathered in the pre-FA assessments (Greer et al., 2020; Santiago et al., 2019). Greer et al. (2020) provided contingent upon the participants engaging in the target behavior, the therapists delivered the standard statement of social disapproval followed by a preferred type of attention, such as backrubs. Newcomb et al.

(2019), compared the attention condition between physical and nonphysical attention. In the physical attention condition, aggression was blocked by therapists with procedures that involved securing and redirecting the participants hands with no verbal attention provided. The nonphysical attention condition was conducted in a way that the staff restricted all physical attention and only provided statements of disapproval contingent upon the occurrence of the target behavior. There was little differentiation in the levels of problem behavior between these two conditions in the initial FA, so the researchers conducted a follow-up FA that only consisted of those two conditions and a control condition. The second functional analysis resulted in clearly differentiated levels of aggression, with no overlapping data points, and physical attention was determined to be the main function of the participant's aggression.

Another social-positive condition that is common in functional analyses is the tangible condition. Though this condition was not used in the seminal FA article (Iwata et al., 1994), many researchers include this condition in their FA, if a tangible function is hypothesized based on parent reports or observations. A common format of the tangible test condition is described in Vollmer et al. (1995), in which the therapist would restrict access to the participant's preferred tangible items, and would only return them for a brief period of time if the participant engaged in the target behavior. During this condition, therapists usually deliver non-contingent attention, so that the lack of attention doesn't establish an unwanted EO for attention-seeking behavior. If the participant would continue to engage in the target behavior when the tangible item was removed, then the behavior would be maintained by access to the tangible item. As found in this review, in order to properly conduct this condition, therapists usually ran a preference assessment with the participant before the FA, to identify highly preferred items. The Rooker et al., (2011) study warned against using a tangible condition unless the target behavior is hypothesized to have a

tangible function, because they found that the tangible condition can result in false-positive results. Five studies from the current review (23.8%) used idiosyncratic preferences of the participants to modify the tangible condition in a way that was most relevant to the participants (Radstaake et al., 2012; Romani et al., 2019; Rooker et al., 2011; Roscoe et al,. 2015; Schmidt et al., 2016).

The purpose of Roscoe et al. (2015) was to establish and test a systematic technology that would identify relevant events to utilize in FAs if an initial FA was inconclusive. Therefore, this study had several individualized conditions, two of which resembled the tangible condition. In both the fixing test condition and the ritualistic behavior test condition, therapists took items that the participant was manipulating, and rearranged them. If the participant engaged in the target behavior, they were allowed to fix one item or engage in ritualistic behavior with the item for 30-s in the corresponding conditions. The results of the fixing test condition showed elevated levels of the target behavior, suggesting that the behavior was maintained by access to fixing items. The results of the ritualistic behavior test condition showed undifferentiated levels of the target behavior from the control condition, so the participants behavior was not maintained by access to items that they could use for ritualistic behaviors.

As previously mentioned, data from Rooker et al. (2011) exposed a limitation of the tangible condition by showing how it can result in false-positive outcomes. The second study in Rooker et al. (2011) differentiated two tangible conditions, one using a preferred edible and the other using an item that was most used in the direct assessment. The findings from this study concluded that highly preferred edibles were more likely to maintain the behavior than the items identified in the direct assessment. This study expanded the literature by emphasizing the

importance of relevant stimuli in FAs, in order to properly replicate the participant's relevant EOs and avoid false-positive or false-negative results.

Standard tangible conditions use preferred non-edible tangible items, however, like Rooker et al. (2011), several studies in the current review discovered that the removal of edibles was more likely to evoke the target behavior in pre-FA assessments than non-edible tangible items (Radstaake et al., 2013; Schmidt et al., 2016). The tangible-edible conditions in both of these studies were formatted the same way as the standard tangible condition, however instead of being allowed brief access to a tangible item contingent upon the target behavior, the participants were delivered an edible item that they could consume.

Romani et al. (2019) modified the antecedent event of the standard tangible condition by restricting the participant's access to a candy or toy aisle. The pre-FA parent reports revealed a possible escape and tangible function for both of the participants that participated in the study (Romani et al., 2019) therefore during the tangible test condition, the participants were guided to leave a candy or toy aisle. If the participant engaged in the target behavior, they were returned to the aisle where they could look at or touch the items for a brief period of time. The participant that only looked at the items in the aisle engaged in less problem behavior and more compliance than the participant that touched the items, but the researchers determined that both participants' target behaviors had a tangible function.

In some of the studies in the current review (19%; n = 4), researchers went beyond modifying conditions and, instead, manufactured their own idiosyncratic social-positive reinforcement conditions to establish relevant EOs for the participants. One such condition was a Walking condition in which the participant was told by the therapist "We're going to walk this way," and then they walked to a certain location. The locations had been previously selected by

the participant, so the researchers hypothesized that these locations were not aversive. If the target behavior occurred, the therapists would comply with the participant's requests to walk to any location and participate in any activity of their choosing min. The results of the FA showed that the participant engaged in the target behavior at higher levels in the test condition than in the control condition, therefore the target behavior was concluded to be maintained by access to certain locations and activities on walks (Roscoe et al., 2015).

A denied mands test condition (Bowman et al., 1997) was not used in the standard FA, however as shown in the current review, it has become a common test condition to add to the FA (14.3%; n = 3). In general terms, a *mand* is defined as a request for something. The overall premise of the condition is that therapists will deny requests from the participants, unless the participant engages in the target behavior. For example, in the Torres-Viso et al. (2018) study, the participant's mands for therapists' body or tangible item rearrangement were not honored during the test condition unless the participant engaged in the target behavior, in which case the therapist or parent would comply with their requests. The Roscoe et al. (2015) study also tested if their participant's target behavior was maintained by compliance with requests. In this specific condition, contingent upon the occurrence of the target behavior, the participant was allowed to request access to the bathroom. All of these conditions showed elevated levels of the target behavior, which indicated that these participants' target behavior was maintained by compliance with their requests, whether for rearrangement, directions in toy play, or the bathroom. The denied mands condition could be especially useful for participants diagnosed with ASD, because they commonly engage in restricted and repetitive behaviors (RRBs; Jiujias et al., 2017) which can include arranging items a certain way or repeatedly asking for specific actions to occur (Torres-Viso et al., 2018).

Combined Conditions

The standard FA test conditions are conducted in isolation to best determine the singular function of the participant's behavior. However, multiple studies in the current review (33.3%; n = 7) determined that in order to best replicate the participant's relevant EOs, conditions needed to be combined. The researchers in the studies used pre-FA assessments, and some of them used the results from inconclusive initial FAs, to decide which conditions to combine. Six of the studies that combined conditions, used social-positive and social-negative reinforcement by synthesizing an escape condition with either a tangible or attention condition (Cariveau et al., 2019; Eluri et al., 2016; Hanley et al., 2014; Roscoe et al., 2015; Santiago et al., 2016; Strohmeier et al., 2017). The therapists removed compliance, tangible items, or preferred attention and they prompted participants to complete a task. Contingent upon the occurrence of the target behavior, participants were provided with not only a break from demands, but also with brief access to compliance, tangible items or preferred attention. In Santiago et al. (2016), the therapist started the attention test condition by talking to the participant about a non-preferred conversation topic. If the participant engaged in the target behavior, the therapist would change the conversation to one of the participant's preferred topics. In this condition the participant both escaped the non-preferred topic and was provided with the preferred topic, so the authors explained how this particular condition had both social-negative and social-positive reinforcement. In both studies (Cariveau et al., 2019; Hanley et al., 2014) the condition the participant both escaped the interruption of the activity and was provided with access to the original activity, so this condition had both social-negative and social-positive reinforcement. The Eluri et al., (2016) denied mands condition, had therapists not only deny mands, but they also began directing the participant's play and prompting them to play a certain way. By

engaging in the target behavior, the participant both escaped the therapist's directions for play and gained compliance to their mands, so this condition had both social-negative and social-positive reinforcement. In this condition, the therapists presented a multiple schedule card in order to help the participant differentiate this condition from the play condition.

Two of the studies (Hanley et al., 2014; Rose et al., 2019) combined social-positive reinforcement conditions by restricting access to both attention and tangibles. During the test condition, the therapists would divert their attention from the participants after also removing a preferred tangible item. When participants engaged in the target behavior, they were given access to the preferred tangible items and attention from the therapist.

Combining conditions can be useful because in some cases, variables may not act as a reinforcer in isolation, but rather, they only reinforce individuals' behavior when combined with another variable. A limitation of combining conditions is that it is unknown whether one of the reinforcers was more potent to participants than another. On the other hand, researchers claimed that there was more social validity in assessing the behaviors in combined conditions because it better replicated the consequences that were presented to the participant in daily (Hanley et al., 2014). The social validity of the assessment was more important to the researchers than spending time to single out the function to which the behaviors were most sensitive.

Contextual Variables

Table 3 displays several contextual variables that have been commonly modified in recent studies based on participant specific information. The number (n) and percent is based on how many participants were tested under that circumstance, out of the 175 participants overall. The standard FA (Iwata et al., 1994) took place in a therapy room, with an experimenter, and they conducted an interview, observation, and special education evaluation before the FA.

The current review shows that therapy/experimental rooms were the most widely used setting for participant's functional analyses (76%). Only two participants (1.1%), were assessed in public, specifically a hospital gift shop and cafeteria. Public settings, other than schools, are uncommon for FAs due to clincian's difficulty to have experimental control, as well as the possible danger that comes with assessing problem behavior. As found in this review, the second most common place to functionally assess behavior is in a classroom or day program (20.6%).

Due to the individualized differences of participants, it is common that researchers modify contextual variables of an FA in order to replicate a more naturalistic environment. For example, six articles in the current review used someone other than the therapist (either a parent, caregiver, or teacher) to conduct FA conditions (Hanley et al., 2014; Hodnett et al., 2018; Machalicek et al., 2014; Rose et al., 2019; Strohmeiera et al., 2017; Torres-Viso et al., 2018). Three of the articles had someone other than the therapist conduct FA conditions following inconclusive FA results (Hodnett et al., 2018; Strohmeiera et al., 2017; Torres-Viso et al., 2018). In the other three studies, the researchers decided that the therapist would not conduct conditions in the initial FA based on information gathered in the pre-FA assessments (Hanley et al., 2014; Machalicek et al., 2014; Rose et al., 2019). Therapists/experimenters most frequently conducted the functional analyses (87.4%). Therapists/experimenters are more commonly used for several reasons, including the fact that they have more training in conducting FAs, training other people would require more resources and time, and the potential physical risk that comes with conducting FAs of problem behavior. Parents/caregivers conducted 9.7% of the FAs in order to better manufacture naturalistic conditions. For this same reason, teachers were used to conduct 2.9% of the FA.

As for the pre-FA assessments, interviews/questionnaires were used for almost all of the FAs (97.7%). Preference assessments were conducted with many of the participants in the reviewed articles (60.6%), which differs from the Iwata et al. (1994) FA that didn't include a preference assessment or a tangible condition. An educational assessment was used in the Iwata et al. (1994) FA, however, current FAs found in this review used demand assessments for 49.7% of participants to focus on the level of aversiveness of the demand, rather than the appropriate level of demand for the age or skill of the participant. Both indirect and direct assessments are useful tools to help researchers form hypotheses about the function of a behavior, or at least rule out functions in order to make the assessment process as efficient as possible (Mueller & Nkosi, 2007). However, there is no strategic plan as to how to go about the pre-FA assessments or which to choose, so researchers decide on their own and the pre-FA assessment choices vary by study.

Similar to the Schlichenmeyer et al. (2013), some of the reviewed articles conducted included an initial standard FA for 17.1% of participants, before the FA with idiosyncratic variables. When those initial FA results were inconclusive, the therapists used a combination of information from the observations of the initial FA and information from the pre-FA assessments to develop idiosyncratic conditions for a second, and sometimes third FA. Idiosyncratic variables were added to the initial FA for 82.9% of participants, based on their pre-FA assessments. Another contextual variable that researchers modified in this review to establish more naturalistic conditions was the location of the FA. Six of the studies conducted the FA in a setting other than a clinic or therapy room (Healy et al., 2013; Newcomb et al., 2019; Radstaake et al., 2013; Romani et al., 2019; Rose et al., 2019; Santiago et al., 2016). The idiosyncratic settings used were the participant's home (Newcomb et al., 2019; Rose et al., 2019; Santiago et al., 2016),

classroom (Healy et al., 2013; Radstaake et al., 2013; Santiago et al., 2016) and the public setting of a hospital gift shop and cafeteria (Romani et al., 2019).

Other contextual variables modified in studies included in this review were less common and more unique to the specific study. In a study with the purpose of analyzing pica, researchers modified the placement of the pica materials, following inconclusive results of the first pica condition (Schmidt et al. 2017). They wanted to more accurately resemble the circumstance that evoked the behavior in the participant's usual environment. The participant's initial FA was inconclusive, so the researchers used idiosyncratic variables that were identified in the interviews to develop an ignore condition that better represented the participant's environment outside of the clinic. The individualized condition was set up with the participant walking alongside the therapist as they passed food left on the ground. This modified ignore condition produced higher levels of pica than the standard ignore condition that was conducted in the initial FA. The researchers emphasized that this participant's assessment results were of particular importance because in many settings, it may not be feasible to conduct a FA on pica due to limited resources (Schmidt et al., 2017).

Quality and Rigor Evaluation

Quality and rigor scores for each article in this review are displayed in Table 4. Each article was evaluated based on WWC standards with a maximum score of ten points. All of the articles in this review met the WWC eligibility requirements to be considered a Single Case Design (U.S. Department of Education, 2017) so they each received two points for the Eligibility category of the Quality and Rigor Evaluation. Every participant's graph from each article was taken into account when evaluating the standards and visual analysis, so some scores have decimal values. For example, in Hodnett et al. (2018) researchers conducted IAA on at least 20%

of sessions for only one of their two participants (1/2), and there were not an adequate number of demonstrations of effect, so they received a score of 0.5 for that category. Newcomb et al. (2019) did not collect IAA data on at least 20% of FA sessions. Most of the articles in this review had at least five data points in each condition (test and control) for their FA, however three studies (Hanley et al. 2014; Hodnett et al., 2018; Romani et al., 2019) had less than five data points in each condition, so they received a lower score for the Standards category. A majority of articles (n = 16) received a score greater than four in the visual analysis category. The rest of the articles received a score between three and four for the visual analysis category (Cariveau et al., 2019; Hall et al., 2018; Newcomb et al., 2019; Strohmeiera et al., 2017). Schmidt et al. (2016) could not be analyzed in this category because they displayed their data in tables rather than graphs. The graphs in Newcomb et al. (2019) and Cariveau et al. (2019) had overlapping data paths across conditions and variable data within conditions, meaning the data was not consistent nor predictable, which lead to a lower score for the Visual Analysis category. Out of the 22 graphs in Hall et al. (2018), many of them had variable data, with unpredictable data paths, and unstable levels and trends. Using this inconsistent data, the researchers determined that eight of the participants' behaviors were multiply maintained, two of their participants' behaviors were maintained by automatic reinforcement, and three of their participants' behaviors were undifferentiated across conditions. All of the articles included in this review received a total score greater than seven for this quality and rigor evaluation. The range of the scores was seven to ten and the average score was 8.43. Articles that received a maximum score of ten (Eluri et al., 2016; Greer et al., 2020; Radstaake et al., 2012; Santiago et al., 2016; Schmidt et al. 2017) met all of the WWC requirements for eligibility, standards, and visual analysis from the Standards Handbook without reservations (U.S. Department of Education).

CHAPTER 4

DISCUSSION

As demonstrated in the articles described in this review, researchers are improving upon the FA process by incorporating various idiosyncratic conditions, based on the specific information gathered from pre-FA assessments. Coding processes were used to evaluate the demographics, quality and rigor, and characteristics of each article to better understand the focus of FA research within the past decade. Table 4 supports the quality of the articles represented in the current review and Table 2 could help advise experimenters on their future research on FAs. In order to broaden the generality of their findings, researchers could include more females, with various diagnoses other than ASD/PDD and target other behavior than problem behavior.

Overall, this review expanded the knowledge of idiosyncratic variables used in FA conditions. Modifications to the social-positive reinforcement condition introduced new ways to think about and assess the function of attention. These alterations showed that certain types of attention can reinforce behavior, and modified attention conditions can determine an attention function of an individual's behavior. The modifications to the social-negative reinforcement conditions in this review have clinical implications because if clinicians do not conduct an indirect assessment based on demands or a demand assessment prior to the FA, they may not use relevant tasks (academic or non-academic) that evoke the target behavior during the demand condition. On the other hand, if clinicians utilize an aversive task that the client does not come into contact with in their daily life, the FA might be subject to false-positive results for the demand condition and the condition would not be socially valid based on the client's daily

experiences. Clinicians need to take into account their client's aversion to tasks, as well as how often the client is presented with certain tasks to ensure the FA is socially valid. The studies that included denied mands conditions expanded the knowledge of functions of behavior, by shedding light on the opportunity to assess the function of compliance with mands. Changes to the contextual variables of the FA call allow researchers to more accurately assess participants using relevant establishing operations, that cannot always be properly manufactured in a clinic setting (Romani et al., 2019).

The Schlichenmeyer et al. (2013) review mentioned the need for a more systematic approach to developing hypotheses from pre-FA assessments. Without a systematic approach to individualizing an FA, and with potential jeopardies in mind, researchers have to deliberate upon the risks and costs of running FAs against the benefit of determining the function of a behavior for the structure of the participant's treatment (Beavers, Iwata, & Lerman, 2013). As seen in two of the articles in this review, there is a growing effort to achieve this kind of technology (Roscoe et al., 2015; Greer et al., 2020). Individualization is imperative when developing an effective treatment plan. In order to know the necessary modifications to make for that specific individual's treatment, the assessment needs to be just as individualized (Hodnett et al., 2018).

In the Iwata et al. (1994) format of the FA, which is continuously utilized in studies, only four basic functions of behavior could be identified for participants. With the advancements made to the individualization of FAs, this review identified articles with 22 different FA modifications throughout, which shows an expansion to researchers' understanding of idiosyncratic variables that affect individual's behavior. Along with the type of condition, all of the variables that are used to arrange an FA can have an effect on behavior, so it is vital that clinicians closely analyze the influence of these variables on an individual's behavior through

pre-FA assessments and possibly initial FAs in order to conduct the most accurate and informative FA possible. From the location, to the therapist, to the materials, and the condition, all aspects of the FA can be altered to manufacture the most relevant assessment possible for an individual. This can then lead to accurate results, that are also socially valid. These results can then inform an effective and beneficial treatment plan. Future research could focus on a more strategic method of assessment to evolve from the standard FA to a more efficient and informative FA using idiosyncratic variables.

REFERENCES

Baer, D. M., Wolf, M. M., & Risley, T. R. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *20*(4), 313–327. https://doi-org.proxy-remote.galib.uga.edu/10.1901/jaba.1987.20-313

Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty Years of Research on the Functional Analysis of Problem Behavior. *Journal of Applied Behavior Analysis*, 46(1), 1–21. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.30

Bowman, L. G., Fisher, W. W., Thompson, R. H., & Piazza, C. C. (1997). On the relation of mands and the function of destructive behavior. *Journal of Applied Behavior Analysis*, *2*, 251.

Call, N. A., Miller, S. J., Mintz, J. C., Mevers, J. L., Scheithauer, M. C., Eshelman, J. E., & Beavers, G. A. (2016). Use of a latency-based demand assessment to identify potential demands for functional analyses. *Journal of Applied Behavior Analysis*, *4*, 900.

Cariveau, T., Miller, S. J., Call, N. A., & Alvarez, J. (2019). Assessment and Treatment of Problem Behavior Maintained by Termination of Interruptions. *Developmental Neurorehabilitation*, *22*(3), 203–208. https://doi-org.proxy-remote.galib.uga.edu/10.1080/17518423.2019.1566278

Eluri, Z., Andrade, I., Trevino, N., & Mahmoud, E. (2016). Assessment and treatment of problem behavior maintained by mand compliance. *Journal of Applied Behavior Analysis*, *2*, 383.

Greer, B. D., Mitteer, D. R., Briggs, A. M., Fisher, W. W., & Sodawasser, A. J. (2020).

Comparisons of standardized and interview□informed synthesized reinforcement contingencies relative to functional analysis. *Journal of Applied Behavior Analysis*, *53*(1), 82–101. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.601

Hagopian LP, Rooker GW, Jessel J, DeLeon IG. Initial functional analysis outcomes and modifications in pursuit of differentiation: a summary of 176 inpatient cases. *Journal of Applied Behavior Analysis* 2013 Spring;46(1):88–100. doi:10.1002/jaba.25.

Hall, S. S., Hustyi, K. M., & Barnett, R. P. (2018). Examining the influence of social□environmental variables on self□injurious behaviour in adolescent boys with fragile X syndrome. *Journal of Intellectual Disability Research*, *62*(12), 1072–1085. https://doi-org.proxy-remote.galib.uga.edu/10.1111/jir.12489

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

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

Healy, O., Brett, D., & Leader, G. (2013). A comparison of experimental functional analysis and the Questions About Behavioral Function (QABF) in the assessment of challenging behavior of individuals with autism. *Research in Autism Spectrum Disorders*, *7*(1), 66–81. https://doi-org.proxy-remote.galib.uga.edu/10.1016/j.rasd.2012.05.006

Hodnett, J., Scheithauer, M., Call, N. A., Mevers, J. L., & Miller, S. J. (2018). Using a

functional analysis followed by differential reinforcement and extinction to reduce challenging behaviors in children with Smith-Magenis syndrome. *American Journal on Intellectual and Developmental Disabilities*, *123*(6), 558–573. https://doi-org.proxy-remote.galib.uga.edu/10.1352/1944-7558-123.6.558

Iwata, B. A., Vollmer, T. R., & Zarcone, J. R. (1990). The experimental (functional) analysis of behavior disorders: Methodology, applications, and limitations. In A. C. Repp & N. N. Singh (Eds.), Perspectives on the use of nonaversive and aversive interventions for persons with developmental disabilities (p. 301–330). Sycamore Publishing Company.

Iwata BA, Dorsey MF, Slifer KJ, Bauman KE, Richman GS. Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*. 1994;27:197–209. Reprinted from Anal and Interv in Dev Disabil. 1982;2,3-20. doi:10.190/jaba.1994.27-197.

Jiujias, M., Kelley, E., & Hall, L. (2017). Restricted, Repetitive Behaviors in Autism Spectrum Disorder and Obsessive-Compulsive Disorder: A Comparative Review. *Child Psychiatry and Human Development*, *48*(6), 944–959. https://doi-org.proxy-remote.galib.uga.edu/10.1007/s10578-017-0717-0

Machalicek, W., McDuffie, A., Oakes, A., Ma, M., Thurman, A. J., Rispoli, M. J., & Abbeduto, L. (2014). Examining the operant function of challenging behavior in young males with fragile X syndrome: A summary of 12 cases. *Research in Developmental Disabilities*, *7*, 1694. https://doi-org.proxy-remote.galib.uga.edu/10.1016/j.ridd.2014.03.014

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Journal of Clinical Epidemiology, 62*(10), 1006-1012. doi:10.1016/j.jclinepi.2009.06.005

Mueller, M. M., & Nkosi, A. (2007). State of the science in the assessment and management of

severe behavior problems in school settings: Behavior Analytic Consultation to Schools. *International Journal of Behavioral Consultation and Therapy*, 3(2), 176-202. http://dx.doi.org/10.1037/h0100798

Newcomb, E. T., Wright, J. A., & Camblin, J. G. (2019). Assessment and treatment of aggressive behavior maintained by access to physical attention. *Behavior Analysis: Research and Practice*, *19*(3), 222–231. https://doi-org.proxy-remote.galib.uga.edu/10.1037/bar0000136

Newcomer, L. L., & Lewis, T. J. (2004). Functional Behavioral Assessment: An Investigation of Assessment Reliability and Effectiveness of Function-Based Interventions. *Journal of Emotional and Behavioral Disorders,* 12(3), 168–181. https://doi.org/10.1177/10634266040120030401

Radstaake, M., Didden, R., Lang, R., O, R. M., Sigafoos, J., Lancioni, G. E., Appels, N., & Curfs, L. M. (2013). Functional Analysis and Functional Communication Training in the Classroom for Three Children with Angelman Syndrome. *Journal of Developmental and Physical Disabilities 1*, 49.

Ringdahl, J. E., Winborn, L. C., Andelman, M. S., & Kitsukawa, K. (2002). The effects of noncontingently available alternative stimuli on functional analysis outcomes. *Journal of Applied Behavior Analysis*, *4*, 407.

Romani, P. W., Donaldson, A. M., Ager, A. J., Peaslee, J. E., Garden, S. M., & Ariefdjohan, M. (2019). Assessment and Treatment of Aggression During Public Outings. *Education & Treatment of Children (West Virginia University Press)*, *42*(3), 345–359. https://doi-org.proxy-remote.galib.uga.edu/10.1353/etc.2019.0016

Rooker, G. W., Iwata, B. A., Harper, J. M., Fahmie, T. A., & Camp, E. M. (2011). False-

Positive Tangible Outcomes of Functional Analyses. *Journal of Applied Behavior Analysis*, *44*(4), 737–745.

Roscoe, E. M., Schlichenmeyer, K. J., & Dube, W. V. (2015). Functional analysis of problem behavior: A systematic approach for identifying idiosyncratic variables. *Journal of Applied Behavior Analysis*, *2*, 289.

Rose, J. C., & Beaulieu, L. (2019). Assessing the generality and durability of interview□informed functional analyses and treatment. *Journal of Applied Behavior Analysis*, *52*(1), 271–285. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.504

Saini, V., Fisher, W. W., Retzlaff, B. J., & Keevy, M. (2020). Efficiency in functional analysis of problem behavior: A quantitative and qualitative review. *Journal of Applied Behavior Analysis*, *53*(1), 44–66. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.583

Santiago, J., Hanley, G., Moore, K., & Jin, C. (2016). The Generality of Interview-Informed Functional Analyses: Systematic Replications in School and Home. *Journal of Autism & Developmental Disorders*, *46*(3), 797. https://doi-org.proxy-remote.galib.uga.edu/10.1007/s10803-015-2617-0

Scheithauer, M., O'Connor, J., & Toby, L. M. (2015). Assessment of self-restraint using a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *4*, 907. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.230

Schlichenmeyer, K. J., Roscoe, E. M., Rooker, G. W., Wheeler, E. E., & Dube, W. V. (2013). Idiosyncratic variables that affect functional analysis outcomes: A review (2001-2010). *Journal of Applied Behavior Analysis*, *46*(1), 339–348. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.12

Schlinger, H. D., Jr. (2017). The importance of analysis in applied behavior analysis. *Behavior*

Analysis: Research and Practice, 17(4), 334–346. https://doi-org.proxy-remote.galib.uga.edu/10.1037/bar0000080

Schmidt, J. D., Rooker, G. W., Fodstad, J. C., Orchowitz, P., Goetzel, A., Kurtz, P. F., & Hagopian, L. P. (2016). On the relation between adaptive functioning and the reinforcement function of challenging behavior. *International Journal of Developmental Disabilities*, *62*(3), 174–182.

Schmidt, J., Long, A., Goetzel, A., Tung, C., Pizarro, E., Phillips, C., & Hausman, N. (2017). Decreasing Pica Attempts by Manipulating the Environment to Support Prosocial Behavior. *Journal of Developmental & Physical Disabilities*, *29*(5), 683. https://doi-org.proxy-remote.galib.uga.edu/10.1007/s10882-017-9548-y

Strohmeier, C. W., Murphy, A., & O'Connor, J. T. (2017). Parent-informed test-control functional analysis and treatment of problem behavior related to combined establishing operations. *Developmental Neurorehabilitation*, *4*, 247.

Torres, V. M., Strohmeier, C. W., & Zarcone, J. R. (2018). Functional analysis and treatment of problem behavior related to mands for rearrangement. *Journal of Applied Behavior Analysis*, *51*(1), 158–165. https://doi-org.proxy-remote.galib.uga.edu/10.1002/jaba.437

U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse.

Vollmer, T. R., Marcus, B. A., Ringdahl, J. E., & Roane, H. S. (1995). Progressing from brief assessments to extended experimental analyses in the evaluation of aberrant behavior. *Journal of Applied Behavior Analysis*, *4*, 561.

APPENDIX

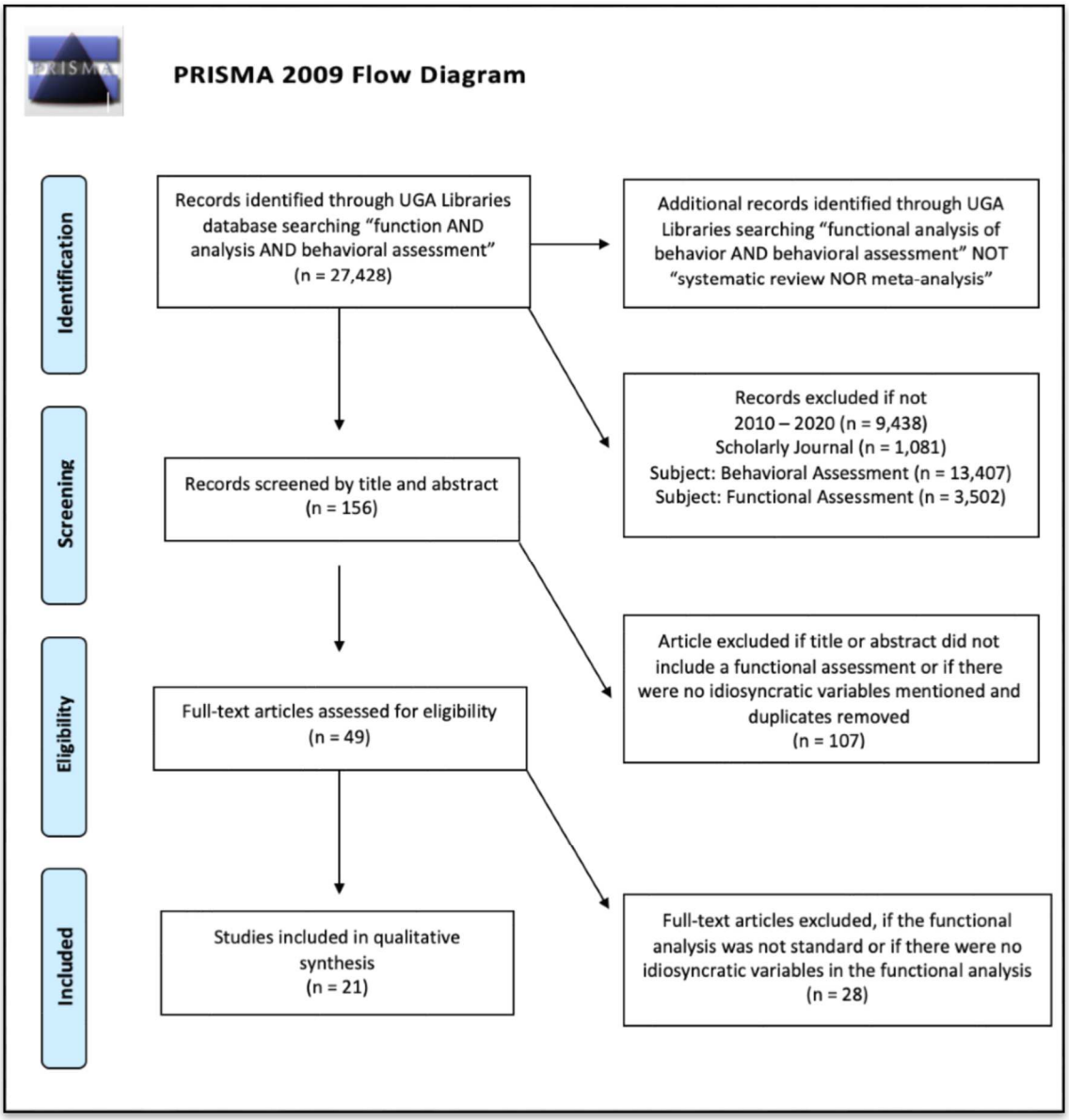

Figure 1

Table 1

Stimulus Parameter	First Author (publication year)
Social-negative reinforcement	
Antecedent Events	
Identified high or low aversive academic tasks (demand)	Healy (2013), Roscoe (2015), Call (2016), Hodnett (2018), Greer (2020)
Drink (demand)	Radstaake (2012)
Transisitons (demand)	Hall (2018)
Continuous attention	Machalicek (2014), Hall (2018)
Interruption of activies	Hanley (2014), Cariveau (2019)
Automatic-negative reinforcement	
Arm splints	Scheithauer (2015)
Social-positive reinforcement	
Antecedent Events	
Divided Attention	Radstaake (2012), Schmidt (2017), Torres-Viso (2018)
Preferred toy (attention)	Machalicek (2014)
Denied mands	Roscoe (2015), Eluri (2016), Torres-Viso (2018)
Removal from candy aisle (tangible)	Romani (2019)
Combine MO's	Hanley (2014), Rose (2019)
Consequent Events	
Combine consequences	Hanley (2014), Rose (2019)
Preferred conversation topic (attention)	Santiago (2016)
Physical or Nonphysical (attention)	Newcomb (2019)
Preferred type (attention)	Greer (2020)
Edible (tangible)	Radstaake (2012), Schmidt (2016)
High Preference Edible or Most Used Item (tangible)	Rooker (2011)
Fixing items	Roscoe (2015)
Ritualistic Behavior	Roscoe (2015)
Walking	Roscoe (2015)
Combined social-positive and social-negative reinforcement	Hanley (2014), Roscoe (2015), Eluri (2016), Santiago (2016), Strohmeiera (2017), Cariveau (2019)
Contextual variables	
Therapist	Hanley (2014), Machalicek (2014), Strohmeiera (2017), Hodnett (2018), Torres-Viso (2018), Rose (2019)
Location	Radstaake (2012), Santiago (2016), Romani (2019)
Location of pica materials	Schmidt (2017)

Table 1

Table 2	Participant and Setting Characteristics	
Characteristic	N	Percent
Gender		
Male	143	81.7%
Female	32	18.3%
Age		
1-10	107	61.1%
10-20	65	37.1%
20-30	2	1.1%
>30	1	0.6%
Diagnosis		
Autism/PDD	60	34.3%
Intellecutal Disability	12	6.9%
Angelman Syndrome	3	1.7%
Smith-Magenis Syndrome	2	1.1%
Fragile X Syndrome	34	19.4%
Mulitple	59	33.7%
Other	5	2.9%
Target Behavior		
Mulitple Pbx	163	93.1%
Aggression/Destruction	5	2.9%
Self Injurous Behavior	1	0.6%
Pica	3	1.7%
Stereotypy	3	1.7%

Table 2

Table 3	Functional Analysis Characteristics	
Characteristic	N	Percent
Setting		
Home	4	2.3%
Public	2	1.1%
Classroom/Day Program	36	20.6%
Therapy/Experimental room	133	76.0%
Interventionist		
Therapist/Experimenter	153	87.4%
Teacher/Paraprofessional	5	2.9%
Parent/Caregiver	17	9.7%
Pre-FA assessment		
Preference assessment	106	60.6%
Demand assesssment	87	49.7%
Interview/Questionnaire	171	97.7%
Direct Observation	68	38.9%
Initial Standard FA		
Yes	30	17.1%
No	145	82.9%

Table 3

Table 4			Quality and Rigor Evaluation	
Author	**Eligibility (out of 2)**	**Standards (out of 2)**	**Visual Analysis (out of 6)**	**Total**
Call et al. 2016.	2	2	4.42	8.42
Cariveau et al. (2019)	2	2	3	7.00
Eluri et al. 2016	2	2	6	10.00
Greer et al. 2020	2	2	6	10.00
Hall et al. 2018	2	2	3.05	7.05
Hanley et al. 2014	2	1	5	8.00
Healy et al. 2013	2	2	4.73	8.73
Hodnett et al. 2018	2	0.5	6	8.50
Machalicek et al. 2014	2	2	4.42	8.42
Newcomb et al. 2019	2	1	4	7.00
Santiago et al. 2016	2	2	6	10.00
Scheithauer et al. 2015	2	2	5	9.00
Schmidt et al. 2016	2	1		3.00
Schmidt et al. 2017	2	2	6	10.00
Strohmeiera et al. 2017	2	2	4	8.00
Torres-Viso et al. 2018	2	2	5	9.00
Radstaake et al. 2012	2	2	6	10.00
Romani et al. 2019	2	1	5	8.00
Rooker et al. 2011	2	2	5	9.00
Rose et al. 2019	2	2	5	9.00
Roscoe et al. 2015	2	2	5.83	9.83

Table 4