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Determining the More Effective Behavior Analytic Intervention for Children with Autism Who Exhibit Pica Behaviors

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by
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Approval Page

This applied dissertation was submitted by Jennifer J. Lanham under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and School of Criminal Justice and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Abstract

Determining the More Effective Behavior Analytic Intervention for Children With Autism Who Exhibit Pica Behaviors. Jennifer J. Lanham, 2024: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education and School of Criminal Justice. Keywords: pica, autism, applied behavior analysis, eating disorders

This dissertation was designed to determine which behavior analytic intervention was more effective in the treatment and reduction of mouthing non-nutritive substances in children diagnosed with autism. This study included four participants in an A-B-A reversal design with a component analysis across four intervention phases. The study participants were enrolled in a center-based treatment environment for children with autism who displayed frequent pica behaviors that present a danger to health and create a barrier to learning. Parents have voiced significant concern for each of their children who were participants and sought out effective interventions that are generalizable across environments. The participating parents of the children and adolescents for this study received required training for appropriate replacement behaviors to maintain low to zero levels of mouthing behavior each day following the fading out of the intervention.

The writer established three treatments beginning with redirection paired with a mild punishment procedure; next was skill acquisition with discrimination training; and the third treatment applied discrimination training with a food exchange procedure, before the removal of pica treatment. Prior to treatment, each participant took part in a series of procedures that included a functional analysis and a preference assessment for foods, items, and activities that might be reinforcing. The first phase was the preintervention and baseline data collection, along with caregiver meetings and completing documentation and assessments. The second phase began with the first intervention, which used redirection of the pica behavior, response blocking with a verbal reprimand to stop the chain of behaviors leading to mouthing before contact with the non-nutritive substance and the child's mouth. The second intervention, introduced in the third phase, consisted of response-blocking paired with discrimination training and noncontingent access to preferred foods. The fourth phase included the training and execution of a food exchange procedure to replace pica items with appropriate food consumption. Lastly, the fifth phase tracked the maintenance and generalization of pica behavior when pica interventions were removed. The level of intrusiveness between phases increased with each intervention. The component analysis was based upon passage of time, which lasted 2 weeks per treatment, with the same amount of intervention for each phase received by each participant.

An analysis of the data revealed that the participants' data across all phases of intervention showed a decreasing trend, which resulted in low to zero levels of pica behavior, although two participants showed spontaneous recovery of the behavior yet also reduced pica instances during the next sessions. The intervention that reduced pica behavior to the lowest levels for all participants was Phase 4 in which the participants exchanged pica items for preferred foods. All parents expressed satisfaction with the reduction in pica, reduction of all maladaptive behavior, and improved language and social skills.

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Chapter 1: Introduction

Statement of the Problem

Children with developmental disabilities are a population in which the mouthing or ingestion of non-nutritive substances is common (Issarraras & Matson, 2018). Those diagnosed with pica or those who are not yet diagnosed display similar mouthing behaviors and need interventions that quickly and effectively reduce and eliminate these potentially dangerous, maladaptive behaviors. Blinder (2008) defined pica as a "pathological craving" (p. 66) of substances that children ingest, which are potentially harmful to the body, such as cement, plant materials, metal (Autism Speaks Treatment Network, 2014; Barrett, 2008; Bay et al., 2013; Falcomata et al., 2007; Ferreri et al., 2006; Gonyea, 2007; Hagopian, Rooker, et al., 2011; Ing et al., 2011). The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* delineates pica as the "persistent eating of non-food substances that are non-nutritious" (American Psychiatric Association, 2022, p. 280) in children of any age, categorized under feeding disorders (Cooper, 2010; Delaney et al., 2015).

Ferreri et al. (2006) further defined pica behaviors as resistant to treatment and categorized this behavior as self-injurious. The *Diagnostic and Statistical Manual* also defines pica behavior as being compulsive and non-discriminatory regarding the items tasted, placed in the mouth, or ingested (American Psychiatric Association, 2022). The self-injury resulting from the ingestion or tasting of inedible objects poses the highest level of self-harm, which may result in death after just one instance of the behavior (Ferreri et al., 2006). Call et al. (2015) stated that pica is a serious and possibly fatal form of self-injurious expression; however, applied behavior analysis (ABA) therapy focusing on behavior reduction is an efficacious method of treatment. Gale et al. (2010) also

reported ABA as providing successful treatment for children with autism who also have dangerous eating disorders by reducing the maladaptive behavior and increasing appropriate food consumption.

The non-nutritive items mouthed or ingested cause hazards of varying degrees, such as mouth sores (Delaney et al., 2015), stomach aches, digestive difficulties, "abdominal perforation and blockages" (Bryant-Waugh, 2019, p. 160), emergency medical treatment for choking or ingesting poisonous materials (Bryant-Waugh, 2019), emergency surgery to remove swallowed items, or even death (Blinder, 2008; Bryant-Waugh, 2019; Delaney et al., 2015; Ferreri et al., 2006; Hagopian, Rooker, et al., 2011; Hartmann et al., 2012; Matson et al., 2012; Young et al., 2008). In a study by Gale et al. (2010), the authors found that children may also experience "malnutrition, lethargy, weight loss, and aspiration" (p. 1383) in their discussion of eating disorders in children with autism.

Pica is commonly considered as a secondary diagnosis or condition found to be comorbid with other developmental and intellectual disorders (Call et al., 2015; Casey et al., 2012; Cooper, 2010; Matson et al., 2012; Mayes & Zickgraf, 2019). Casey et al. (2012) further reported that children are susceptible to pica resulting from hereditary and neurological components. Levy and Perry (2011) noted similar findings that mouthing and ingesting non-nutritive substances are one of the most common secondary conditions for persons with intellectual disabilities (Casey et al., 2012; Ing et al., 2011; Matson et al., 2012).

Although pica behavior remains underreported, there are high prevalence rates of 28% reported for mouthing behaviors in populations of children with comorbid diagnoses of autism spectrum disorder **(**ASD) and intellectual disability (Centers for Disease

Control and Prevention, 2016; Cooper, 2010; Mayes & Zickgraf, 2019). The Centers for Disease Control and Prevention (2016) reported that 14% of children diagnosed with ASD without intellectual disability presented with pica behavior; 10% of children with intellectual disability only, without an ASD diagnosis, have pica behavior; and pica impacts 4% of the general population of children. Children and adolescents within the ASD population make up the majority of reported and repeated rates of incidence of those who display persistent pica behavior, beyond the norm for their developmental age (American Psychiatric Association, 2022; Call et al., 2015; Falcomata et al., 2007; Kurtz et al., 2011; Matson et al., 2012; Mayes & Zickgraf, 2019). In clinic-based environments, prevalence rates of pica behavior in persons diagnosed with autism range from 22% to 25% (Call et al., 2015; Gonyea, 2007; Hagopian, Gonzalez, et al., 2011; Matson et al., 2012). These problem behaviors are concerning behaviors for parents and service providers of children with disabilities due to the need for continuous supervision and the potential for serious harm. Pica behaviors without intervention remain at high levels and may become more severe without treatment (Matson et al., 2012; Young et al., 2008). Not engaging in therapy for pica behavior translates to a high rate of potential daily risk for the children who may ingest chemicals, swallow harmful objects, or contact unsanitary substances resulting in illness.

The problem that was addressed in this dissertation was that children with a primary diagnosis of ASD exhibit mouthing behaviors that present immediate and potentially severe health risks. The topography of responses shown by the children selected for this study included but were not limited to mouthing of hands and feet, objects, and clothing with little discrimination as to what went into their mouths. Some participants for the study were children who consumed items and substances such as

plant material, paper, sand, dirt, and fecal matter. Ing et al. (2011) explained the ingestion of fecal matter, known as coprophagia, is found mainly in populations of persons with developmental delays (Bay et al., 2013; Call et al., 2015; Casey et al., 2012). Other participants in the study mouthed clothing and their own hands and fingers, and some were non-discriminate with preferred pica items.

The Research Problem

Gaps continue to exist in pica behavior research. One gap in the pica literature from Casey et al. (2012) suggested deficiencies in identification and treatment of eating disorders as a whole to determine more accurate prevalence rates for eating problems in children with autism who are in the foster care system. Although the current study did not focus specifically on children in foster care, research reported that, of the children in foster care, 77% have behavioral deficits, 61% have eating dysregulation, and 24% of those children display pica behavior. The evidence from other studies showed that children with ASD and intellectual disability have a higher rate of pica; therefore, exploring autism in children within the foster care system is an imperative part of the social crisis faced by these children. In ABA-center environments, children in foster care had Medicaid coverage, and, in many states, ABA therapy was a covered benefit to identify and treat pica behavior (Casey et al., 2012).

The review by Matson et al. (2013) discussed a clear gap in the research presented in terms of the direct comparison of effective treatment options within the field of ABA as compared to other methods of therapy, such as the areas of pharmacology and nutritional supplements. The same study also suggested that research will move toward more studies using less intrusive techniques, as compared to more intrusive intervention procedures that continue to be widely utilized (Matson et al., 2013). LeBlanc et al. (2000)

suggested implementing treatment in natural environment settings in longitudinal studies is needed for future research for a better understanding of overall intervention success.

Background and Justification

Pica behaviors include a range of topographies with varying degrees of severity. These behaviors lead to infection and illness through contact with chemicals from non-food items, ingestion of toxins, or items that may not be passed safely and require surgery, and, in some cases, death. Pica behaviors may present with symptoms such as stomach pain; constipation, along with a change in behavior; pale skin; fatigue; or gagging (Bay et al., 2013; Ferreri et al., 2006). In the study by Ing et al. (2011), the authors reported additional hazards of pica behavior, including "diarrhea, intestinal parasites, and blood-borne pathogens" (p. 151), which was also stated in the Kern et al. (2006) study. The *Diagnostic and Statistical Manual* states that pica must occur for more than 30 days; however, there are no frequency definitions included (American Psychiatric Association, 2022). The only indication is a persistent mouthing or ingestion of non-nutritive substances. Individuals with developmental disabilities and pica behavior who live at home have a prevalence rate of 0.3% to 14.4%, and those who live in residential settings have a prevalence rate of 25.8% (Ashworth et al., 2009; Call et al., 2015; Delaney et al., 2015; Gal et al., 2011; Gonyea, 2007; Hagopian, Gonzalez, et al., 2011; Hagopian, Rooker, et al., 2011; Ing et al., 2011; Matson et al., 2013; Roscoe et al., 2013). These numbers are significant, as ASD is a neurological and developmental disabilities, and pica was more commonly diagnosed in persons with an ASD diagnosis (Casey et al., 2012; Hagopian, Rooker, et al., 2011). Falcomata et al. (2007) reported prevalence rates of 10% to 20% for those with developmental disabilities and reported that the annual cost of these maladaptive behaviors in the United States alone is more than "$3.5 billion" (p.

351), which led to placement in residential facilities for persons with developmental disabilities. Treatment cost for long-term care is another essential indicator that supports early intervention and treatment for children to reduce pica behavior before adolescence.

Infants with eating abnormalities may present with food refusal and weight loss and Gale et al. (2010) reported that one third of persons with developmental disabilities have feeding issues. Sixty-seven percent of parents with children diagnosed with autism said their children are picky eaters, which include those who mouth objects and show pica behavior (Gale et al., 2010). Mayes and Zickgraf (2019) indicated that children with autism display "atypical eating behavior" (p. 76) beginning in infancy. Dr. Rowland Barrett (2008) reported that children ranging from 1 year to 6 years of age have a feeding disorder prevalence rate of 10% to 32%; however, these rates do include neuro-typical children within the developmental age for mouthing behaviors based upon oral examination of the environment. Mayes and Zickgraf found a gap in children between the ages of 1 and 6 due to a lack of identification of pica behavior and delayed autism diagnoses.

Hagopian, Gonzalez, et al. (2011) reported "parasitic infection, choking, and gastrointestinal blockage/obstruction" (p. 309) as additional health risks incurred by children with disabilities and mouthing behaviors, which echoed many other studies (Ferreri et al., 2006; Ing et al., 2011). Children qualify for a diagnosis of autism beginning at a mean age range from 38 to 120 months, as missed milestones are evident at this age, such as communication deficits, repetitive behavior, and lack of social engagement, although authors state diagnosis for ASD occurs before 24 months (Van't Hof et al., 2021). Gabbay-Dizdar et al. (2022) discussed the recommendation for autism screening between 1.5 years and 2.5 years and found 65% of children who receive an

ASD diagnosis are under the age of 2.5 years. The Blinder (2008) study reported prevalence rates for children between 18 and 36 months as 50%, as most occurrences of pica behavior are part of typical development for this age. Pica behavior is underreported for infants and toddlers, as mouthing behavior is a normal part of development before age 2 (Bhatia & Kaur, 2014).

Pica behavior is most prevalent among children diagnosed with autism at the elementary level, which puts them at risk for this life-threatening practice; 10% to 15% present with pica behaviors and behavior topographies like pica (Barrett, 2008; Casey et al., 2012; Gale et al., 2010; Hagopian, Gonzalez, et al., 2011). Gale et al. (2010) divided eating and feeding issues into three categories. The first starts at infancy and toddler age with severe problematic behaviors, the second includes eating and feeding disorders occurring following trauma from infancy through adulthood, and the third is early development of these disorders across various eating and feeding issues.

Adolescents are also vulnerable to pica behavior, particularly those with developmental disabilities (Casey et al., 2012; Falcomata et al., 2007). Blinder (2008) reported that pica behavior decreased over time, yet stated that 10% of children over the age of 12 years old display this behavior. Falcomata et al. (2007) developed a treatment package for a 12-year-old male with autism and self-injury in the form of pica to understand the stimulus control measures that maintain pica behavior. The study found that the control of pica behavior was maintained by stimuli that were not intended as the primary stimulus within the environment. The Falcomata et al. research showed results comparable to the previous Rincover and Koegel (1975) study that compared incidental and intended stimuli to understand what environmental elements may keep pica behavior intact.

Interventions using reinforcement or punishment procedures may reduce and maintain low levels of pica behavior; however, finding an intervention that reduces the pica response quickly is imperative to the safety and overall well-being of those inflicted with this disorder (Ferreri et al., 2006; Minshawi, 2008). Some children with autism who present with low-frequency mouthing behavior may need to contact a mild intervention, such as redirection, positive practice, or maintenance with conditional discrimination skills (Ferreri et al., 2006) to reduce levels of mouthing. Children with autism who present high-frequency, high-intensity, or high-risk mouthing behavior may be resistant to reinforcement procedures and conditional discrimination training without also pairing these procedures with punishment procedures (Ferreri et al., 2006; Kern et al., 2006; LeBlanc et al., 2000; Minshawi, 2008). Neither the *Diagnostic and Statistical Manual* nor the current literature clearly defines high-frequency pica behavior, yet only refers to the persistent eating of non-nutritive substances (American Psychiatric Association, 2013, 2022). For the purposes of this study, acceptable levels of frequency were determined for each participant individually, following the collection of baseline data. Hirsch and Smith Myles (1996) found discrimination training, differential reinforcement, and multiple interventions all produced moderate results in the reduction of pica behavior, but the researchers noted that many of these procedures required a clinical setting and multiple staff to implement. Their study focused on an intervention that may be effective in less restrictive environments using a “pica box” (Hirsch & Smith Myles, 1996, p. 222). The pica box was designed as a lesser restrictive treatment option to reduce pica behavior by allowing access to pica substitute items with similar textures and qualities to preferred pica items (Hirsch & Smith Myles, 1996). The substitute items could be safely consumed or mouthed by the participants. Punishment procedures for pica behavior must be

implemented ethically by trained staff consistently and show long-term reductions and eliminations of unwanted mouthing behavior; however, replacement behaviors should be trained simultaneously (Minshawi, 2008).

Deficiencies in the Evidence

Weaknesses in the evidence are apparent, with a lack of current research addressing pica behavior with large groups of participants. Another weakness is the lack of literature using taste aversion to treat the mouthing of non-nutritive substances. In many instances, these behaviors present imminent danger and may require a more intrusive intervention that will drastically reduce the harmful items that individuals contact or ingest. Future research for effective reduction and maintenance of pica behavior at near-zero levels is warranted. Studies regarding parental involvement during interventions for mouthing behaviors are not available, which creates a significant gap in the evidence for this specific treatment modality. However, parental involvement and training for more general problem behaviors are apparent in the literature (Casey et al., 2012; Jarmuz-Smith, 2011; Karge & Lasky, 2011; MacKenzie, 2007), which are generalizable to interventions across environments including those discussed in this study. The most current behavioral training programs for parents were the RUBI model (Bearss et al., 2018). The current literature reflects small sample sizes of one to 11, which make overall and long-term success unclear (Kern et al., 2006), which limits the ability to generalize some parental training programs.

Audience

Patients who suffer from a disorder such as mouthing non-nutritive substances or present with some of the markers of pica disorder would benefit from further research in this area. Having a reliable, individualized plan backed by empirical evidence may save

and change the lives of the children and families dealing with dangerous pica behavior. Professionals who research, assess, and design individualized programs, as well as create behavior intervention plans, will also benefit from current research. The professionals implementing the interventions included clinical staff, and all clinicians received ethics training for effective and humane interventions that minimize the intensity of punishment procedures.

A great benefit of the study consisted of support and education for parents and caregivers of the children who received the intervention for pica behavior as they learned effective methodologies to protect and care for their child. Embregts et al. (2010) stressed the importance of family education, training, and support when caring for children with special needs, displaying maladaptive behaviors. In the Gale et al. (2010) study, children were more successful in consuming appropriate foods when presented by a parent, demonstrating the critical role parents and their training play in providing a comprehensive treatment package to address pica behavior.

Setting of the Study

The research setting for the study was a center-based clinical environment. The participating center is an ABA center in Indiana. The center provides ABA therapy, behavior consultation, and parent training for children with a primary diagnosis of autism, many of whom have comorbid diagnoses. Following an initial evaluation, the level of support and location needed for a comprehensive treatment package was determined individually to customize the care, the medically necessary recommended number of weekly hours, and individualized treatment and behavior intervention plans the children receive. The funding sources are a blend of commercial insurance, state funding, private pay, and funding from the U.S. Department of Education and are specific

to each child. The children range from 2 years old to 14 years old. Assessments are conducted, and individualized programs and interventions are written for each child. The collaboration of care between the center, home, physicians, educators, and other service providers is essential for successful outcomes of each child (Casey et al., 2012). The center in the current study works across multidisciplinary teams composed of caregivers, physicians, Board-Certified Behavior Analysts (BCBA), Speech-Language Pathologists, and Occupational Therapists, and educators.

Researcher's Role

The researcher is a BCBA and has served as an Executive Board member for Hoosier Association for Behavior Analysis, which is Indiana's chapter of the Association for Behavior Analysts. She has presented three behavior analytic lectures for the Association of Behavior Analysis International and currently serves as the Chief Executive Officer for Alphabet Soup ABA. In this role, the researcher has designed the ABA center environment, developed operations, and created the development of the financial and clinical model; she also oversees the day-to-day operations of all aspects of the company. The researcher has worked with children with autism for 17 years. The researcher trained Board-Certified Assistant Behavior Analysts (BCaBA) and Registered Behavior Technicians (RBTs) to assist with data collection for the study, implementation of the behavior intervention plans, and assistance to the researcher in any way required for the study.

Purpose of the Study

The purpose of the study was to examine and compare ABA methodologies of reinforcement and consequence-based interventions, which data show as the most immediately effective techniques for the reduction or elimination of pica behaviors. This

study was designed to determine the intervention package that eliminates or reduces pica behavior in an abbreviated period and to add to the current research. Techniques to include parents in the training protocol will support generalization of techniques to environments outside the clinical setting (i.e., home).

Definition of Terms

Mouthing behaviors range in definition and severity in elementary-aged children with a primary diagnosis of autism. To read the study, one must understand the terms found within the content. For the purpose of this applied dissertation, the following terms are defined.

Antecedent Condition

This term refers to the stimulus that occurs immediately before the observed behavior (Cooper et al., 2019).

Applied Behavior Analysis (ABA)

This term refers to the science of the study and change of behavior, using empirical, evidence-based experimentation to manipulate specific variables to find the function of the behavior (Cooper et al., 2019).

Automatic Reinforcement

This term refers to behavior that occurs without “social consequence” (Kern et al., 2006, p. 136) and is considered to be an intrinsic sensory stimuli, regardless of the environment and directly aligned with the function of the behavior (LeBlanc et al., 2000).

Biological Interventions

This term refers to treatment options using medical treatments in replacement of, or along with behavioral therapy (Matson et al., 2013).

Coprophagia

This term refers to the ingestion of fecal matter (Cooper et al., 2019; Cooper, 2010; Ing et al., 2011).

Differential Reinforcement of Alternative Behaviors (DRA)

This term refers to the "arrangement of positive contingencies" (Jessel et al., 2015, p. 402).

Differential Reinforcement of Other Behaviors (DRO)

This term refers to "the reinforcement of any behavior other than the target behavior" (Jessel et al., 2015, p. 402).

Extinction

This term refers to when a previously elicited behavior no longer does so (Garcia-dela Torre et al., 2010).

Hand-Mouthing

This term refers to placing or attempting to put one's hand in the mouth in a consistent manner, such as licking, sucking, biting, or holding hand in the mouth (Roscoe et al., 2013).

Independent Discard

This term refers to the participant's unprompted disposal of pica items (Hagopian, Gonzalez, et al., 2011).

Mouthing

This term refers to any inappropriate items crossing the plane of the lips, attempting to put a non-nutritive substance in the mouth, licking non-nutritive elements, placing objects in the mouth, or ingesting non-nutritive substances, such as child's shirt, necklace, playdoh, toys, or trash or dirt from the floor (Matson et al., 2012; Tarbox et al.,

2007).

Noncontingent Reinforcement

This term refers to providing a stimulus that is a known reinforcer for an individual. Reinforcement is offered on a continuous schedule, without a demand or behavior expectation that qualifies access, or "no contingency" (Cooper et al., 2019, p. 489).

Non-Nutritive Substance

This term refers to a non-food item that may or may not cause harm when tasted or ingested (Matson et al., 2012).

Pathological Craving

This term refers to continuous attempts to mouth, taste, or ingest an item without nutritive value that may be harmful to health or presents a hinderance to learning (Blinder, 2008).

Pica

For the purpose of this study, this term will be defined as the first movement in the chain of behaviors to move a pica item toward the mouth to taste, lick, bite, or ingest a non-nutritive or inappropriate food item (Kern et al., 2006).

Positive Reinforcement

This term refers to the stimulus provided directly after a behavior that increases the likelihood that the behavior will occur again in similar circumstances (Cooper et al., 2019).

Redirection

This term refers to prompts toward an alternative item or activity (Hagopian, Gonzalez, et al., 2011).

Response Interruption

This term refers to the disruption of the unwanted response (Hagopian, Gonzalez, et al., 2011).

Stimulus Control

This term refers to the relation between the stimulus presented as an antecedent and the topography of the behavior immediately following (Cooper et al., 2019).

Taste Aversion

This term refers to a procedure that pairs an unwanted behavior (e.g., Pica) with an aversive taste stimuli to reduce the target behavior selected for reduction and to "decrease the desire to taste or ingest inedible items" (Casey et al., 2012, p. 318).

Chapter 2: Literature Review

Theoretical Perspective

The interventions that were used in this study are based on ABA, which developed from Skinner's (1965) theory of behaviorism. ABA had its beginning with Watson in 1913, who became known as the father of behaviorism. In his work, Watson focused on measurable and observable aspects of behavior instead of the previous introspective treatments. In the 1920s, Skinner advanced the study of behavior using operant conditioning and radical behaviorism to measure behavior in various environments and experimental conditions (Cooper et al., 2019). The concepts of the founders of ABA are now applied in various settings, such as clinics, homes, schools, and in the community, to treat individuals with problematic behaviors and skill deficits. This study used ABA to identify effective interventions for the treatment of pica in children with autism.

Nutrition and appropriate eating skills are essential for the overall quality of life and an individual's well-being. Gal et al. (2011) described the ability to eat as part of the development of social, daily living, and physical skills, which may be harmful to individuals who do not receive treatment for eating deficits and disorders. Children diagnosed with autism who also display insufficient eating and discrimination skills are at risk for malnutrition and life-threatening circumstances. Appropriate interventions address the skill deficits that are present within the domains of autism necessary to reduce and eliminate pica behaviors that inhibit health, safety, and wellness. The critical domains of autism include stereotypy, restrictive and repetitive behavior, deficits in social and emotional exchanges, and notable deficits in communication (American Psychiatric Association, 2022). The American Psychiatric Association defines severity

levels ranging from 1 to 3, with the first level needing some support, Level 2 requiring substantial support and treatment, and Level 3 requiring a high level of support (American Psychiatric Association, 2022). Multiple strategies and combined interventions are typical courses of treatment to build appropriate eating and safety skills. Gal et al. further noted that future placement and levels of support depend significantly on an individual's ability to eat independently, which may be the difference between community and institutionalized living.

Clinicians using reinforcement and punishment procedures must abide by strict ethical guidelines to reduce and eliminate dangerous pica behaviors. The theoretical perspective is grounded in the work of Ferreri et al. (2006). They used punishment in the form of taste aversion for treating pica and response-blocking used by Hagopian, Gonzalez, et al. (2011) and LeBlanc et al. (2000). The research suggests that punishment procedures are not a modern-day modality of treatment for severe problematic behaviors (Matson et al., 2013; Minshawi, 2008). Several studies indicated that punishment procedures produced a quick reduction in abhorrent behavior, whereas reinforcement procedures alone took longer to show lower frequencies or never reduced behavior to acceptable levels without additional intervention components (Ferreri et al., 2006; LeBlanc et al., 2000; Matson et al., 2013; Minshawi, 2008).

Hagopian, Gonzalez, et al. (2011) reported that punishment procedures are not a contemporary methodology, although they do produce high rates (80%) of reduction in pica behavior when included in a behavioral treatment package. Matson et al. (2013) reviewed a study by Williams et al. (2009), indicating that punishment may not be the first treatment methodology of choice in current research. Results suggested that some use of punishment procedures produced a quick reduction in dangerous behavior,

whereas reinforcement procedures typically take longer to show reductions or never reduce behavior to acceptable levels without additional intervention components (Ferreri et al., 2006; Minshawi, 2008).

Benefits of ABA Intervention

The benefits of ABA intervention in children with autism who display pica behaviors are multi-faceted. The most critical point is the reduction or elimination of severe health risks to the child. Additionally, families benefit from training, education, and support from BCBAs who supervise their child's treatment. Parents and caregivers of children with pica behavior must always be hypervigilant to ensure their child's health, safety, and wellness (Mayes & Zickgraf, 2019). With successful treatment, parents have tools to reduce the amount of intense oversight, such as the ability to make a meal or use the restroom without fear of their child consuming a non-nutritive substance. With successful intervention, children are more likely to be included in general education settings with a higher staff-to-child ratio. Children who receive successful treatment are also more engaged and able to participate in social situations with peers. Cooper (2010) found behavioral therapy to be nearly unique, in terms of effective and positive outcomes, for individuals with developmental disabilities. Casey et al. (2012) recommended ABA and the strategies of positive reinforcement and, at times, the need to move to strategies using aversive pairings, such as taste aversion. Mayes and Zickgraf (2019) recommended ABA for early intervention for children with autism and pica behavior, as ABA is highly effective with atypical eating behaviors.

Understanding Pica Behavior

It is important to understand the topographical nature of pica when identifying pica behavior. As established by Sturmey and Williams (2016), some characteristics of

pica may overlap with other diagnoses, such as “hand-mouthing” (p. 146), which may be an indicator of social deficits. Hand-mouthing determined to be pica behavior would instead be persistent, have an automatically reinforcing function, and impair learning, health, and overall functioning (Sturmey & Williams, 2016). Other topographical indicators of pica behavior involve restrictive and repetitive actions surrounding eating, which may overlap with food selectivity and not qualify as pica behavior. To determine pica behavior, the persistence and risks to health are the differentiating factors (Sturmey & Williams, 2016).

As reported by Blinder (2008), there are many contributing factors to the development of pica behaviors, including developmental disabilities, history of learning, preferred tastes and textures, need for oral stimulation, inadequate parental supervision, and socioeconomic and cultural norms commonly found in children. It is rare that a report in the research literature states that pica is the sole behavioral issue for a child, as pica behavior presents comorbidly with other diagnoses such as autism (Blinder, 2008; Casey et al., 2012). Pica behavior and preferred pica items vary by individual. Examples of pica items include the mouthing or ingestion of hair (Sturmey & Williams, 2016), earth (Delaney et al., 2015; Sturmey & Williams, 2016), feces (Mayes & Zickgraf, 2019; Sturmey & Williams, 2016), chalk (Delaney et al., 2015), magnets (Rosenfield et al., 2013), clothing (Mayes & Zickgraf, 2019; Sturmey & Williams, 2016), string (Mayes & Zickgraf, 2019; Sturmey & Williams, 2016), paper (Delaney et al., 2015; Mayes & Zickgraf, 2019; Sturmey & Williams, 2016), coins and metals (Mayes & Zickgraf, 2019), cigarette butts (Falcomata et al., 2007; Sturmey & Williams, 2016), and plant material (Kern et al., 2006; Sturmey & Williams, 2016). Ice may constitute a pica item if it interferes with typical daily functioning or presents damage to teeth or overall health

(Casey et al., 2012; Delaney et al., 2015; Sturmey & Williams, 2016).

Interventions for pica behaviors discussed in the research literature range from less intrusive procedures, such as planned ignoring (Cooper et al., 2019), to more intrusive punishment procedures (Matson et al., 2012). Additional studies are needed for quick, effective, and long-lasting methods to reduce the dangers associated with this type of disorder. Research supporting automatic reinforcement as the most common function of pica behaviors and intervention using reinforcement instead of punishment was published by Morrison et al. (2011). In the LeBlanc et al. (2000) study, researchers noted that differential reinforcement effectively reduced behaviors that function as automatic reinforcement or are stereotypic. The quantitative evaluation of four individuals with autism began with preference assessments and used the most preferred items for high levels versus low levels of interaction (LeBlanc et al., 2000). Pica behaviors function predominantly as automatically reinforcing or stereotypic behavior, which is resistant to intervention (Autism Speaks Treatment Network, 2014; Barrett, 2008; Falcomata et al., 2007; Ferreri et al., 2006; Hagopian, Rooker, et al., 2011; Kern et al., 2006; Tarbox et al., 2007). LeBlanc et al. (2000) defined automatic reinforcement as “behavior maintained without consideration for socially mediated reinforcement” (p. 139).

Socially mediated refers to behavior that is maintained and reinforced by attention (Cooper et al., 2019). The function of some pica behavior in children with autism is attention seeking. When provided positive reinforcement, the likelihood that the pica behavior will recur increases (Barrett, 2008). Pica behavior may present because of the imitation of others, physical or nutritional deficiencies, and culturally appropriate practices (Barrett, 2008; Bay et al., 2013; Cooper, 2010). In their study of children in the foster care system, Casey et al. (2012) reported that pica behaviors may also result from

trauma and physiological shock based upon environmental and social factors, while citing the same explanations as the previous authors. For more severe instances of pica behavior, punishment procedures may reduce the response faster; however, the benefits must outweigh the costs and the practice of ethical standards required throughout treatment. As the ABA field has developed, antecedent strategies are preferred to treat maladaptive behavior, instead of punishment procedures (Matson et al., 2013; Minshawi, 2008).

Further Examination of Pica Behavior

Blinder (2008) introduced mouthing prevalence in populations of children with autism and discussed potential causes and suggested interventions. The quantitative study compared ethnic groups and cultural reasons for pica in some countries. Interventions such as a change in diet are recommended to treat some forms of pica (Blinder, 2008). The author also reported that oral fixation might be a driving factor in some instances of pica behaviors and found access to appropriate alternative stimuli was effective in the initial reduction of the expression of pica. Blinder defined pica as a "pathological craving" (p. 66) for ingested substances potentially harmful to the body, such as cement, plant materials, and metal. According to the American Academy of Family Physicians (2018), the most common pica items ingested are dirt, clay, and flaking paint. Mayes and Zickgraf (209) found the most common pica items in their study to be "crayons, soap, paper, feces, and Play-Doh" (p. 80). Lesser mouthed or ingested pica items include hair, feces, and cigarette ashes (American Academy of Family Physicians, 2018). The literature reports the most to least occurring pica items but does not indicate the individual prevalence of the items. Non-nutritive items mouthed or ingested cause hazards of varying degrees such as damage to the mouth, tongue, and teeth (Bhatia &

Kaur, 2014; Cooper, 2010; Delaney et al., 2015), digestion difficulty (Sturmey & Williams, 2016), emergency medical treatment for choking or ingesting poisonous materials (Bhatia & Kaur, 2014; Falcomata et al., 2007), emergency surgery to remove swallowed items (Bhatia & Kaur, 2014; Matson et al., 2013), or death (Kern et al., 2006; Matson et al., 2013). Delaney et al. (2015) reported additional consequences of pica behavior to include infections, gastrointestinal obstruction, (Blinder, 2008; Delaney et al., 2015; Falcomata et al., 2007), and toxins in the body that could result in critical health issues or death. Gal et al. (2011) reported additional risks associated with pica and feeding disorders, which include aspiration and poisoning from objects and substances that are non-food items, along with malnutrition and underdevelopment (Falcomata et al., 2007). Gale et al. (2010) also stated that malnutrition and aspiration (Falcomata et al., 2007) are serious concerns for children with autism and pica behavior. Blinder (2008) reported that pica has "broad epidemiological implications" (p. 72), such as physical and intellectual impairments that may be severe in response to pica behavior and the consumption of toxic or inedible substances. Incidental outcomes of pica behavior include social stigmas, disconnection from family members, reduction of overall independence and quality of living, and limitations in overall development (Gal et al., 2011; Stasolla et al., 2014). Stasolla et al. (2014) stressed the level of social impact mouthing behaviors may have on children with autism. They also emphasized that the goal of intervention should be twofold to reduce unwanted behavior and build the necessary skills to replace aversive behaviors (Stasolla et al., 2014).

Cooper (2010) wrote that pica behavior reflects a history of learning, which is found in many children with autism when understanding behavioral concerns (Delaney et al., 2015). Learned behavior is a powerful barrier, as treatments are designed to retrain

individuals and their families to break cycles that reinforce maladaptive behavior by strengthening appropriate responses. Actions that may present as pica but are not categorized as pica include age-appropriate mouthing, defined by placing objects on or in the mouth during exploration by a child under 18 months of age (American Psychiatric Association, 2022; Blinder, 2008). Additionally, non-examples of pica behavior include chewing or ingesting food items, such as ice, frozen foods, uncooked foods, or low-nutrient foods (Delaney et al., 2015). Eating ice would not be considered pica behavior unless the level impeded the consumption of proper nutrients, was continuous as in craving or obsession, or was at a level that is damaging to the teeth. Gal et al. (2011) reported children with autism may demonstrate eating problems when denied access to a wanted item, when the individual is unable to get the same sensory input appropriately, and when the child shows fixed or repetitious behavior.

Prevalence

Prevalence rates of pica in the general population are not easy to obtain. Delaney et al. (2015) reported the overall population prevalence for pica behaviors is inconclusive. The authors compared typically developing peers to children with autism and found those with autism are far more likely to display pica behavior, $X^2 = 12.13$, $p = .0005$. Ashworth et al. (2009) found that males have a higher incidence of pica behavior, $X^2 = 12.59$, $p = .0004$, a lower cognitive ability, $X^2 = 40, 15$; $p < .0001$, and display more outward aggression, $X^2 = 21.52$, $p < .0001$. In the 2019 study by Mayes and Zickgraf, the authors found that 11.6% of the children with autism also presented with pica behavior. Kern et al. (2006) and Delaney et al. (2015) described pica as particularly prevalent in children with developmental disabilities. The operational definition of pica may also show underreporting or overreporting of pica behavior. Some include the consumption of ice,

uncooked pasta, or cornstarch; however, other clinicians may not include the consumption of edible items (Delaney et al., 2015). Ongoing pica behavior may not be reported or considered a problem until a health emergency arises. The literature consistently shows higher incidence rates in persons with developmental and intellectual disabilities (Casey et al., 2012; Delaney et al., 2015; Ferreri et al., 2006; Gal et al., 2011; Gale et al., 2010). The current study included any item that is mouthed or ingested to the extent that it poses a health hazard and limitations to more independence and quality of life.

When Pica Behavior Presents

When pica behavior begins, it is essential to seek medical and behavioral intervention. If a child or adolescent is compelled to eat non-food items and is beyond 18 months old, he or she should be assessed for developmental or intellectual disorders, as well as for pica (American Psychiatric Association, 2013). The earlier an intervention begins, the faster it may be resolved and save a life and maintain proper health and nutrition. A full medical assessment will help rule out any physical limitations or deficits that a physician addresses, such as low iron or zinc. Bhatia and Kaur (2014) indicated that many children with pica behavior also have low levels of iron and zinc and found that lower levels of Dopamine contribute to the continuation of these behaviors. Bay et al. (2013) found their participants with pica behavior had low levels of iron, selenium, and zinc, yet they found no significant correlation between the two. Blinder (2008) indicated that pica has potential links to iron, zinc, and calcium deficiencies in their study. In the analysis by Mikami et al. (2010), researchers suggested two “cardinal features” (p. 249) of pica behavior, which include poor impulse control and Dopamine “dysfunction” (p. 250). There are many hypothetical factors regarding the etiology of pica behavior in the

current literature, including socioeconomic, cultural, environmental, and nutritional (Bay et al., 2013; Bhatia & Kaur, 2014; Casey et al., 2012; Delaney et al., 2015). However, Mayes and Zickgraf (2019) did not find nutritional deficiencies in most children with autism in their study of 1,462 children.

Bryant-Waugh (2019) published a review of the current literature for feeding and eating disorders. This review included children with pica behavior who also have autism. The author defined the most common etiology of pica as complex with individual differences. The differences reported included self-stimulatory behavior and automatic reinforcing behavior, sensory needs, and malnourishment, which was also found by Bhatia and Kaur (2014) and Falcomata et al. (2007). Once underlying contributing factors have been considered, and medical issues addressed, the child or adolescent may be referred to a BCBA to work on individualized behavior interventions to reduce pica behavior. ABA and behavioral treatment were the most recommended treatment for pica disorders (Bryant-Waugh, 2019; Call et al., 2015; Gale et al., 2010; Matson et al., 2013). Matson et al. (2013) included biological interventions as a treatment option but recommended, based on current research, that behavioral therapies be applied first as medications can have lifelong harmful side effects. The authors also stated that most of the research for pica has been in the field of ABA (Matson et al., 2013).

The Need for Intervention

Pica behavior has severe consequences for health, wellness, and safety, and has secondary implications such as social isolation and the need for more intensive support for children with autism. Casey et al. (2012) described the need for preemptive therapies with individualized interventions, as well as generalization of treatments to any environment. Pica behavior is a limiting element for proper mental and physical growth

and has the potential to be fatal (Blinder, 2008; Bryant-Waugh, 2019; Delaney et al., 2015; Ferreri et al., 2006; Hagopian, Rooker, et al., 2011; Hartmann et al., 2012; Kern et al., 2006; Matson et al., 2012, 2013; Young et al., 2008). Families with children who exhibit pica behavior must always be hypervigilant in supervision, which has adverse outcomes for the relationship between the parent and child due to exhaustion, the necessary arrangement of a sterile environment, and the continuous management of the disorder (Casey et al., 2012). This form of self-injury leaves the child susceptible to ongoing barriers that preclude the individual's highest level of learning and positive outcomes. Research shows that the comorbidity of autism and pica behaviors may also be associated with other eating disorders (Delaney et al., 2015) or obsessive-compulsive disorder (Ing et al., 2011; Rohde et al., 2013), which creates an additional layer of treatment and concern for families and therapists.

Current Interventions

The current body of research includes a wide range of evaluated interventions for the effectiveness in reducing pica behavior in children with autism. Rohde et al. (2013) studied pharmacological interventions utilized to integrate medications, which showed little success in overall decreases of pica behavior. This study included an adolescent who developed pica behaviors at the age of 12 years old. His treatment targets included other psychological disorders and pica, but most combinations of medication were ineffective for reducing these behaviors (Rohde et al., 2013). The combination that showed a slow improvement in pica behavior in this study included "carbamazepine (800mg/day), Clozapine (300mg/day), diazepam (40mg/day), and low doses of zinc" (Rohde et al., 2013, p. 89), which also showed a slow reduction in aggression. A declining trend for the frequency of pica attempts is impactful yet very concerning that the decline was at a slow

rate when the child was ingesting hazardous items such as cigarettes, fecal matter, batteries, clothing, and a kitchen knife (Rohde et al., 2013). The authors suggested that the severity of this behavior warrants a more intensive intervention to save the child's life, which may include a punitive consequence at the first attempt to mouth an inedible object.

Replications From Previous Research

Falcomata et al. (2007) replicated a study by Rincover and Koegle from 1975. The purpose of each study was to determine the maintaining stimuli for pica behavior and to uncover any unintended items of stimulus control throughout the invention (Falcomata et al., 2007; Rincover & Koegel, 1975). The intervention paired an intended neutral stimulus, such as a colorful piece of cardboard (Falcomata et al., 2007), with a consequence (e.g., verbal reprimand or response blocking) for pica behavior. The hypothesis for the studies concluded that fading the intervention occurred when the neutral stimulus was paired with the consequence. Falcomata et al. found that the neutral stimulus was not an effective stimulus for pica reduction. Instead, the behavioral therapist's presence was the unintended stimuli that maintained lower levels of pica behavior (Falcomata et al., 2007). Falcomata et al. extended the body of research for discriminative responding pertaining to the reduction of pica behavior.

Preventative Care and Antecedent Strategies

Caring for a child with autism is extremely challenging for parents and caregivers. Providing options for therapy, such as ABA, gives hope, support, and solutions to some of their most significant concerns. When a child with autism also displays pica behavior, it becomes even more critical to set up the environment for success. Hirsch and Smith Myles (1996) trained parents to vacuum regularly at home and keep trash cans out of

reach, while requiring that therapists do the same cleaning in the center environment. Additionally, the Hirsch and Smith Myles study trained parents to use select clothing at night to restrict the child from accessing her diaper, which she would regularly consume. As an antecedent strategy, the researchers used discrimination training to help the child recognize the difference between trash and food.

Matson et al. (2013) reviewed a case study of a male with autism who engaged in the wiping of feces on himself or objects and coprophagia. The parents' training consisted of a change in their son's daily schedule, such as shower and playtime, which ended the pica behavior (Matson et al., 2013). An additional study reviewed by Matson et al. had promising results with three children with autism and pica behavior. The children practiced throwing away pica items along with an environment set up with objects or activities for engagement, and reinforcers were readily available (Matson et al., 2013). Setting up the environment for success and safety includes preparation for therapy staff and parents concerning available foods and reinforcers to deliver immediately after the appropriate behavior is displayed (Casey et al., 2012). The current study used a paired stimulus preference assessment to determine what would be highly motivating for each child.

Antecedent strategies are a critical component of any treatment package in ABA. Every learner had the environment arranged and set up for the most significant possibility for success. One such example is to have preferred food items available, considered as noncontingent access to reinforcement (NCR) strategy, so the response cost of finding non-food items is higher than having quickly available appropriate foods for tasting or ingesting. In the Kern et al. (2006) investigation, the authors added that using NCR with sensory input with the mouth was more effective in reducing pica behavior than without.

Another antecedent strategy in an ABA center environment is to continually engage with the child and provide reinforcement in the form most meaningful to that child when the appropriate behavior is displayed (Brusa & Richman, 2008). For example, if the child is asked to match three items to the pictures and does so at the level expected, the child will receive praise or a tangible item (i.e., positive reinforcement) to demonstrate that this is the behavior that should occur again in the future.

Reinforcement Strategies

Tarbox et al. (2007) used reinforcement procedures to reduce pica behavior in two boys who were 4 and 5 years old. The researchers used preferred items and blocked access to toys and other pica items used for mouthing and stereotypic behavior. A hypothesis was developed, which stated that using an incompatible behavior, in this case playing with items in an appropriate manner, would decrease the child's ability or interest in mouthing and stereotypic behavior. LeBlanc et al. (2000) found that using competing stimulus approaches alone for actions with stereotypical functions does not consistently or entirely reduce abnormal behavior. Response blocking revealed no change in efficacy when the quantitative data were collected. Response blocking refers to the physical interruption in a child's ability to engage in mouthing behavior with an inappropriate item (Kearney et al., 2005; Kern et al., 2006).

Barrett (2008) affirmed that preventative treatments, such as response blocking and differential reinforcement, are effective in reducing pica behaviors with a comprehensive treatment package (Kern et al., 2006; Tarbox et al., 2007). The key findings in the above research indicated that response blocking is most effective in reducing mouthing behavior when not used alone. Response blocking, however, is a punishment procedure but successful when paired with reinforcement strategies, as

discussed by Kearney et al. (2005), Kern et al. (2006), and Barrett in 2008. Hagopian, Gonzalez, et al. (2011) reviewed 34 pica case studies and concluded that intervention packages using methodologies of reinforcement and response reduction are efficient in reducing pica behavior. Matson et al. (2013) reviewed the study by Hagopian, Gonzalez, et al. and agreed that intervention packages were most successful in the overall reduction of pica behavior and that packages using less intrusive methods of ABA were showing favorable outcomes, particularly the use of noncontingent access to reinforcement.

Differential Reinforcement of Other Behaviors (DRO) and Noncontingent Reinforcement Strategies (NCR)

Reinforcement strategies such as differential reinforcement of other (DRO) items and NCR have been shown in the research literature to be effective strategies to reduce pica behavior (Jessel et al., 2015; Weston et al., 2023). NCR procedures allow the learner to access items without displaying the target behavior (Jessel et al., 2015). DRO strategies use competing behaviors to make it difficult or less likely to exhibit pica behavior (Jessel et al., 2015). Behavioral treatment using DRO strategies is commonly used in ABA to reduce aversive behaviors. DRO procedures offer appropriate reinforcers following a period without engaging in unwanted behavior, intending to minimize inappropriate reinforcement items or actions, such as pica (Jessel et al., 2015). Unwanted behavior put on extinction occurs by using DRO and has a punishment effect, by not reinforcing those instances, whereas concurrently, the presence of acceptable target behavior received reinforcement (Jessel et al., 2015; Minshawi, 2008).

One study reviewed by LeBlanc et al. (2000) used a DRO with an intermittent schedule of reinforcement ranging from 5 seconds to 60 seconds, which researchers concluded was not effective in reducing maladaptive behavior. Jessel et al. (2015)

described DRO as existing in a group of reinforcer strategies, and the use of this methodology creates negative contingencies for the learner, indicating that there is no reinforcement available if the wanted behavior does not occur. For example, teaching a child to eat a variety of foods, put hands in pockets, or chew gum would compete with the ability or compulsion to taste non-food items. Allowing a child to have noncontingent access to preferred foods may also reduce the likelihood of pica behavior. Gale et al. (2010) indicated that differential stimulus reinforcement with the presentation of a pairing of preferred and non-preferred foods are more effective than using a delayed reinforcement strategy that delivers a preferred food contingent upon the consumption of a non-preferred food. Ferreri et al. (2006) cautioned that less intrusive interventions such as DROs and discrimination training may have mixed results and not work as quickly or effectively as a punishment-based intervention for the dangers of pica behavior. Whereas DRO is considered a negative contingency, NCR arranges for no contingency and is critical to discriminate when deriving a treatment plan for a child with maladaptive behavior (Jessel et al., 2015; Minshawi, 2008). NCR is a methodology where the child is given free access to items that are motivating to continue displaying the appropriate behavior. Matson et al. (2013) reviewed an earlier study by Piazza et al. (2000) that used NCR alone with a group of four children with autism and found promising results in reducing the level of pica behavior.

LeBlanc et al. (2000) discussed a case study for a child with hand-mouthing behavior, where researchers used NCR with tactile stimuli as an alternative to his preferred pica items. The results were dramatic and reported at “maintaining near-zero levels” (LeBlanc et al., 2000, p. 143) when they found that toys made of rubber were a reinforcing substitution for pica items. The authors also noted that hand-mouthing, in

many instances, has dual stimulus functions, which included hand and oral stimulation (LeBlanc et al., 2000). The Kern et al. (2006) research was consistent with previous research, which found oral stimulation as a function of pica behavior with an automatically reinforcing function; therefore, matched stimuli replacement like similar oral stimuli with appropriate foods or items was more effective than unmatched stimuli (Kern et al., 2006).

Matson and Koslowski (2011) used a quantitative method to describe their data collected when patients were allowed noncontingent access to alternative stimuli. Researchers provided noncontingent access to acceptable items, which showed a decrease in coprophagia, generalized across two settings (Matson & Koslowski, 2011). The goal of any reinforcement strategy for challenging behavior is to reduce the target behavior and incrementally increase the amount of time that passes between access to reinforcement. The systematic thinning of a reinforcement schedule is critical to systematically fade the intervention and the need to reinforce appropriate behavior (Jessel et al., 2015; Kern et al., 2006; Minshawi, 2008).

Differential Reinforcement of Alternative Behaviors (DRA) + Positive Reinforcement (R+) With Food Exchange Strategies

Differential reinforcement of alternative (DRA) items sets up a positive contingency for the learner (Jessel et al., 2015). DRA is used to increase appropriate target responses when inappropriate behavior is not present (Jessel et al., 2015). LeBlanc et al. (2000) described a study using DRA strategies with two boys with autism with maladaptive behaviors that functioned as automatic reinforcement. Following DRA's application, reinforced behavior that was independent of the wanted behavior showed an overall reduction in the level of target behaviors (LeBlanc et al., 2000).

Matson et al. (2013) reviewed a case of cigarette butt pica using NCR alone. In this case, NCR presented with the delivery of edibles, such as small candy preferred by the client, was allowed every 10 seconds in 5 minutes for not attempting to consume cigarette butts (Matson et al., 2013). When DRA was presented, along with an NCR procedure, the pica behavior began to reduce over time. The DRA strategy stopped the pica behavior and provided an alternative to cigarette butts (Matson et al., 2013). Kern et al. (2006) trained two males with developmental disabilities and pica behavior to bring pica items to their caregiver in exchange for a preferred food item. This study's results showed a notable reduction in pica behavior (Kern et al., 2006). In the LeBlanc et al. (2000) review, NCR procedures were found more effective in the suppression of maladaptive behavior than the extinction treatment condition for three children with autism.

Kern et al. (2006) studied the food exchange treatment package for children with developmental disabilities with pica behavior, which included training each participant to exchange pica items for preferred foods. The preferred edibles were selected because of a forced choice preference assessment and were paired with a verbal and visual prompt to exchange pica items for the preferred food (Kern et al., 2006). The baseline data collected during the intervention phase took place for nine sessions, followed by a return to baseline. The return to baseline continued until levels of pica attempts stabilized and then moved to the second phase of the intervention, which added delayed reinforcement from a preferred food for every exchange to a preferred food after every two exchanges (Kern et al., 2006). The intervention continued until the exchange generalized across four environments with a delay in the reinforcement of 30 minutes, which resulted in near-zero levels of pica behavior (Kern et al., 2006).

Differential Reinforcement of Incompatible Behavior (DRI)

The research reported some reduction of pica using DRI. In the case of cigarette pica, a reduction of pica behavior was published in a case study of a male with autism who ingested "paper, paper clips, bottle caps" (Mayes & Zickgraf, 2019, p. 80) and other inedible objects by using DRI strategies (Matson et al., 2013).). The client accessed reinforcement every 15 minutes if he remained on task, remained in his workspace, and refrained from pica. The tasks given to him were incompatible with pica behavior by keeping his hands busy, and his mind focused on appropriate skill-building tasks (Matson et al., 2013). Minshawi (2008) discussed DRI in his study of self-injurious behavior and determined the use of differential reinforcement for behaviors that are incompatible with self-injurious behavior, such as praise, access to items or tasks that the child prefers, and giving time away from tasks, are effective in reducing maladaptive behaviors.

Punishment Strategies

Punishment-based treatments have been shown through the literature to be effective in the reduction of pica behavior. In more recent studies, reinforcement strategies replaced punishment procedures (Kern et al., 2006; Minshawi, 2008). Severe and dangerous behaviors such as pica may warrant a treatment package including punishment strategies to quickly reduce behavior that puts a child's health and life at risk (Matson et al., 2013; Minshawi, 2008). Punishment procedures, defined as the presentation of aversive stimuli and removal of stimuli, function stronger than the maladaptive behavior (LeBlanc et al., 2000; Minshawi, 2008). Punishment procedures must always maintain ethical standards and may be viewed as unnecessary when success attained with reinforcement procedures succeeds. Researchers have found that the pica behavior was maintained by automatic reinforcement, which is highly resistant to

intervention, which may make punishment procedures necessary (Falcomata et al., 2007; Ferreri et al., 2006; Kern et al., 2006; Mayes & Zickgraf, 2019).

Overcorrection Strategies

Overcorrection was the most common punishment procedure in the 1980s and is still used today (Matson et al., 2013). Overcorrection techniques guide a client through skill practice related to the preferred behavior in the replacement of unwanted behavior. An example of this procedure was outlined by Matson et al. (2013), who intervened on tasting or ingestion of fecal matter by practicing the following skills: cleaning of the body by wiping and hand washing, cleaning the bathroom, washing garments and any surfaces that participants touched during the pica episodes. This guided practice may appear outwardly to be too intrusive, as the client may not want to do the tasks and needs hand-over-hand prompting to complete the tasks.

Seminal studies such as those completed by Foxx and Martin (1975) used overcorrection, a mild punishment procedure, and found success in the reduction of severe and life-threatening pica (Matson et al., 2013). Singh and Bakker (1984) replicated this study, which resulted in similar outcomes, in which the researchers used punishment to treat a participant with severe pica by pairing overcorrection with brief restraint to reduce this maladaptive behavior. Overcorrection was paired with a DRO strategy by Finney et al. (1982) when treating young children with pica, which resulted in a successful reduction in mouthing. The need for further study of pica behavior would not only aid in adding preventative measures, but also find effective interventions with both punishment and reinforcement procedures.

Ferreri et al. (2006) used a single-subject quantitative study using food aversion to decrease severe pica behavior. The research demonstrated the use of systematic

punishment to maintain the reduction in behavior. This study treated a 4-year-old boy with autism who had a severe form of pica. The child had gastrointestinal difficulties due to the ingestion of plastics. The intervention was presented in one condition, the child's preschool class, and then generalized to other settings that were essential in the child's life. The intervention was considered successful when the child was able to play with plastic toys without ingestion across environments and maintained near-zero levels when examined after 1 year following the intervention.

Aversive Stimuli Strategies

Garcia-dela Torre et al. (2010) also found success using a taste aversion punishment procedure that "paired an aversive taste to the memory of pica behavior, thus reducing the behavior" (p. 1018). In their study, the aversive taste was conditioned "during extinction through continuous presentations of the flavor" (Garcia-dela Torre et al., 2010, p. 1018). This qualitative study found success in reducing pica behavior using an extinction process and taste aversion in their 9-day study conducted with rats. Conditioned taste aversion provides an immediate consequence applied at the first movement towards pica behavior. Taste aversion stimuli will be different for every individual with any taste that a person does not like, such as pickle juice, garlic water, mustard powder, tapioca, and lemon juice (Ferreri et al., 2006). Garcia-dela Torre et al. (2010) described "taste memory" (p. 1018) using shaping procedures with safe food items to replace harmful elements such as dirt, feces, paper, or plant material. Taste memory occurred when an olfactory-based aversive consequence was applied immediately following the pica behavior to reduce the craving and consumption of targeted hazards, thus developing a taste aversion for the non-food items (Garcia-dela Torre et al., 2010). Casey et al. (2012) recommended taste aversion or the use of noxious

but safe odors as a secondary treatment option if reinforcement strategies alone are ineffective. The authors suggested presenting the aversive stimuli at the first movement in the chain of behaviors that will lead to pica behavior, which is the same process used by other researchers who have found success with this procedure (Casey et al., 2012). Minshawi (2008) found that the use of aversives such as tastes, odors, or water mist was effective for severe self-injurious behavior when reinforcement strategies were not powerful enough to treat behaviors such as pica alone.

Bay et al. (2013) reported that aversion and behavior therapy have been shown to reduce pica behaviors and found that a multidisciplinary approach is most effective to address all aspects of the physical and behavioral needs (Barrett, 2008; Tarbox et al., 2007). Bhatia and Kaur (2014) outlined present conditions that may be contributing factors to pica behavior using a global approach. Their study is informative but does give an aversive treatment recommendation, which suggests that children with autism or other developmental disabilities may need aversive conditioning, particularly with younger children within a behavior intervention package (Bhatia & Kaur, 2014).

The Matson et al. (2013) study discussed the effectiveness of ABA, even with the use of punishment procedures, to show more progress and have far fewer side effects than medications. The same study reviewed treatment packages for pica in persons with developmental disabilities and found that taste aversion and aversive stimuli treatment were successful in reducing pica behavior. The authors expected that more acceptable intervention for social situation would replace aversion-based interventions in future studies (Matson et al., 2013).

Response Blocking and Verbal Reprimand Strategies

Punishment procedures applied by Jennett et al. (2011) did not include taste or

food aversion but, instead, treated with response blocking to reduce pica behavior. Their quantitative analysis found that response blocking alone does not mitigate these dangerous behaviors to acceptable levels, nor did it maintain any reduction over time (Barrett, 2008; Jennett et al., 2011). Another concern reported pertained to aggression evoked using response blocking procedures without additional intervention strategies (Jennett et al., 2011). Response blocking paired with access to acceptable foods found more success (Kern et al., 2006; Tarbox et al., 2007).

Hagopian, Gonzalez, et al. (2011) evaluated response blocking and, like the Ferreri et al. (2006) study, used a single case study for data collection during a functional assessment. They found this punishment procedure was unable to maintain low levels of mouthing, which agreed with the Jennett et al. (2011) study. This study used a quantitative method of data collection, which implemented response blocking, response blocking paired with verbal reprimands, and verbal reprimands paired with noncontingent access to preferred foods. None of these conditions produced a reduction of mouthing behavior to acceptable levels. In their functional analysis, Falcomata et al. (2007) used verbal reprimands in their attention condition prior to their data collection in their study with “statements of concern” (p. 353).

Time-Out Strategies

In their study of a 12-year-old male with autism and pica behavior, Falcomata et al. (2007) found that reinforcement strategies alone did not produce low levels of pica. It was only with an added consequence of a time-out procedure that pica reduced to near-zero levels. The researchers exhausted the positive reinforcement methodologies prior to beginning the punishment procedure. Minshawi (2008) found time out from reinforcement procedures and contingent exercise to both be effective interventions in the

reduction of maladaptive behavior. This study stated that ethical and systematic plans to fade to the least restrictive form of treatment must be considered when using a punishment procedure, yet they show a swift reduction in dangerous behaviors (Minshawi, 2008).

Intervention Built Into Treatment Packages

Current research indicates that behavioral interventions for pica are more effective when used in a treatment package (Williams & McAdam, 2012). For example, response blocking alone does not show reduced pica; however, adding NCR to response blocking does show a reduction in pica behavior (Kern et al., 2006; Minshawi, 2008). Minshawi (2008) investigated self-injurious behavior in children with autism and found reinforcement procedures alone may not reduce self-injurious behavior, such a pica behavior. Minshawi suggested the need for a comprehensive treatment package including behavior reduction strategies paired with skill-building, such as discrimination, paired with appropriate communication skills (Minshawi, 2008). One such treatment package recommendation from Minshawi included NCR, DRO, and communication training, which showed a moderate reduction in target behaviors. For severe problem behavior, Minshawi mentioned the use of punitive strategies and the inclusion of adaptive equipment.

Parent Roles and Training

Parents and caregivers are critical in the treatment and care for children with ASD and for those with pica, caregiver education, training, and support are necessary to keep children safe and reduce dangerous behaviors across environments. Caring for a child with ASD leaves many caregivers feeling depressed, anxious, and in need of support and education for themselves as well as their child. Current research analyzed various

methods of parent training to address caregiver and child needs to determine effective methods outside of the clinical environment (Cheng et al., 2022; Deb et al., 2020; Frolli et al., 2021; Karge & Lasky, 2011). When comparing parent-facilitated interventions in the home with the child, researchers found higher positive effects when in conjunction with professionals and when training took place individually versus in a group setting (Cheng et al., 2022; Deb et al., 2020; Frolli et al., 2021). Cheng et al. (2022) reported that parents who implemented their child's care, particularly in behavior management, found beneficial outcomes. Deb et al. (2020) reported that parents who received training and support for their child's specific needs found reductions in maladaptive behaviors and for themselves, felt empowered with the new skills learned to assist their children. Multidisciplinary teams provide for the needs of the caregiver and child and represent a shared responsibility that allows for significant behavioral changes and skill-building (Jarmuz-Smith, 2011). Parents who receive support and training from clinicians who practice ABA increased awareness such as close supervision and implementation of reduction of maladaptive behaviors, such as pica behavior, and provided appropriate replacement options for those behaviors (Liu et al., 2015).

The Gale et al. (2010) study used natural environment teaching and trained caregivers to provide therapy, as well as implemented caregiver interviews and observations. Parents may also give in to a child's demands once a tantrum begins, which is another example of positive reinforcement, which maintains inappropriate behavior. Parent training for interventions is essential to learn the functions of pica behavior so that removing or accessing an item will not inadvertently strengthen dangerous behavior. The Gale et al. study focused on two functional assessments with caregivers to find the maintaining variables to the problem behavior found in patients in the study. In this

study, there were multiple maintaining contingencies, such as access to socially mediated attention and escape from task demands. The authors presented preventative measures related to the pica behavior and found results to be more effective than punishment procedures also tested in this quantitative study. Gale et al. found a decrease in pica-like behavior within the first 20 trials, which could yield significant results for this dangerous behavior. The authors recommended a multiple-component treatment plan for caregivers to implement with their children, which is echoed in later research (Dawson-Squibb et al., 2020; Jarmuz-Smith, 2011; Tabatabaei et al., 2022).

According to the research by Dawson-Squibb et al. (2020), parent and caregiver education was most effective when it is specific to their child's needs instead of more generalized training. These authors further stated that parents must begin with acceptance of their child's disorder and where the actual current skill levels are and to understand the impact that was made by utilizing multiple methods of training from the child and parents. The goal of any successful treatment is to generalize success from the clinical environment to home, school, and in the community. Parental involvement positively impacted children with ASD and the family as a whole (Jarmuz-Smith, 2011; Karge & Lasky, 2011)

Summary

Pica behavior, combined with autism, creates a complex blend of domains that require medical and behavioral intervention. Characteristics of pica indicate compulsive behavior (American Psychiatric Association, 2022) and stereotypy are present (Autism Speaks Treatment Network, 2014; Barrett, 2008; Falcomata et al., 2007; Ferreri et al., 2006; Hagopian, Rooker, et al., 2011; Kern et al., 2006; Tarbox et al., 2007). Both characteristics often functioned as automatically reinforcing, which made pica behaviors

treatment resistant to intervention (Falcomata et al., 2007; Kern et al., 2006; LeBlanc et al., 2000; Sturmey & Williams, 2016). ABA received strong support throughout the literature as the most effective intervention to reduce pica levels to zero levels (Call et al., 2015; Gale et al., 2010; Matson et al., 2013; Mayes & Zickgraf, 2019). According to the research literature, prevalence rates average 14% for children diagnosed with autism and display pica behavior without intellectual disability (Centers for Disease Control and Prevention, 2016; Cooper, 2010; Mayes & Zickgraf, 2019) and range from 10% to 32% in children ages 1 to 6 years old (Hagopian, Gonzalez, et al., 2011; Mayes & Zickgraf, 2019). In the center environment, pica behaviors make up 22% to 25% of children with autism (Call et al., 2015; Gonyea, 2007; Hagopian, Gonzalez, et al., 2011; Matson et al., 2012), which is a considerable number of children needing effective intervention. This deadly form of self-injurious behavior (Call et al., 2015) must be addressed and results generalized across environments and caregivers to resolve and replace pica effectively.

Pica behavior impacts children, adolescents, and adults for individuals with developmental disabilities, including autism, and intellectual disabilities. Pica is underreported in the general population with no disabilities, at a rate of 4% for children (Centers for Disease Control and Prevention, 2016), and remains underreported across all ages and populations (Bhatia & Kaur, 2014) due to social stigmas or being seen as part of development and exploration. Furthermore, pica behavior impairs health, learning, social abilities (Bhatia & Kaur, 2014; Blinder, 2008; Gal et al., 2011; Stasolla et al., 2014; Sturmey & Williams, 2016), and overall positive outcomes, which are critical reasons to intervene swiftly and effectively. Research widely reported the detrimental impacts on health that include malnourishment (Blinder, 2008; Gale et al., 2010), gastrointestinal disease (Ferreri et al., 2006; Ing et al., 2011), blockages (Ferreri et al., 2006; Ing et al.,

2011), parasites (Blinder, 2008; Delaney et al., 2015), aspiration (Falcomata et al., 2007; Gale et al., 2010), dental trauma (Bhatia & Kaur, 2014; Cooper, 2010; Delaney et al., 2015), poisoning (Blinder, 2008; Falcomata et al., 2007), severe intellectual impairment (Blinder, 2008), and death (Blinder, 2008; Bryant-Waugh, 2019; Delaney et al., 2015; Ferreri et al., 2006; Hagopian, Rooker, et al., 2011; Hartmann et al., 2012; Kern et al., 2006; Matson et al., 2012, 2013; Young et al., 2008).

The negative impacts of pica demonstrate the level of support, intervention, and continuing research needed to address these maladaptive behaviors. Research clearly shows that ABA treatment packages successfully reduce pica behavior while building critical skills to replace pica with appropriate responses with similar functions (Sturmey & Williams, 2016). Research has studied reinforcement (Call et al., 2015; Williams & McAdams, 2012), punishment (Blinder et al., 2008), and treatment packages using both reinforcement and punishment strategies (Blinder et al., 2008; Call et al., 2015) as promising interventions. Earlier ABA studies relied heavily on punishment procedures. The following examples of punishment included overcorrection (Ferreri et al., 2006; Foxx & Martin, 1975; Matson et al., 2013), response blocking (Blinder, 2008; Falcomata et al., 2007; Hagopian, Gonzalez, et al., 2011; Kern et al., 2006; LeBlanc et al., 2000), verbal reprimands (Falcomata et al., 2007; Jennett et al., 2011), taste aversion (Blinder, 2008; Casey et al., 2012; Garcia-dela Torre et al., 2010; Matson et al., 2013; Roscoe et al., 2013), and restraints (Minsahwi, 2008). Punishment is still used in ABA today, but it is not as socially acceptable as the early research (Matson et al., 2013; Minshawi, 2008). Punishment strategies, when used ethically and with a proper ABA design, are highly effective in reducing and in some instances eliminating pica behavior (Bryant-Waugh, 2019; Call et al., 2015; Cooper et al., 2019; Gale et al., 2010; Jessel et al., 2015; Matson

et al., 2013). Children with severe pica, such as ingestion of metals (Delaney et al., 2015; Falcomata et al., 2007; Kern et al., 2006), feces (American Academy of Family Physicians, 2018; Garcia-dela Torre et al., 2010; Matson et al., 2013; Rohde et al., 2013), and cigarette butts (American Academy of Family Physicians, 2018; Falcomata et al., 2007; Rohde et al., 2013), and cement (Autism Speaks Treatment Network, 2014; Barrett, 2008; Bay et al., 2013; Falcomata et al., 2007; Ferreri et al., 2006; Gonyea, 2007; Hagopian, Rooker, et al., 2011; Ing et al., 2011), justified punishment-based treatment packages, as one instance of pica frequently resulted in medical emergencies or death (Blinder, 2008; Falcomata et al., 2007).

Reinforcement strategies are predominantly used in the field of ABA to reduce pica behavior. Reinforcement was reported as most impactful when used as a treatment package such as DRO + NCR + Food Exchange, according to the research (Kern et al., 2006). The research strongly supported evidence-based ABA treatments, as mentioned above (Kern et al., 2006; Matson et al., 2013; Mayes & Zickgraf, 2019), because they demonstrated that singular strategies such as NCR were not found to be effective in the reduction of pica behavior (Ferreri et al., 2006; Jennett et al., 2011). Other reinforcement interventions include DRA and DRI, which reinforce either an alternative behavior, which is the wanted behavior, or reinforces behavior that is incompatible with pica behavior. DRA and DRI interventions showed some pica improvement (Jessel et al., 2015; LeBlanc et al., 2000 ; Matson et al., 2013). The same interventions resulted in skill-building, such as appropriate skills trained throughout the treatment consisted of discarding trash and pica items, staying on tasks doing daily living activities, or eating suitable foods (Gale et al., 2010; Hirsch & Smith Myles, 1996).

Parents play a vital role in the success of ABA interventions for pica behavior, as

the intervention must generalize across environments and caregivers to maintain overall reductions of pica behavior (Ashford et al., 2008; Stasolla et al., 2014). In many cases, parents do not have the training or knowledge to identify or to know what modality of treatment is needed to eliminate pica behavior. Falcomata et al. (2007) suggested that children with pica behavior need close supervision to reduce to safe levels, yet, with the proper treatment, low pica levels remain possible without direct parental oversight. Research supports strong parental or caregiver involvement with the treatment process to produce the best outcomes and maintain these outcomes over time (Call et al., 2015).

Although treatment for pica behavior in children with autism and developmental disabilities began in the 1970s, with seminal research completed by Foxx and Martin (1975), there remains much to learn about the disorder and the most effective interventions to reduce and eliminate pica behavior. Researchers have agreed that standardized and comprehensive assessment tools for pica behavior remain needed (Bryant-Waugh et al., 2019; Kern et al., 2006; Matson et al., 2013). Others suggested the need for studies with larger groups of participants (Kern et al., 2006) and longitudinal research needed to learn about the maintenance and generalization over the years to determine the lifetime outcomes of early intervention (Casey et al., 2012; LeBlanc et al., 2000). A small number of participants limits the current research (Casey et al., 2012; Kern et al., 2006), and underreporting of pica behavior (Call et al., 2015; Delaney et al., 2015; Roscoe et al., 2013) does not allow an understanding of how widespread the disorder is.

Research Questions

The following research questions were established to guide this applied dissertation:

1. Was the treatment package effective at reducing pica behaviors?

2. Was the intervention durable with effects lasting after the intervention was withdrawn?

3. Was any treatment component more or less effective at reducing pica behavior?

4. What were the parents' attitudes towards the treatment?

Chapter 3: Methodology

Participants

The researcher received approval from the Dissertation Committee and Institutional Review Board to proceed with the study. Participants were then recruited for the study based upon parent and clinician report of pica behavior, which limited or endangered the child, but a formal diagnosis of pica was not required. Potential participants were informed of the study and had the opportunity to self-volunteer participation in the study, within the total population of 43 children who had an ASD diagnosis enrolled in an ABA therapy day program at the center. The researcher used convenience sampling, as she was employed with the ABA company and had access to the participants who volunteered to participate in the study. Following the recruitment period, she obtained informed consent from the participants' families who indicated they would voluntarily like to be included in the study and interventions. None of the participants were able to give their own consent. In this study, parents' involvement started at the beginning with the identification and consent to assess and treat for pica behavior, while considering the skill deficits and strengths noted with their comorbid autism diagnosis (Casey et al., 2012).

The population for this study included a sample of children and adolescents with the following shared characteristics: (a) diagnosis of ASD, (b) enrolled in an Indiana-based ABA center for a day treatment program for a minimum of 2 hours a day and a minimum of 3 days a week, (c) displayed pica behavior, and (d) were referred for treatment of pica behavior by their parents, physicians, BCBAs, or RBTs. Pica behavior in the target population occurred outside of the normative behavior for their developmental age, continued for more than 1 consecutive month, presented a barrier to

learning, and jeopardized health and safety (American Psychiatric Association, 2022). Four children enrolled at the center met the criteria for participation in the study. The participants for the study ranged in age from 5 years old to 14 years old. Each child who participated was identified as exhibiting pica behaviors that presented immediate and potentially severe health risks due to frequency (i.e., consistent for a month) and the types of substances mouthed or ingested.

The gender distribution of the sample was female (n = 1) and male (n = 3). In addition to autism, the children had comorbid diagnoses (n = 4), including global developmental delay (n = 2), intellectual disability (n = 1), language impairment (n = 4), obsessive-compulsive disorder (n = 4), speech delays (n = 4), and bilateral hyperplasia, which is blindness in both eyes (n = 1). Additional characteristics that were shared by the potential participants included the following: 2 or more years in ABA center treatment (n = 4), previous pica intervention (n = 0), displayed aggression (n = 4), delayed communication and social skills deficits (n = 4), and other diagnoses (n = 4). The racial demographics for the participants included Caucasian (n = 3) and African American (n = 1).

Two of the four participants were twin males. The participants' ages were as follows: two 5-year-old twin males, one 9-year-old male, and one 14-year-old female. All participants were residents of the same county in Indiana who attended varying assigned school systems. The participants shared multiple characteristics. All participants demonstrated pica behavior and presented with skill deficits across domains, which included communication and social skills delays and maladaptive behaviors including aggression, tantrum, and self-injurious behaviors. All participants presented with obsessive-compulsive behaviors with fixed and rigid patterns of speech and behavior.

Participant 1

Participant 1 was a 9-year-old male who was nonverbal, apart from five inconsistent words produced with prompts and five signs that he used consistently. He had an ASD diagnosis with no severity level identified on his diagnostic evaluation and consistently displayed pica and obsessive-compulsive behavior across environments. The maladaptive behaviors displayed by this child included aggression, self-injurious behavior, tantrums, and elopement in addition to pica behavior. Participant 1's social skills were extremely limited due to elevated levels of maladaptive behaviors and deficits in communication and social skills. Participant 1 was highly fixated on items and demonstrated a high level of sensory defensiveness. His preferred pica items were string, paper, hair, and small pieces of items to play with, and he also used these for play. He was largely non-discriminate with preferred pica items at the beginning of the study, which required continuous supervision across environments.

Participant 2

Participant 2 was a 14-year-old female who speaks on the phrase and sentence level and requests the things she wants and needs spontaneously, unless she is frustrated. Then she needs prompts to request the things she wants and needs. She was diagnosed with ASD with no severity level indicated on her diagnostic evaluation, intellectual disability, and bilateral optic dysplasia. She displays pica and obsessive-compulsive behavior consistently across environments. The primary maladaptive behaviors demonstrated by Participant 2 along with pica were aggression, self-injury, and tantrums. Participant 2's social skills were limited in terms of peer interaction and more prominent with adults. Her preferred pica items at the beginning of the study were biting and mouthing bathroom sinks (which resulted in dental injury), toys, foam, clothing, hair,

skin (her own and others), and her chewing implement referred to as her "chewy." When pica items were blocked or removed prior to the study, she became aggressive or had a meltdown (e.g., crying, dropping to the floor, hitting, kicking, and self-injury). Due to pica and her visual impairment, she required constant supervision from caregivers in any environment.

Participant 3

Participant 3 was a 5-year-old male who showed an increase in communication over the course of the study moving from the phrase level to the sentence level. His articulation and intonation of words continued with limited intelligibility as his words were spoken rapidly and in a high pitch. He was diagnosed with ASD with no severity level included in his diagnostic report, global developmental delay and displayed pica and obsessive-compulsive behavior across environments. Prior to the start of the study, he responded with tantrum behavior (e.g., dropping to the floor, kicking, hitting, screaming, and head hits to his head with his fist) and required continuous supervision. As the study's onset, his social skills were hindered by aggression, limited intelligible communication, and inability to share. His preferred pica items at the initiation of the study were largely non-discriminate and he required continuous supervision. They included Legos, Play Doh, paper, dirt, rocks, trash, a "chewy," small parts of items, and toys.

Participant 4

Participant 4 was a 5-year-old male who demonstrated progress in his communication and social skills over the period of the current study, and he predominantly spoke on the phrase level at the end of the study, which improved from the word level. He was diagnosed with ASD with no severity level included in his diagnostic

report, global developmental delay, and display of pica and obsessive-compulsive behavior across environments. The maladaptive behaviors displayed by Participant 4, such as aggression, self-injurious behavior, and tantrums, created significant barriers to developing meaningful peer relationships. He began to interact with peers in both spontaneous and prompted opportunities, when previously his preference was to play alone, and his preferred pica items prior to the onset of treatment were Legos, Play Doh, paper, dirt, rocks, trash, a "chewy," small parts of items, and toys. He was largely non-discriminate with pica items that were mouthed with both attempts at mouthing and ingestion.

Additional Participants

Additional participants of the current study included the caregivers of each of the four participants. The total caregiver participation included three caregivers, as one parent had two children in the study with similar profiles. Furthermore, the center staff served as participants including the researcher and BCBA, BCaBA, and five RBTs.

Instruments

The researcher selected multiple instruments to collect data from varying tools with the caregivers of each participant to gain information to determine the current needs and best course of treatment for each child.

Reinforcer Profile

The participant reinforcer profile (see Appendix A) identified a current qualitative list of the most preferred items for each participant at the onset of the study. Parents completed the reinforcer profile preceding the completion of the functional assessment. These data provided the researcher with pre-identified toys, foods, preferred people, and activities that were used as reinforcers throughout the intervention to reinforce

appropriate behaviors and create motivation for not engaging in pica behavior. The reinforcer profile was a tool selected by the researcher to gain the parents' perspectives on their children's strongest motivators within a nine-category list. The items described by parents as reinforcing were added to the preference assessment to prioritize the list of potentially reinforcing objects, people, or activities.

Paired Stimulus Preference Assessment

Before implementing the treatment package, each participant completed a Paired Stimulus Preference Assessment (see Appendix B). The evaluation determined preferred pica items, foods, toys, activities, or preferred people, which functioned as reinforcers used to train alternative behaviors while reducing the target behavior (Fisher et al., 1992; LeBlanc et al., 2000). Fisher et al. (1992) reported that the Paired Stimulus Preference Assessment is an empirically validated instrument with a reliable prediction of the quality and ranking of reinforcers. Hagopian, Gonzalez, et al. (2011) referred to the Paired Stimulus Preference Assessment as a competing stimulus assessment and defined selection of items by contacting the item with fingers, hands, or with an intentional eye gaze directed at the item. The dependent variable for the preference assessment included the pointing or picking up of an item or photo to indicate the preferred selection between two items for each trial. The researcher recorded each session for 20 trials. The selection of items for each trial included preferred items, based upon the parent interview, reinforcer profile, and direct observation by the assigned behavior analyst and therapists. Trials were conducted in the child's therapy room and occurred at a table with the researcher and behavior analyst. The data were analyzed and summarized with the results assigned to the selections made during the 20 trials. The researcher and the behavior analyst collected data using the Catalyst online data collection system. Interobserver

agreement was calculated for the data collection occurring across the first 20 trials. The results of the Paired Stimulus Preference Assessment can be found in Appendix C.

Functional Assessment

A functional assessment using the Questions About Behavioral Function (QABF) and the Functional Assessment Screening Tool (FAST), which can be found in Appendices D and E, was conducted prior to the onset of treatment for pica behavior to determine the environments in which pica was observed and, most importantly, to identify the functions of the pica behaviors. A functional assessment uses interviews and direct observations in various conditions to assess the maintaining variables, antecedents, and consequences of behavior (LeBlanc et al., 2000; Sturmey & Williams, 2016). The dependent variable was defined as the first movement in the attempt to lick, taste, chew, or ingest a pica item. Pica items were defined as any non-food object or food on the floor or in the trash, which provided the conceptual definition for the study. The researcher and behavior analyst counted pica behavior frequency for each instance of a pica attempt or completion. The researcher used the established function for each participant to create treatment plans based on that behavioral function. For example, when pica behavior functions as socially mediated attention (e.g., eye contact, verbal phrases, or closer proximity), providing attention likely increases the response. Pica behavior maintained by automatic reinforcement, which has significant barriers to intervention, is treatment resistant and may need longer to reduce to zero levels of pica behavior over time. Determining the function of the behavior was essential to identify appropriate replacement behaviors that function in the same manner as the pica behavior. If a treatment modifies a child's ability to behave in a specific way, it is only ethical to replace that behavior with a skill that gives the child what he or she wants and needs,

while maintaining health and safety. Gale et al. (2010) used functional behavior analysis to determine problematic feeding issues within various conditions and then used the data to create an intervention to address the maintaining variables present.

The QABF. The QABF has 25 questions and five subscales to determine rates of behavior, function, and maintaining variables (Matson et al., 2012; Sturmey & Williams, 2016). The instrument was developed in 1995 by Vollmer and Matson to assess functions of specific maladaptive behavior for individuals and for the clinicians to use as a tool to develop the most effective ABA interventions based on those functions (Sturmey & Williams, 2016). Matson reported that the QABF is an empirically based instrument and is psychometrically sound to determine functions of behavior. Matson also reported the QABF to have a psychometric analysis that yielded a Cronbach's alpha and Guttman split-half reliability of 0.86 and 0.91 for the reliability of coefficients. Internal consistency was also measured by Matson et al. (2012), who found a Cronbach's alpha estimate to be 0.905. Matson also stated that the QABF is a widely accepted tool and highly reliable and valid to determine the function of challenging behaviors, such as pica and other feeding and behavior disorders. Singh et al. (2009) reported that the QABF has both adequate reliability and validity and is an appropriate manner to assess the function and maintaining variables, which contribute to presenting maladaptive behaviors.

The FAST. The FAST includes 16 items in questionnaire form, which focuses on the antecedents and consequences that directly correlate with the target behaviors (Iwata et al., 2013). Authors of the FAST determined the tool has relative reliability and achieved up to 84.5% agreement after considering 196 maladaptive behaviors along with the comparisons of 69 functional analyses (Iwata et al., 2013). Orhan et al. (2020) described the FAST as having strong psychometric properties.

Vineland Adaptive Behavior Scales: Third Edition

In conjunction with the functional analysis tools, this study included the third edition of the Vineland Adaptive Behavior scales to gain additional insight into the skill levels, deficits, and maladaptive behaviors of the current participants. The Vineland-3 is a standardized measure of adaptive behavior (Hill et al., 2017) for individuals with developmental and intellectual disabilities. Pandolfi and Magyar (2021) suggested using the Vineland-3 in conjunction with additional tools for a more complete view of skill deficits and strengths, to develop appropriate treatment packages based on the collective data from all instruments.

Initial and Final Parent Interviews

The researcher developed the initial and final parent interviews to understand the frequency of each participant's pica behavior, as well as identify the types of pica items, the topography of pica behaviors, concerns for safety, and the caregivers' goals for their child during and following the study (see Appendix F). The development of this tool presented a threat to the validity of this study as it was not standardized, yet it contains the exact information needed to understand each client and family's needs who are enrolled in ABA therapy. Each interview contained open-ended questions. The initial interview contained seven open-ended questions and the final interview had 11 open-ended questions for each caregiver. The interviews were qualitative documents that parents completed before the intervention as a part of the first phase of the study. The data provided the researcher with relevant background details for each child, which influenced the intervention package and treatment if any specific needs were required.

Materials

The researcher selected materials for each of the participants in the study, based

upon the required elements and the individualized items found to be preferred or reinforcing following the parent interview, reinforcer profile, and Preferred Stimulus Preference Assessment. All clinician participants required access to a tablet with the Catalyst online data collection installed for clinical staff to record data during each phase. The researcher used the above-listed tools printed for easy access for parents, as not all the current caregivers were comfortable using technology to complete the forms online. The necessary materials were selected based on the individual preferences of each child.

All participants had access to their preferred or reinforcing items for correct responding, such as choosing appropriate items or not engaging in pica behavior. Each participant had a box of pica items, a trash can, a plate, and each of their preferred foods to use for discrimination training. Parents used the same reinforcers for wanted behavior, as was used in the center environment. Parents also took care to vacuum one to two times a day and provided alternative, preferred foods that would compete with their child's pica tendencies. Reinforcing materials and activities were selected for each participant based on the results of the individuals' reinforcer profile and the Paired Stimulus Preference Assessment.

Measures

The researcher determined the dependent variable as pica behavior for all participants. The operational definition of pica behavior for this study included every instance of licking, sucking, biting, tasting, putting pica items past the plane of the mouth, or consuming non-food items or the attempted use of pica items (e.g., clothing, trash, food on the floor, toys, metals, paper, hair, fecal matter, picking nose and putting finger in mouth, dirt/sand, plant material). Pica behavior began with the first motion in the chain of behaviors to attempt or complete the consumption of pica items (e.g.,

bending to pick up an item with a hand motion to that item, grabbing or reaching for a known pica item, putting item past the plane of the lips) and ended when the item was no longer in the participant's hand or mouth. Pica behavior did not include consuming food that was provided to the participant that was approved by each of the participants' families. Additional measures to summarize outcomes included caregiver report of treatment success and their satisfaction with training, training completion, generalization of progress and skill development, and willingness to continue pica treatment following the treatment.

Design

The current quantitative research utilized a quasi-experimental, A-B-A design with the removal of treatment in the final phase to test maintenance and generalization. A component analysis was completed using three interventions identified in the literature as effective treatment packages to treat pica in children with autism. A single subject study is the prevailing research design within the ABA field to evaluate interventions and identify individual outcomes of participants (Edmonds & Kennedy, 2013). Each participant served as their control for the study (Edmonds & Kennedy, 2013). The current study spanned 11 weeks that began with Phase 1, which was baseline data collection. The researcher found social significance in reducing pica behavior for the individuals, while monitoring increases for appropriate replacement behaviors, such as increases in communication and socialization with peers across participants. The topography and function of individual pica behavior varied by participant. The ABA treatment approach emphasized the overall reduction in pica behavior while building a discriminatory skill repertoire regarding food versus trash. The ABA interventions were applied across subjects to measure the increase or reduction of pica behaviors. The goal of this study and

any effective intervention was to create replicable interventions and positive outcomes across children with similar profiles and showed a decrease in pica behaviors, maintained after the intervention was faded out, and generalized across environments. Therefore, data were collected after the study's phases to include a maintenance and generalization probe. The intervention phases were as follows:

1. Baseline. No treatment, beyond safety measures (ex: removing a pica item).

2. Tx1: Response Blocking (RB) with and Verbal Reprimand (VR) (ex: "no"), Redirection (RD).

3. Tx2: Noncontingent Access to Preferred Foods (NCR), Discrimination Training (DT), and Differential Reinforcement of Alternative Behavior (DRA).

4. Tx3: Food Exchange (FE).

5. Reversal: Return to Baseline and Maintenance.

Procedures

Preceding the study, the researcher obtained informed consent from the participants' families, who had the option not to participate and stop the intervention at any point. The consent included the following: consent to participate in this research study, consent to functional analysis for pica behavior, consent to treatment, and commitment to parent training throughout the study. None of the four participants were able to consent for themselves and could not understand the information provided about the study. Following the signed consent by the participants' caregivers, the researcher provided a schedule for each phase of treatment and parent interviews and training. The intervention was completed in the center environment, dependent upon each participant's daily ABA schedule.

The researcher scheduled individual, face-to-face meetings with the families who

responded affirmatively to joining the study with their child. In the initial meeting, the researcher reviewed the purpose of the study and the qualifying characteristics that identified their child for the research. Risks and benefits were discussed with each caregiver before obtaining informed consent, and a detailed explanation of the study was provided for clarity to the families. The Health Insurance Portability and Accountability Act was reviewed with each family to ensure compliance with confidentiality and protection of identities for each participant. The names of each participant for this study were represented as Participant and the ordinal number as each was enrolled to add a level of confidentiality by removing any identifiable information. Each participant's caregivers provided voluntary written consent to the intervention and data collection prior to baseline data collection and had the option to decline participation in this study at any time. Once informed consent was gained, the participant data were collected using an online data collection platform, Catalyst, with an individual login and password for each caregiver. Families had the ability to log in at any point to see real-time data collection and behavior intervention graphs. Behavior data were collected by the researcher, who trained the BCaBA, and also trained the RBTs who worked directly with each participant. The BCBA, BCaBA, and RBTs collected data and provided direct therapy for the study.

Parents and caregivers of the children in the study had a critical role by providing consent and completing parent training and behavior consultation before and during the study. Once treatment levels were stable, parents received training to generalize the intervention to the home environment for continuity of care that was extended, as needed per participant following the study. Families of the participants received copies of all documents from the study including the QABF, FAST, Vineland-3, reinforcer profile, Paired Stimulus Preference Assessment, parent interviews (initial and final), graphs, and

raw data. The originals would be kept for 3 years as was required by insurance payors, which also met the university requirements. All documents were kept in the legislation-compliant online data collection system, Catalyst, and then would be destroyed following the required period to secure all participant data confidentiality for their protection. No identifying information was accessible during the research study. Each study participant had the option to discontinue treatment at any time without repercussions; however, no participant dropped out of the study.

The researcher created a behavior intervention plan based on current assessment, paired with the individual needs of the children included in the study (see Appendix G). The researcher met individually with the consenting families and discussed implications of the behavior observed with and without intervention and trained on home intervention for generalization once intervention levels were stable. Following parental consent for the behavior intervention, the researcher designed the data collection and the interventions for the BCBA, BCaBA, and RBTs who work with each child on a routine basis. The BCBA trained relevant staff on each of the behavior intervention plans and were supervised by the researcher throughout the implementation process.

In the preintervention phase, the researcher administered the parent interview, reinforcer profile, and Vineland-3, QABF, and the FAST with the participants' parents. The interview collected information on the topography, frequency, duration, severity of the target behavior, antecedent events, and maintaining variables from the parent perspective. Parents participated in an initial parent meeting to discuss their desired goals and outcomes of the intervention. The researcher administered the QABF and FAST with the participants to determine the function of the pica behavior (Cooper et al., 2019; Hanley et al., 2014; LeBlanc et al., 2000). The functional assessment allowed the

researcher to determine the function of the pica behavior and the maintaining variables.

The first phase of the intervention included collecting baseline data for each participant for 1 week of ABA therapy sessions. The data were collected using the Catalyst online data collection platform, used by the RBTs, BCaBA, and the researcher, to record the frequency of pica behavior as outlined in the operational definition for each participant's pica topography and function. When participants attempted pica behavior, therapists blocked the attempt for safety, putting their hand between the pica item and child's mouth, with no additional attention such as words or actions. Blocking occurred at the first move in the chain of behaviors leading to pica attempts. The researcher met with the families following Phase 1 to review the steps of the interventions and to answer any questions they had.

The second phase (Tx1) began with the first treatment package using response blocking with verbal reprimand "No" or "That's trash, not food" (Kern et al., 2006; Minshawi, 2008) and redirection. Response blocking began at the first movement in the chain of behaviors for pica behavior (e.g., picking up playdough and moving towards the mouth), by putting their hand between the pica item and child's mouth, along with the simultaneous verbal reprimand. Immediately following the blocking and verbal reprimand, the therapist redirected the client to the original task that was occurring at the time of the pica attempt. This phase was conducted for 2 weeks. The researcher met with the families at the end of Phase 2 to review data and to evaluate if generalization is happening across environments without direct training outside of the center.

The third treatment phase (Tx2) implemented response blocking paired with discrimination training, with noncontingent access to preferred foods. Discrimination trials followed any pica attempt. The discrimination training sessions included an array of

items that were edible and non-edible pica and trash items on a tray at the participant's worktable. The participant selected an item from the tray and received prompts to put food on a plate, or nonfoods in the trash can. The RBT stated either "That is food" or "That is trash," with a gestural prompt to indicate where the item belongs until the prompt could be faded. Each time the participants made a correct response, verbal praise was given. Only the frequency of pica attempts precluding the discrimination trials were recorded. Following each pica attempt, discrimination trial sessions began with 10 items to complete before returning to the task present when the pica attempts occurred.

In the initial parent interview, the families identified preferred foods for their child, and the researcher also identified preferred foods and other reinforcers in the Paired Stimulus Preference Assessment. This intervention phase continued with response blocking at the first movement in the chain of pica behavior and began discrimination training trials following any pica attempt. Verbal reprimands were removed in this phase, and noncontingent access to preferred foods was added. The implementation of these items began in the previous phase so that the child could access appropriate food items for discrimination or anytime he or she wished during treatment using non-contingent access to preferred foods. The preferred items were available in each participant's therapy room on a plate in exceedingly small portions to prevent satiation and to prevent refusal of their lunchtime meal. Having noncontingent access to preferred food items presented a competing element with the hypothesis that the pica items would be less attractive to the participant, thereby reducing pica behavior and increasing appropriate eating and discrimination skills (Jessel et al., 2015). The researcher met with the family at the end of Phase 3 to review data and to evaluate if generalization is happening in other environments without direct training.

The fourth phase and third treatment (Tx3) included a food exchange procedure (Kern et al., 2006; Minshawi, 2008), which proceeded for 2 weeks during ABA therapy sessions. As the participants learned in Phase 3 to discriminate food from trash (or toys, clothing, etc.), they moved to the food exchange procedure by discarding the item in the trash or handing pica items to the therapy staff in exchange for preferred foods, which were available on a plate in the child's therapy room. The exchange procedure was trained and prompted at the first movement of any pica attempt with prompt fading as the participants learned the exchange procedure. Once the exchange procedure was complete, the participant returned to the original task. Only frequency data was collected for pica attempts. The researcher met with the family at the end of Phase 4 to review data and to evaluate if generalization was happening in other environments without direct training.

The fifth phase (Reversal) measured the maintenance and generalization of pica behavior (Ferreri et al., 2006) for 4 weeks, which returned to baseline with no intervention, with the exception of response blocking for safety, at the first movement in the chain of behavior that precluded pica attempts with no additional words or actions. The therapy staff and researcher collected frequency data of all pica attempts in the center throughout this phase. The researcher met with the family at the end of Phase 5 to review data and to evaluate if generalization was happening in other environments without direct training. The posttreatment steps included final parent interview and training to review the data and the outcomes of the study. Parents were given the option to continue intervention following the study, as a part of their child's ABA treatment package and receive support and training to generalize the interventions to the home environment. Parents completed a concluding survey to express any concerns, comments, and final goals or thoughts regarding the study.

Parent Roles in Intervention

The role of parents and caregivers is crucial in the potential outcomes for children with pica behavior. The first step for parents and caregivers is to learn about the causes, dangers, and appropriate treatments to address this dangerous behavior. As discussed by Ashford et al. (2008), an important variable for those with pica behavior is family and social connectivity (Stasolla et al., 2014). When adults with disabilities are not socially integrated into their family and community, the literature found 22% were more likely to display pica behavior (Ashworth et al., 2009; Casey et al., 2012). Children with pica experience social rejection and solitude, due to the disorder and other deficits of their autism and comorbid diagnoses (Call et al., 2015). Social skills should be addressed early for children with autism and related disabilities while intervening on pica behaviors to avoid future health risks.

In this study, parents began with a consultation and interview meeting with the researcher to provide information and reasons for the referral for pica behavior intervention. Parents completed the following forms: consent to participate in the research study, consent to assessment, consent to treatment, parent interviews, reinforcer profile, Vineland-3, FAST, and QABF. Parents in the study agreed to participate in parent meetings either in person or via video conference for training and updates, as well as continue the treatment in the home environment following the center-based study to maintain reduced levels of pica behavior across settings.

Data Collection and Analysis

Baseline data were taken over a minimum of 2 hours each day for 5 consecutive days to collect the target behavior's frequency. The researcher wrote a specific behavior intervention plan for each phase of the treatment and made individualized adjustments to

accommodate the special needs of each child. The researcher analyzed data following the baseline data collection every fifth day throughout the study for each participant. The researcher supervised, checked interrater reliability through data collection, and checked for consistency across therapists. The first training session of each intervention phase for the first hour included live observation of each participant. The researcher reviewed the data she collected and the data collected by the BCaBA to calculate the interobserver agreement (IOA) between the observer and the experimenter. The mean IOA for live observations was calculated by the researcher to show reliability in the measurement, observers, and the definitions of the target behavior. The observer and the researcher used the same behavior definitions to maintain consistency in frequency counts. Additional IOA data were calculated during live supervision sessions, occurring for 1 hour every 2 weeks, to show ongoing reliability. Each time the target behavior occurred, the therapist recorded the frequency data in the online data collection system, provided by the BCBA and researcher. Each IOA session was recorded by the two observers, whereas the total number of agreements was divided by the total number of intervals and multiplied by 100. The researcher analyzed data using the Catalyst online data collection system to provide relevant information summarizing the target behaviors, as well as detected trends in the data that required a behavior intervention change. The researcher used a time-based criterion for each intervention phase so that each participant received an equal amount of each treatment.

Generalization

Generalization of results was planned for from the beginning, as the behavior intervention was implemented in the center with parent training from the researcher and BCBA so they could continue any necessary interventions following the study. During

posttreatment, the researcher trained the parents to implement the same procedure in the home environment, and parents committed to ongoing parent meetings every 4 to 6 weeks or sooner if pica behavior levels increased. Training for the parents occurred in the center and via video call, which consisted of modeling the implementation of the intervention with the child and data collection procedures. Effective intervention in the center environment would be meaningless without generalization.

Maintenance

Maintenance of reduced levels of pica behaviors was a vital part of the effectiveness of the intervention. The overall goal was to maintain zero levels to low levels of pica behavior over an extended period of time across environments. Frequency data were collected at the center throughout the reversal phase and paired with caregiver report of pica behavior in the home.

Internal Validity

Strong internal validity was found in the current study in the reversal phase, which indicated that the participants were able to maintain and generalize their skills and reductions in pica behavior across environments, as shown in the frequency measurements of this phase as compare to the other conditions. Each participant served as their own control in this single-subject design to evaluate the independent variables and how participants responded to each treatment. Confounding variables threaten the reliability of the outcome measures. As an example, in this study, multiple participants had medical issues, which led to increases in maladaptive behavior and a decrease in attending and toleration.

Social Validity

The current study measured and obtained social validity levels by collecting data

by verbal report with questionnaires and interviews presented by the researcher to with caregivers prior to treatment and at the close of the maintenance and generalization phase. The outcomes from the caregiver perspective were compared and quantified to determine the level of social validity. Social validity was measured and obtained with the comparisons of treatment phases by participants with a final comparison of the maintenance of learned skills across the center and home environments. The purpose of the study was to determine the most effective interventions for the reduction of pica behavior, which provide increased safety and welfare to the participants and support and training for the families to continue the reduction of pica across environments.

Reliability of Measurement

This study utilized several reliable and valid instruments that have been shown to exhibit good validity and reliability. Matson et al. (2012) reported that the QABF is an empirically based instrument and is psychometrically sound to determine functions of behavior. Matson et al. also reported the QABF to have a psychometric analysis that yielded a Cronbach's alpha and Guttman split-half reliability of 0.86 and 0.91 for the reliability of coefficients. This study also included the Vineland-3 to gain additional insight into the skill levels, deficits, and maladaptive behaviors of the current participants. The Vineland-3 is a standardized measure of adaptive behavior (Hill et al., 2017) for individuals with developmental and intellectual disabilities. Additionally, Fisher et al. (1992) reported that the Paired Stimulus Preference Assessment is an empirically validated instrument with a reliable prediction of the quality and ranking of reinforcers. IOA data were collected by the researcher and the BCaBA at the end of the first week of each intervention phase for each participant to record correct and incorrect implementation by the RBTs for the protocol for each phase. The IOA data were

collected concurrently, yet independently, for each participant with the following results: The IOA data by phase for Participant 1 were 95% for Phase Tx1, Tx2, and Reversal and 98% agreement for Phase Tx3. For Participant 1, the overall IOA data for the entire study resulted in 95.75% agreement. The IOA for Participant 2 for each phase included Tx1 and Reversal with 100% agreement across 20 trials, 98% IOA for Tx3, and 95% agreement in phase Tx2. IOA for Participant 2 across the entire study showed 98% agreement. Participant 3's IOA data across phases included Tx1 with 98%, Tx2, Tx3, and Reversal with 95% IOA, and Participant 3's results for the study showed IOA of 95%. The IOA across phases for Participant 4 was recorded as 100% IOA for Tx1, Tx2, Tx3, and for the Reversal phase. Participant 4 had an IOA measurement of 100% agreement for the study. The study as a whole across participants and all phases resulted in a 97% IOA.

Treatment Fidelity

To ensure treatment fidelity, the researcher provided ongoing training, observed treatment sessions which included modeling the proper treatment and data collection procedures, maintained appropriate materials throughout the study and continuously monitored data collection. The researcher provided additional training and answered questions pertaining to the correct methodologies for each treatment phase to maintain proper implementation. Additionally, the researcher provided a behavior intervention plan for each phase to outline the procedures, materials, data collection, and responses for each phase, which added to the reliability and validity of the current study.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to examine and compare applied behavior analysis methodologies of reinforcement and consequence-based interventions, in the reduction or elimination of pica behaviors. The importance of this examination and comparison is to determine the intervention package that eliminates or reduces pica behavior in an abbreviated period and to add to the current research. In doing so, clinicians treating children with autism will be able to include these interventions to save the lives of those in their care.

Results for Research Question 1

Was the treatment package effective at reducing pica behaviors? The full treatment package showed a reduction of pica behavior for three of the four participants (see Table). Participant 1 maintained baseline levels at the finalization of the study; whereas Participants 1, 3, and 4 demonstrated reductions from baseline as compared to the final phase. The median data for Participant 1 showed a decrease of 3.5 pica behaviors. Participant 3 had an overall reduction of three pica attempts when comparing baseline to the conclusion of the study. The greatest total decrease of seven pica behaviors was accomplished by Participant 4 who responded well to the treatment package.

Results for Research Question 2

Was the intervention durable with effects lasting after the intervention was withdrawn? For all participants, the intervention demonstrated a descending trend in pica behavior from the first week of baseline measures and the final week in the reversal and maintenance phase of the intervention (see Figure 1). Each participant increased skill sets

across domains, which enabled them to understand the contingencies of each treatment phase. This resulted in global improvements in the reduction of pica behavior, increased communication, and increased social skills, as the compulsion to consume non-nutritive substances decreased. With a reduction on the focus on pica items, each child began to focus outward on peers, appropriate actions with toys, and they demonstrated reductions in all maladaptive behaviors outside of a pica. The findings from the study showed success in durable effects across participants throughout the withdrawal of treatment.

Table

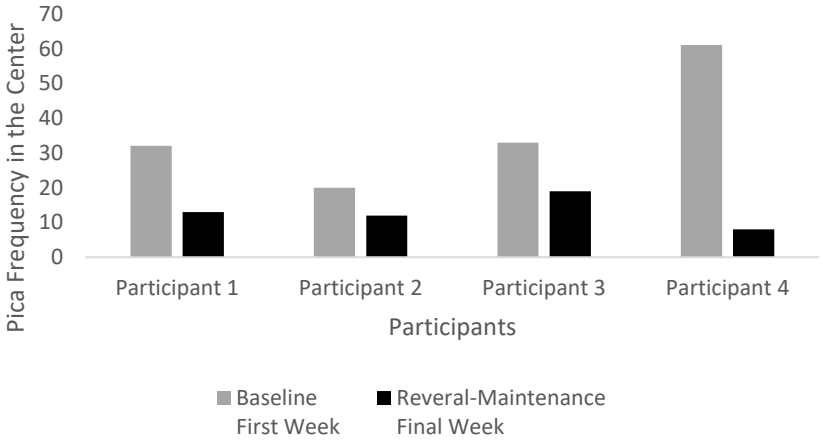
Median Measures Across Participants by Phase

Participant	Baseline	Tx1	Tx2	Tx3	R-M
1	6	5	5	3.5	2.5
2	3	3	3.5	4	3
3	6	4	9	9	3
4	10	4	5	4	3

Note. Tx = Treatment. R-M = Reversal-Maintenance.

Figure 1

All Participants: Comparison of First Week and Final Week of Pica Treatment



Participant 1 had a reduction of pica behavior in the reversal and maintenance phase, which had a mean of 2.86 attempts down from the mean of 6.6 attempts at baseline. Participant 2's data from baseline showed a slight mean reduction from 4.0 to 3.83 in the reversal and maintenance phase. Participant 3 showed spikes in pica attempts in the reversal phase, yet reached zero levels on 5 days, and only one pica attempt was observed for 4 days of this phase. The highest level of the study for Participant 3 reached 53 attempts in 1 day, which correlated to dental pain and increases in all maladaptive behavior tracked at that time. Participant 4's pica attempts in the reversal phase reached zero levels on 2 days and only one pica attempt for 5 days of this phase.

Results for Research Question 3

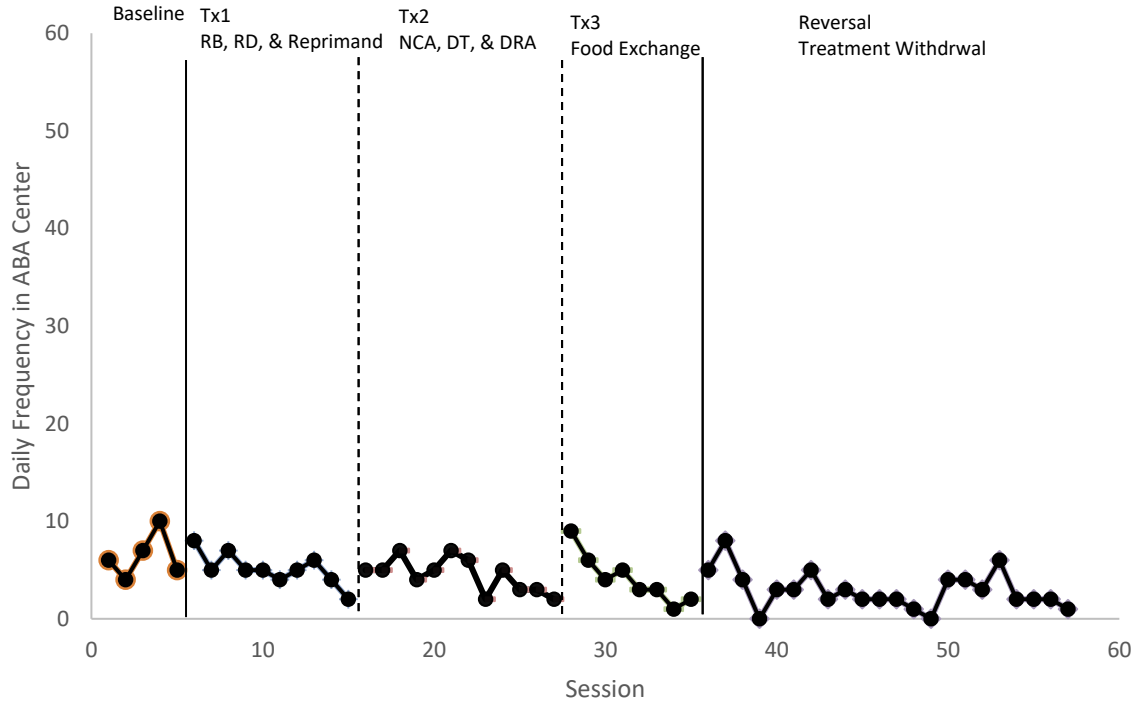
Was any treatment component more or less effective at reducing pica behavior? There were global findings across participants, for three of the four participants, who had reductions in pica behavior, while Participant 2 remained at stable levels of pica behavior when all treatment phases were compared. Each participant demonstrated a significant reduction in pica along with socially significant results with increases for all participants in communication and social skills and an overall decrease across all maladaptive behaviors.

Participant 1 exhibited the greatest reduction shown by the median data of pica behavior in Phase Tx3 and the reversal and maintenance phase (see Figure 2). As his language increased through signs and vocalizations, he was able to comprehend the treatment and communicate more effectively. Participant 1demonstrated a minor reduction from baseline and within the Tx1 phase. The median data at baseline was six pica attempts per session, and, during the Tx1 phase, pica reduced to five attempts. The final point of Tx1 for Participant 1 was two attempts per session, which indicated a

successful treatment effect for this child.

Figure 2

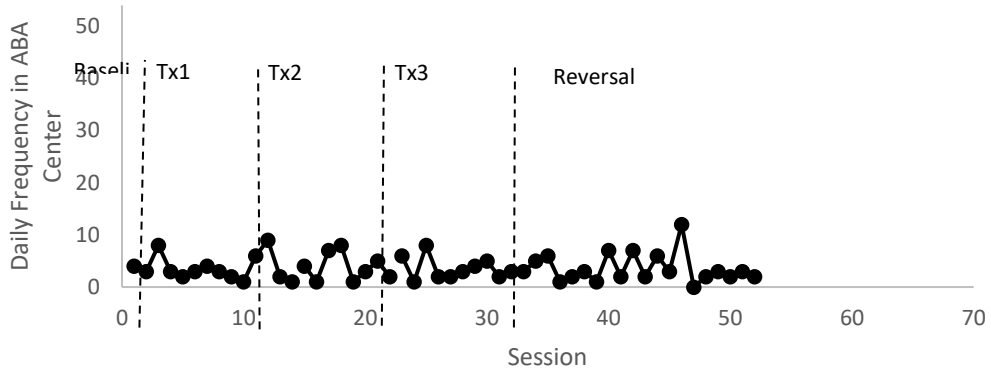
Treatment Results for Participant 1



Participant 2 demonstrated a stable trend in pica behavior throughout the treatment and had a reduction at the beginning of Tx1 from baseline, increased for 2 days and then decreased at the end of the treatment phase (see Figure 3). The median of three pica attempts per session for Phase Tx1 was equal to the baseline median. In the reversal phase, she had low levels of pica including one zero level day, 2 days with only one pica attempt, and 6 days with two pica attempts, which were all below the median baseline levels. Participant 2 made some progress; however, bilateral visual hypoplasia did not make visual discrimination possible. Participant 2 also had additional diagnoses and sensory challenges and historically had a learning curve that required more time to build discrimination skills.

Figure 3

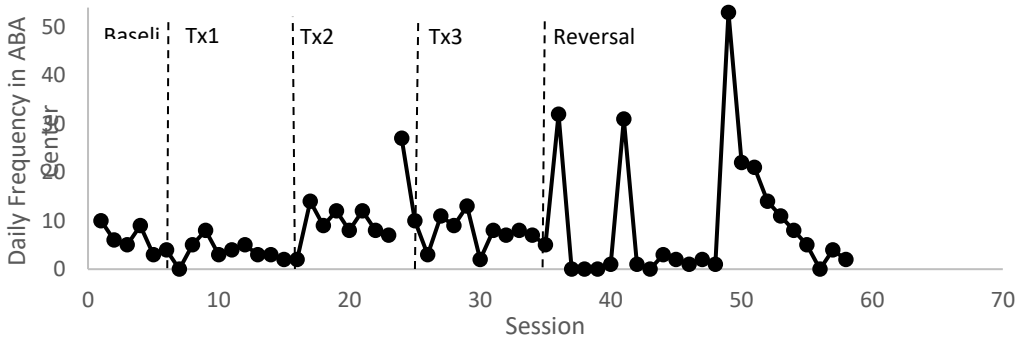
Treatment Results for Participant 2



Participant 3's median data for phases Tx1 and the reversal and maintenance phase were lowest for pica behavior when compared to baseline measures (see Figure 4). Participant 3 showed an overall decrease in pica behavior during the Tx1 treatment phase. The first few sessions of the Tx1 phase increased to baseline levels and decreased as the participant began to understand the contingency in place. The baseline median was six, and the Tx1 phase showed a 2-point decrease in pica attempts with a median of four. Participant 3 showed spikes in pica behavior in the return to baseline, which was correlated with illness and pain from dental issues, shown across each target behavior tracked (i.e., pica, aggression, tantrum, self-injury, and noncompliance).

Figure 4

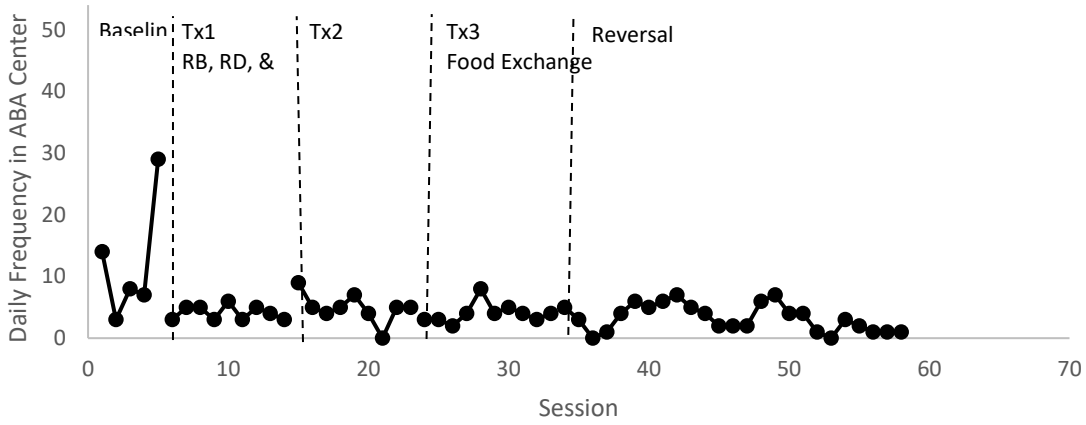
Treatment Results for Participant 3



Participant 4 was a treatment responder and had an immediate decrease from baseline, which demonstrated a steady trend throughout Phase Tx1 (see Figure 5). Participant 4 had the greatest reduction in pica overall, as he responded well to all treatment phases compared to baseline and showed the greatest reduction in the reversal and maintenance phase.

Figure 5

Treatment Results for Participant 4



Results for Research Question 4

What were the parents' attitudes towards the treatment? All participants' caregivers reported socially significant results in the reduction of both pica frequency and reductions in pica types. Parent satisfaction measures indicated that 100% of participants completed clinical sessions. All of the caregivers completed all of the caregiver training sessions. All of the caregivers reported a perceived efficacy with decreased pica behavior in the home environment, 50% reported decreases at school, and 25% included a noticeable reduction in pica in the community. Additional parent satisfaction was reported by 100% of caregivers who perceived an increase in discrimination skills (food versus non-food items) based upon clinical data, completion of the study, and requests to

continue treatment, which aligned with data from the center environment. All caregivers reported an increase in vocal language including moving from vocals on the word level to the sentence level for the other three participants. Participant 1 had increases in sign language and vocal language on the word level. Three quarters of the caregivers felt they had developed skills to help their child at home at the conclusion of the study. Each caregiver additionally reported that their children demonstrated an increase in communication and social skills with reductions in other maladaptive behaviors. Each caregiver stated they would like to continue treatment following the study. Most importantly, each caregiver said that they felt their child was safer than prior to treatment and that their increase in appropriate play skills allowed for more independence for all family members.

Participant 1's caregiver stated that behavioral change was observed over the course of the study with decreases in pica, aggression, and self-injury. He reported that his child went from being nondiscriminatory with pica items and has reduced pica items to strings on clothing and cold items when he experiences dental pain. The caregiver observed Participant 1 beginning to throw away former pica items, although reminders were still occasionally needed. An unintentional consequence to the treatment period as reported by Participant 1's caregiver included an increase in communication of both signs and vocals and an increase in meaningful social interactions.

Participant 2's caregiver observed an overall reduction in pica behavior as compared to the levels that were reported prior to treatment. Participant 2 learned to request an appropriate item to chew on for sensory input instead of pica items and has shown a reduction in overall pica items following the treatment. Participant 2 began to label an item either food or trash by the way the item felt or smelled, yet she remains

somewhat prompt dependent with discrimination skills. Unintended consequences of the study as reported by Participant 2's caregiver included an increase in vocal communication, increased spontaneous social interactions, and improved navigation across environments.

Participant 3's caregiver found the study to be successful for her child, as the pica behavior declined from baseline throughout treatment. On two occasions, in Phases Tx2 and Tx3, the child put a Lego in his ear, which appeared to be an alternative to putting the toys in his mouth. These were removed by a physician, which the child found unpleasant and did not repeat the behavior after the second time. Participant 3 is now able to play with toys with small pieces that had been preferred pica items including Legos and play doh. The caregiver reported that her child has begun to independently throw away trash items. Before playing with prior pica items, the caregiver would state, "We are going to play Legos now, but they are toys and not for your mouth." The caregiver reported that she felt more comfortable allowing her child to play out of her vision, which allowed her child and herself more independence. Participant 3 also showed a reduction in aggression and tantrum behavior, as well as increased vocal communication and social interactions, which led to a scaled increase in time in public school from 1 hour a day to 5 hours a day, with reduced time in the clinic environment.

Participant 4's caregiver saw an overall reduction in pica behavior and the number of pica types that her child preferred. The caregiver reported that her child understood toys, food, and trash were different, and he would discard items that were trash with verbal prompts. She learned to prepare her child for events or before playing with prior items used for mouthing by talking about the rules of the items with the labels he has learned during treatment. Participant 4 increased his time in school with the reduced pica

levels and with the reduction of aggression and tantrum behavior. Participant 4 also increased his vocal language to the sentence level with improved articulation so that his peers and wider audience may understand what he wants. With these improvements, the child became interested in peers and began to invite peers to play games such as “chase” and making items from clay.

The findings of the study found global results in the reduction of pica behavior with socially significant unintended results with increased language, increased social skills, increased discrimination skills, decreases in other maladaptive behaviors, and parental satisfaction across all participants. When comparing the first week of baseline to the last week of the reversal and maintenance phase, all participants decreased pica behavior. The most successful of the three treatment phases were the first phase with redirection, response blocking, and verbal reprimand; and the third phase, using a food exchange procedure, demonstrated a median reduction of pica attempts of four, which was a decrease from baseline measures. The reversal and maintenance phase for all participants had a median of 3, which was a 50% median reduction from the baseline.

The results from the caregivers’ feedback suggested that the participants were safer with the reductions in pica behavior, and caregivers did not feel they had to be as hypervigilant as they were previously, as their children began to appropriately play with toys and understand the difference between food and non-food items. With a reduction in the compulsion to mouth non-nutritive items, the children began to take interest in social interactions with peers and young family members, which increased each child’s overall quality of life.

Chapter 5: Discussion

Introduction

The current single subject research study examined three interventions ending with a return to baseline over the course of 11 weeks to determine the most effective interventions to treat pica behavior for children and adolescents diagnosed with autism spectrum disorder. Accompanying the primary goal of a reduction of pica behavior to low or zero levels, this study used the last 4 weeks to remove treatment and measure the maintenance of learned skills and to see whether the reduction of pica behavior would generalize. Generalization was reported by caregivers to show reductions in pica behavior like that recorded in the therapy center in other environments (e.g., home, school, and the community). Maintenance of the progress and the appropriate replacement skills with reduced levels of mouthing were demonstrated, although two participants did demonstrate spontaneous recovery of pica behavior. Each instance of the behavior spike was recorded for 1 day for both participants with spontaneous recovery of mouthing in the final phase.

Summary of Findings

Each participant underwent a series of procedures prior to treatment, including a functional analysis and a preference evaluation for foods, objects, and activities that might be reinforcing. The preintervention and baseline data were collected following meetings with caregivers, who completed documentation and assessments with the investigator. Three treatment packages were presented to each participant for 2 weeks per treatment. The first intervention (Tx1) used response blocking and a verbal reprimand to stop the chain of behaviors leading to mouthing before contact with the non-nutritive substance and the child’s mouth, which served as the starting point for the second phase.

The second intervention (Tx2) consisted of response-blocking paired with discrimination training and non-contingent access to preferred foods. The third intervention (Tx3) was the most successful at the reduction of pica behavior and involved the application of the discrimination training from Tx2 with a food exchange procedure. Following the treatment packages, the last 4 weeks of the study included the removal of pica treatment and tested for maintenance of pica reduction and generalization of pica reduction in the home, school, and community, as reported by their caregivers.

The postintervention results from the Paired Stimulus Preference Assessment showed that all participants increased their number of preferred items and activities, which indicated that the previous fixation on pica items was reduced and allowed the participants increased interested in appropriate interactions with peers, items, and activities. Regarding the QABF, the five possible functions that were measured included access, escape, non-social, physical, and tangible conditions. The physical function was more prevalent in Participants 1 and 2, whereas the tangible function was more prevalent with Participants 3 and 4. Lastly, the median values of pica for each participant were considered to show significant reductions in pica behavior when the baseline measures were compared to the measures from the final week of the study.

Discussion of the Results for Participant 1

The baseline results from the Paired Stimulus Preference Assessment showed that Participant 1 did not have consistent motivation for any item or activity. Participant 1 was reported by his father and therapy staff that it was difficult to find items and activities to motivate him and it had been a goal to increase preferred items and activities, which was supported by the current assessment. Research has indicated that children with autism have limited interests along with repetitious behaviors and with the increase of interests

in appropriate items, unwanted behaviors are more likely to reduce (Nyakundi & Wairungu, 2021). The postintervention results from the Paired Stimulus Preference Assessment showed that Participant 1 had increased his preferred items and activities including the trampoline, visiting his preferred therapist, riding the scooter, and bites of a banana, all which were novel items of interest to him. Along with the increase in preferred items that he interacted with during the study, he decreased the number of pica items he engaged with from the beginning of the study. When competing stimuli are present, it becomes crucial to build motivation for the selection of safe items in place of pica items (Nyakundi & Wairungu, 2021; Ruckle et al., 2022). The QABF was administered to each participant during the preintervention phase to identify the function of each child's pica behavior. The four possible functions that were measured with the QABF included access, escape, non-social, physical, and tangible conditions. Physical function was most prevalent in Participant 1.

The FAST was administered to each participant with the inclusion of the parents and the assigned BCBA during the preintervention phase of the study. The FAST was used to determine any factors that may influence behavior to provide information to identify the primary function of maladaptive behavior. The social factor was the most prevalent with Participant 1. Determining the function of the behavior exhibited allows the clinical team to prepare individualized interventions to target maladaptive behaviors and replace them with appropriate behaviors that give the child an alternative behavior with the same function (Nyakundi & Wairungu, 2021).

Participant 1 was evaluated by the researcher who completed the Vineland-3 domain-level teacher form along with the analysis of scores. Participant 1's overall level of adaptive functioning was described by his score on the adaptive behavior composite.

His adaptive behavior composite score was 30, which is well below the normative mean of 100 (the normative standard deviation is 15). Participant 1 had many barriers outside of pica behavior including lack of impulse control, obsessive-compulsive tendencies, stereotypy, dental injuries, and was predominately nonverbal at the beginning of the study, which are all common among children with presenting pica behavior (Liu et al., 2015; Stiegler, 2005). Regarding pica behaviors, at baseline, Participant 1 exhibited a median of 6 instances of pica behavior with an end median result of 2.5 instances in the reversal phase. When comparing the first week to the last week, this participant had 32 pica attempts with a reduction for the final week to eight attempts over a 5-day period. Training new skills took a multitude of trials for this participant, yet he demonstrated strong outcomes in the reduction of pica and increase of skills across domains.

Discussion of the Results for Participant 2

The results indicated that Participant 2 increased his preferred items or activities, which allowed the BCBA to target the most preferred items to build motivation to access those items once a task or group of tasks were completed. Regarding the QABF, a physical function was most prevalent in Participant 2. Results of the FAST revealed that the social factor was the most prevalent with Participant 2. Participant 2's overall level of adaptive functioning was described by her score on the adaptive behavior composite. Her adaptive behavior composite score was 23, which was well below the normative mean of 100 (the normative standard deviation is 15).

Participant 2 had the greatest number of barriers to learning at the beginning of the study which included the following: ASD, bilateral optical hyperplasia, intellectual disability, low impulse control, self-injurious behavior, dental injuries, stereotypy, and feeding issues, along with pica behavior. Milano et al. (2019) suggested that many

children with feeding difficulties have anxiety with food, and, once the anxiety is reduced, issues surrounding food may decrease combined with targeted interventions. With Participant 2's blindness and comorbid diagnoses, she historically demonstrated anxiety, particularly with eating a variety of foods, as she would only eat soft foods. She incurred dental injuries resulting from mouthing porcelain and hard surfaces and has scarring on her hands and arms from self-injurious behaviors.

Bearss et al. (2018) spoke to a similar profile in patients at a dental practice who found methodologies of ABA assisted in the reduction of pica behavior, which also led to compliance during dental exams and procedures, necessary as a result of pica. Participant 2 compulsively sought out pica items that were either within reach or that were cold (e.g., porcelain, cold metal, and countertops) to soothe her dental pain from pica. Stiegler (2005) indicated that tooth damage is common in individuals with developmental and intellectual disabilities. Visuals are key to success for many with ASD (Bearss et al., 2018); however, for Participant 2, this was not an option due to blindness and created additional challenges to fast progress. Following the study, she only used a hard rubber ring to chew on and stopped seeking other outlets for mouthing. Regarding pica behaviors, at baseline, Participant 2 exhibited a median of three instances of pica behavior with a stable end median result of three instances in the reversal phase. When comparing the first week to the last week, this participant had 20 pica attempts with a reduction for the final week to 13 attempts over a 5-day period.

Discussion of the Results for Participant 3

The results indicated that Participant 3 increased his preferred items or activities, which allowed the BCBA to target the most preferred items to build motivation to access those items once a task or group of tasks were completed. Regarding the QABF, the

tangible function was most prevalent in Participant 3. Results of the FAST revealed that the socially mediated attention was the most prevalent factor for Participant 3. Participant 3's overall level of adaptive functioning was described by his score on the adaptive behavior composite. His adaptive behavior composite score was 59, which is well below the normative mean of 100 (the normative standard deviation is 15).

Participant 3 had barriers that included ASD, global developmental delay, obsessive-compulsive disorder, attention deficit hyperactivity disorder, dental injury, and poor impulse control along with pica behavior. One study discussed pica behavior as a sensory-seeking compulsion to gain access to items that have satisfying textures and used them to reduce anxiety or even to avoid things they do not like (Stiegler, 2005). Participant 3 demonstrated impulsive behaviors in a consistent manner, including pica behavior. When he found a pica item, such as a Lego, to gain socially mediated attention, he would look at the caregiver and attempt to put the item in his mouth. Unattended, he would mouth or consume pica items in a broad range of textures; however, by the end of the study, he reduced his pica items from nine to only one across environments. On days with spikes in pica attempts, Participant 3 indicated that his mouth hurt, and the clinicians reported increases in all maladaptive behaviors, including tantrums, aggression, and verbal refusal. A study on the improvement in communicating pain in those with ASD stated that the higher the level of pain a child experiences, there is a correlation with a higher frequency of maladaptive behaviors (Fitzpatrick et al., 2020). Regarding pica behaviors, at baseline, Participant 3 exhibited a median of six instances of pica behavior with an end median result of three instances in the reversal phase. When comparing the first week to the last week, this participant had 33 pica attempts with a reduction for the final week to 17 attempts over a 5-day period.

Discussion of the Results for Participant 4

The results indicated that Participant 4 increased his preferred items or activities which allowed the BCBA to target the most preferred items to build motivation to access those items once a task or group of tasks were completed. Regarding the QABF, the tangible function was most prevalent in Participant 4. Results of the FAST revealed that the social factor was the most prevalent with Participant 4. Participant 4's overall level of adaptive functioning was described by his score on the adaptive behavior composite. The adaptive behavior composite score was 54, which was well below the normative mean of 100 (the normative standard deviation is 15).

Participant 4, the twin sibling of Participant 3, had the same profile with slightly more severity in delays across domains. His barriers included ASD, obsessive-compulsive disorder, global developmental delay, attention deficit hyperactivity disorder, dental injury, gastrointestinal issues, and poor impulse control. The function of his pica behavior was controlled by sensory seeking and socially mediated attention. He began the study with 12 pica items that he would mouth or consume, resulting in dental injury. At the conclusion of the study, he had a reduction to two pica items that he attempted at the clinic or at home. Although he had many challenges, Participant 4 responded to treatment with a stable reduction from baseline, which was maintained and generalized across environments. Regarding pica behaviors, at baseline, Participant 1 exhibited a median of 10 instances of pica behavior with an end median result of three instances in the reversal phase. When comparing the first week to the last week, this participant had 61 pica attempts with a reduction for the final week to 13 attempts over a 5-day period.

Interpretation of Findings

Pica is a dangerous form of self-destructive behavior that affects people with

developmental disabilities (Bryant-Waugh, 2019). According to studies, pica has also caused the deaths of individuals with developmental disabilities (Blinder, 2008; Falcomata et al., 2007). Even though numerous published studies have shown that behavioral treatment can significantly reduce pica behavior, few of these studies included techniques for generalization and maintenance outside of quick sessions (Falcomata et al., 2007; Kern et al., 2006; McAdam et al., 2004).

Another drawback of current research is that, although some studies significantly reduced pica, pica responses continued to happen at rates that make it difficult to prevent negative outcomes. As a result, practitioners must further reduce pica to create safeguards for those who are exhibiting pica behaviors. Maintenance and generalization are imperative to continued positive outcomes and to make certain pica behaviors are reduced across caregivers and environments and must be a focus of any pica intervention (Ferreri et al., 2006).

According to research, a sizable proportion of young children with autism spectrum disorder also have coexisting clinically important behavioral issues. The areas of socialization, communication, repetitive behaviors, and constrained interests are frequently severely impacted in children with ASD. Children with ASD are more likely to exhibit problematic behaviors that call for treatment because of the impairment in communication and socialization (Martins et al., 2008). Positive behavioral changes in children are frequently brought about by interventions that teach parents to alter their patterns of interaction (Oono et al., 2013).

The data analysis conducted in this study showed that participants' data across all intervention phases exhibited a decreasing trend, leading to low to zero levels of pica behavior, although two participants demonstrated spontaneous recovery of the behavior

while having it reduced in the following sessions. The treatment package, Tx3, in which participants traded in pica items for preferred foods, was the intervention that brought all participants' levels of pica behavior to their lowest points. Additionally, the reduction in the median number of pica behaviors was significantly reduced after ABA intervention. The detrimental effects of pica show how much support, assistance, and ongoing research are required to address these maladaptive behaviors. This research demonstrates unequivocally that ABA treatment plans successfully reduce pica behavior while fostering vital abilities to replace pica with appropriate responses that serve similar purposes.

Context and Implications of Findings

Casey et al. (2012) discussed the impact of subsets of behavioral disorders, such as pica, in children within the foster care system. The study stated the need for further research and education in areas of nutrition, evaluation of pica, and timing of referral to intensive behavioral services for treatment. In a broader stroke, Casey et al. found that psychological shock and environmental constraints may be an underlying cause of eating and behavior disorders in children with pica behavior and autism. In the Casey et al. investigation, the authors also described the importance of future studies on training for caregivers and therapy staff to obtain the highest level of progress. Cooper (2010) suggested future research in dentistry for patients with pica, as an important part of an interdisciplinary team. All of the participants in this study had ongoing dental issues such as broken teeth from mouthing porcelain or concrete and dental decay and other types of damage from a myriad of pica items. The current research discussed that persons with pica experience ongoing dental concerns, which are directly related to their pica behavior (Williams et al., 2022). With the current participants, dental pain was a cycle beginning

with pica behavior, which led to dental injury, and the pain from their dental injuries increased maladaptive behavior, such as self-injury, aggression, and tantrums. Bearss et al. (2018) stated that, for those with ASD, like the participants in this study, processing information is difficult, which creates a need to explore their environment differently. Increasing the ability to express pain through vocalizations, signs, or gestures decreases maladaptive behavior, such as pica, aggression and tantrums when seeking sensory input to avoid or alleviate pain (Fitzpatrick et al., 2020).

Bryant-Waugh (2019) explained that future critical additions to the literature consisted of identifying and treating pica behavior. These additions move from hypotheses regarding etiologies to a more concrete understanding of pica, further dissemination of pica characteristics, and the development of evidence-based assessments to further aid effective treatment (Matson et al., 2013). Matson et al. (2013) also suggested future development of formulas that disseminate and record data for the following characteristics of pica: frequency, type, topography, age, intensity, and duration. These types of data collection improve initial identification, assessment, and treatment planning, as the *Diagnostic and Statistical Manual* and current literature do not specify these characteristics.

Kern et al. (2006) suggested future treatments in which cues for preferred foods are faded at a faster rate that may make the food exchange less important. The authors further stated that studies involving large groups of participants would demonstrate actual intervention effectiveness. Kern et al. suggested a hypothesized increase in the rate of identification of children who need treatment, with the addition of assessments explicitly designed for pica. The same recommendation came from Matson et al. (2013), Delaney et al. (2015), and Mayes and Zickgraf (2019). Delaney et al. further advised that future

research is needed to understand the physiological and mental strain of pica behavior. The current investigator found that tools specific to identify and address pica behavior using ABA with children diagnosed with autism were not available and therefore used current tools that identified a variety of maladaptive behaviors.

Positive reinforcement was used throughout the study to differentiate wanted versus unwanted behavior for each child. Two participants responded well to praise and affirmation, whereas two participants responded more to physical praise such as high fives, smiles, or tickles. Studies have indicated that more research with a positive reinforcement focus, showing success in reducing pica to near-zero levels maintained over time, remains necessary (Falcomata et al., 2007; Liu et al., 2015). Falcomata et al. (2007) also found that reinforcement alone did not produce significant reductions in their study. Future research was additionally suggested by Falcomata et al. to investigate generalization and maintenance procedures more intensely to identify the frequency at which unintended stimuli control pica behavior across settings and caregivers. Bay et al. (2013) noted that they were unable to compare their study results to the current literature as there were no similar studies when finding correlations between pica behavior and low levels of elements such as iron, zinc, and selenium. The researchers suggested future work in finding links to deficiencies in nutrients as they relate to this disorder.

The participants in the current study were identified by their caregivers and ABA clinical staff and not by their primary care physicians. Beginning with the onset of the study, caregivers were encouraged to coordinate care with their child's physicians and dentists to address physical concerns because of years of pica behavior. Mayes and Zickgraf (2019) referred children below the age of 12 to feeding clinics for medical and behavioral intervention, whereas adolescents received referrals to eating disorder clinics

for medical and behavioral intervention. The investigators suggested that more research is needed to possibly link autism with various eating disorders including pica (Mayes & Zickgraf, 2019).

Limitations of the Study

Many researchers' limitations pertain to the small sample sizes of studies of pica behavior and ABA interventions (Kern et al., 2006). Many children go undiagnosed or do not receive behavioral intervention and, therefore, are not identified in the population of children with autism who display pica behavior. According to Call et al. (2015), limitations are found due to the deficiency of outcome studies, and many of those studies are from 10 years ago or older. Call et al. recorded a bias of over reporting outcomes and effectiveness of treatments to increase the chances of getting publication.

The time allotted for the current study did not allow for extended data collection on generalization or maintenance of target behavior reduction beyond the 4 weeks of return to baseline. The researcher recommends that treatment and data collection continue beyond the study for the participants who demonstrated treatment resistance due to their automatically reinforcing target behavior (Falcomata et al., 2007; Kern et al., 2006; LeBlanc et al., 2000). The researcher's self-designed and unvalidated reinforcer profile may threaten validity; however, the literature's reinforcer profile was not precisely what was necessary for the purposes of this study. An additional limiting factor to this study was the small number of participants and the lack of randomization in the participant selections. Every child treated in the ABA center received individualized accommodations for the base treatment plans and behavior interventions for each phase. These accommodations to the interventions were based upon assessments, ongoing observation, parent reports, and collaboration with physicians and educators connected to

each child. Although components of each treatment were individualized, such as types of positive reinforcement, preferred foods, and the manner in which items were presented, all participants received the same treatment for the same amount of time. Outside of the study, the best method would be to move to the next phase only as the data show great improvement or when the intervention is not effective in a given time frame. This study included only children with presenting pica behavior. Randomizing treatments for the participants create ethical concerns, as each child needs individualized plans dependent on the function, severity, frequency, and topography of their pica behavior.

Future Research Directions

Pica behavior in children with autism and developmental disabilities first emerged as a research target in the 1970s, with a ground-breaking study by Foxx and Martin (1975), yet there is still much to learn about the disorder and the best ways to reduce and eliminate it. The need for larger samples and longitudinal studies is warranted to determine the long-term impacts of treatment once the intervention has been faded and expanded on current research. To determine the lifetime outcomes of early intervention, other researchers have suggested the need for studies with larger participant populations (Kern et al., 2006) and longitudinal research (Casey et al., 2012; LeBlanc et al., 2000).

In a broader stroke, Casey et al. (2012) discussed the impact of subsets of behavioral disorders, such as pica, in children within the foster care system. The study stated the need for further research and education in areas of nutrition, evaluation of pica, and when to refer to intensive behavioral services for treatment. In the Casey et al. study, the authors found that “acute stress” (p. 310) and environmental constraints may be an underlying cause of eating and behavior disorders in children with pica behavior and autism. In the Casey et al. investigation, the authors also wrote about the importance of

future studies focusing on training for caregivers and therapy staff to obtain the highest level of progress. Cooper (2010) suggested future research in dentistry for patients with pica. Studies in an overlooked area of practice, such as dentistry, would support children and practitioners dealing with pica behavior in this type of setting.

Bryant-Waugh (2019) explained that future critical additions to the literature consist of identifying and treating pica behavior. These additions move from hypotheses regarding etiologies to a more concrete understanding of the causes, further dissemination of pica characteristics, and the development of evidence-based assessments to further aid effective treatment (Matson et al., 2013). Matson et al. (2013) also suggested future development of "investigating algorithms" (p. 2569) that record data for the following characteristics of pica: frequency, type, topography, age, intensity, and duration. These types of data collection improve initial identification, assessment, and treatment planning, as the *Diagnostic and Statistical Manual* and current literature do not specify these characteristics.

Following the Kern et al. (2006) examination, researchers suggested future treatments in which cues for preferred foods faded at a faster rate may make the food exchange less important. The authors further stated that studies involving large groups of participants would demonstrate actual intervention effectiveness. Kern et al. suggested a hypothesized increase in the rate of identification of children who need treatment, with the addition of assessments explicitly designed for pica. The same recommendation came from Matson et al. (2013), Delaney et al. (2015), and Mayes and Zickgraf (2019). Delaney et al. further advised that future research is needed to understand the physiological and mental strain of pica behavior.

Falcomata et al. (2007) suggested that more research with a positive

reinforcement focus, showing success in reducing pica to near-zero levels maintained over time, remains necessary. The authors also found that reinforcement alone did not produce significant reductions in their study. Future research was additionally suggested by Falcomata et al. to investigate generalization and maintenance procedures more intensely to identify the frequency at which unintended stimuli control pica behavior across settings and caregivers. Bay et al. (2013) noted that they were unable to compare their study results to the current literature as there were no similar studies when finding correlations between pica behavior and low levels of elements such as iron, zinc, and selenium. The researchers suggested future work in finding links to deficiencies in nutrients as it relates to this disorder.

Mayes and Zickgraf (2019) referred children below the age of 12 to feeding clinics for medical and behavioral intervention, whereas adolescents received referrals to eating disorder clinics for medical and behavioral intervention. These investigators suggested that more research is needed to possibly link autism with various eating disorders, including pica (Mayes & Zickgraf, 2019). Ferreri et al. (2006) discussed the need for a deeper understanding of the specific conditions in which taste aversive is most effective, as they found in their study that taste aversion was impactful for reducing pica behavior. The researchers concluded that the link between the independent and dependent variables as they relate to the function of pica behavior is the key to progress in using this methodology (Ferreri et al., 2006).

Conclusions

Despite the study's limitations, socially significant results in increased social and communication skills occurred along with a reduction in pica behavior in children with ASD using methodologies of ABA. The results of the study suggest that pica behavior

can reduce when treatment packages that include skill building of discrimination and communication, along with the presentation of alternative and appropriate behaviors that function similarly to the participants' pica behaviors, which mirrors current literature (Nyakundi & Wairungu, 2021). The component analysis indicated that the food exchange procedure was most effective for participants following direct discrimination training that identified appropriate foods versus trash, toys, or other non-nutritive substances. Stiegler (2005) concluded that component analysis with a variety of empirical treatment packages is impactful in understanding the most appropriate behavior analytic interventions for pica.

The clinicians' and caregivers' reports suggested that there were socially significant unintentional consequences to the treatment, which included increased language and communication skills, increased social skills, and an overall reduction of all maladaptive behaviors. Nyakundi and Wairungu (2021) outlined the importance of communication social, and leisure skills for individuals with ASD to understand his or her environment and the ability to process information to address deficits across domains and allow for greater overall outcomes. Caregivers from this study were satisfied with the results for each child and found that generalization of reduced pica behavior did occur at home, in school, and in the community. The results of the final parent interview also indicated that caregivers felt that their children were safer than prior to the treatment and also reported that they had gained skills themselves to care for the challenges of autism and pica behavior. As stated by Liu et al. (2015), pica behavior takes full attention from caregivers, and it becomes extremely distressing to keep their child safe. Each caregiver demonstrated commitment to their child's treatment as well as increased understanding of pica behavior and treatment. All caregivers stated that they felt they were a collective

team with the clinical staff and felt more prepared to meet the needs of their children.

The quantitative research study used an A-B-A design with a component analysis of three treatment packages to determine the most effective intervention for the reduction of pica behavior. Although further research and tools are warranted in the realm of pica behavior, this study provides formidable treatment options based upon the current research. The study's results indicated that the treatment packages used were appropriate and effective in the reduction of pica behavior in children with ASD and resulted in positive consequences that were not directly targeted, which increased the overall quality of living for participants and overall parental satisfaction.

References

American Academy of Family Physicians. (2018). *What is pica?* https://publications.aap.org/pediatrics/article/147/2/e20200462/77057/what.is.pica

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://www.psychiatry.org/psychiatrists/practice/dsm

American Psychiatric Association. (2022). *Neurodevelopmental disorders*. DSM Library. https://dsm.psychiatryonline.org/doi/10.1176/appi.books.9780890425787.x01_Neurodevelopmental_Disorders

Ashford, J., Smit, F., Van Lier, P. A., Cuijpers, P., & Koot, H. M. (2008). Early risk indicators of internalizing problems in late childhood: A 9-year longitudinal study. *Journal of Child Psychology and Psychiatry*, *49*(7), 774-780. https://doi.org/10.1111/j.1469-7610.2008/01889.x

Ashworth, M., Hirder, J. P., & Martin, L. (2009). The social and recreational characteristics of adults with intellectual disability and pica living in institutions. *Research in Developmental Disabilities, 30,* 512–520. https://doi.org/10.1016/j.ridd.2008.07.010

Autism Speaks Treatment Network. (2014). *Parent's guide to managing pica in children with autism.* https://www.autismspeaks.org/sites/default/files/2018-08/Pica_Parents.pdf

Barrett, R. (2008). Pica: Toward understanding a complicated condition. *Brown University Child and Adolescent Behavior Letter, 24*(6), 4–6. https://doi.org/10.1002/cbi.20068

Bay, A. Dogan, M., Bulan, K. Kaba, S., Demir, N., & Oner, A. F. (2013). A study on the effects of pica and iron-deficiency anemia on oxidative stress, antioxidant

capacity and trace elements. *Human and Experimental Toxicology, 32*(9), 895–903. https://doi.org/10.1177/0960327113475676

Bearss, K., Johnson, C. R., Handen, B. L., Butter, E., Lecavalier, L., Smith, T., & Scahill, L. (2018). *Parent training for disruptive behavior: The RUBI autism network, clinician manual*. Oxford University Press.

Bhatia, M. S., & Kaur, J. (2014). Pica as a culture bound syndrome. *Delhi Psychiatry Journal, 17*(1), 144–147. http://medind.nic.in/daa/t14/i1/daat14i1p144.pdf

Blinder, B. J. (2008). An update on pica: Prevalence, contributing causes, and treatment. *Psychiatric Times, 25*(6), 66, 72-73. https://www.psychiatrictimes.com/view/update-pica-prevalence-contributing-causes-and-treatment

Brusa, E., & Richman, D. (2008). Developing stimulus control for occurrences of stereotypy exhibited by a child with autism. *International Journal of Behavioral Consultation and Therapy, 4*(3), 264-269. https://doi.org/10.1037/h0100855

Bryant-Waugh, R. (2019). Feeding and eating disorders in children. *Psychiatric Clinics of North America, 42*(1), 157-167. https://doi.org/10.1097/YCO.0b013e328365.a34b

Call, N. A., Simmons, C. A., Lomas Meyers, J. E., & Alverez, J. P. (2015). Clinical outcomes of behavioral treatments for pica in children with developmental disabilities. *Journal of Autism and Developmental Disorders, 45,* 2105-2114. https://doi.org/10.1007/s10803-015-2375-z

Casey, C. M., Cook-Cottone, C., & Beck-Joslyn, M. (2012). An overview of problematic eating and food-related behavior among foster children: Definitions, etiology, and intervention. *Child Adolescent Social Work Journal, 29,* 307-322. https://doi.org/10.1007/s10560-012-0262-4

Centers for Disease Control and Prevention. (2016). *Prevalence of pica in preschoolers with and without autism spectrum disorder: Study to explore early development—United States, 2008-2016*. https://www.cdc.gov/eis/conference/dpk/ Prevalence_ of_Pica_in_Preschoolers.html

Cheng, W. M., Smith, T. B., Butler, M., Taylor, T. M., & Clayton, D. (2023). Effects of Parent-implemented interventions on outcomes of children with autism: A meta-analysis. *Journal of Autism and Developmental Disorders, 53*, 4147-4163. https://doi.org/10.1007/s10803-022-05688-8

Cooper, J. O., Heron, T. E., & Heward, W. L. (2019). *Applied behavior analysis* (3rd ed.). Pearson.

Cooper, M. D. (2010). Pica. *American Dental Association, 5*(1), 39-41.

Dawson-Squibb, J. J., Davids, E. L., Harrison, A. J., Molony, M. A., & Vries, P. J. (2020). Parent education and training for autism spectrum disorders: Scoping the evidence. *Autism*, *24*(1), 7-25. https://doi.org/10.1177/1362361319841739

Deb, S., Retzer, A., Roy, M., Acharya, R., Limbu, B., & Roy, A. (2020). The effectiveness of parent training for children with autism spectrum disorder: A systematic review and meta-analyses. *BMC Psychiatry*, *20*, 583-584. https://doi.org/10.1186/s12888-020-02973-7.

Delaney, C. B., Eddy, K. T., Hartmann, A. S., Becker, A. E., Murrary, H. B., & Thomas, J. J. (2015). Pica and rumination behavior among individuals seeking treatment for eating disorder or obesity. *International Journal of Eating Disorders, 48*(2). https://doi.org/10.1002/eat.22279

Edmonds, W. A., & Kennedy, T. D. (2013). *An applied reference guide to research design: Quantitative, qualitative and mixed methods.* Sage.

Embregts, P. J., du Bois, M. G., & Graef, N. (2010). Behavior problems in children with mild intellectual disabilities: An initial step towards prevention. *Research in Developmental Disabilities, 31*(6), 1398-1403. https://doi.org/10.1016/j.ridd.2010.06.020

Falcomata, T. S., Roane, H. S., & Pabico, R. R. (2007). Unintentional stimulus control during the treatment of pica displayed by a young man with autism. *Research in Autism Spectrum Disorders, 1*(12), 350-359. https://doi.org/10.1016/j.rasd.2006.12.004

Ferreri, S. J., Tamm, L., & Wier, K. G. (2006). Using food aversion to decrease severe pica by a child with autism. *Behavior Modification, 30*(4), 456-471. https://doi.org/10.11177/0145445504272970

Finney, J., Russo, D., & Cataldo, M. (1982). Reduction of pica in young children with lead poisoning. *Journal of Pediatric Psychology, 7*, (2), 197-207. https://doi.org/10.1093/jpepsy/7.2.197

Fisher, W. W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*(2), 491-498. https://doi.org/10.1901/jaba.1992.25-491

Fitzpatrick, R., McGuire, B. E., & Lydon, H. K. (2020). Improving pain-related communication in children with autism spectrum disorder and intellectual disability. *Pediatric and Neonatal Pain, 4*(1), 22-32. https://doi.org/10.1002/pne2.12076

Foxx, R. M., & Martin, E. D. (1975). Treatment of scavenging behavior (coprophagy and pica) by overcorrection. *Behavior Research and Therapy, 13*(2), 153-162. https://

doi.org/10.1016/0005-7967(75)90009-1

Frolli, A., Bosco, A., Di Carmine, F., Cavallaro, A., Lombardi, A., Sergi, L., & Ricci, M. C. (2021). Parent training and therapy in children with autism. *Pediatric Reports, 13*(2), 216-226. https://doi.org/10.3390/pediatric13020030

Gabbay-Dizdar, N., Ilan, M., Meiri, G., Faroy, M., Michaelovski, A., Flusser, H., Menashe, I., Koller, J., Zachor, D. A., & Dinstein, I. (2022). Early diagnosis of autism in the community is associated with marked improvement in social symptoms within 1-2 years. *Autism 26*(6), 1353-1363. https://doi.org/10.1177/13623613211049011

Gal, E., Hardal-Nasser, R., Engel-Yeger, B. (2011). The relationship between the severity of eating problems and intellectual development deficit level. *Research in Developmental Disabilities, 32,* 1464-1469. https://doi.org/10.1016/j.ridd.2010.12.003

Gale, C. M., Eikeseth, S., & Rudrud, E. (2010). Functional assessment and behavioural intervention for eating difficulties in children with autism: A study conducted in the natural environment using parents and ABA tutors as therapists. *Journal of Autism and Developmental Disorders, 41,* 1383-1396. https://doi.org/10.1007/s10803-010-1167-8

Garcia-dela Torre, P., Rodriguez-Ortiz, C. J., Balderas, I., & Bermudez-Rattoni, F. (2010). Differential participation of temporal structures in the consolidation and reconsolidation of taste aversion extinction. *European Journal of Neuroscience, 32,* 1018-1023. https://doi.org/10.1111/j.1460-9568.2010.07365.x

Gonyea, J. (2007). Pica: Do you know what your patients are eating? *Nephrology Nursing Journal, 34*(2), 230-232.

Hagopian, L. P., Gonzalez, M. L., Rivet, T. T., Triggs, M., & Clark, S. B. (2011). Response interruption and differential reinforcement of alternative behavior for the treatment of pica. *Behavioral Interventions, 26*(4), 309-325. https://doi.org/10.1002/bin.339

Hagopian, L. P., Rooker, G. W., & Rolider, N. U. (2011). Identifying empirically supported treatments for pica in individuals with intellectual disabilities. *Research in Developmental Disabilities, 32*(6), 2114-2120. https://doi.org/10.1016/j.ridd.2011.07.042

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

Hartmann, A. S., Becker, A. E., Hamption, C., & Bryant-Waugh, R. (2012). Pica and rumination disorder in DSM-5. *Psychiatric Annals, 42*(11), 426-430. https://doi.org/10.3928/00485713-20121105-09

Hill, T. L., Saulnier, C. A., Cicchetti, D., Gray, S. A. O., & Carter, A. S. (2017). Vineland III. In F. R. Volkmar (Ed.), *Encyclopedia of autism spectrum disorders* (pp. 1-4). Springer.

Hirsch, N., & Smith Myles, B. (1996). The use of a pica box in reducing pica behavior in a student with autism. *Focus on Autism and Other Developmental Disabilities, 11*(4), 222- 225, 234. https://doi.org/10.1177/108835769601100403

Ing, A. D., Roane, H. S., & Veenstra, R. A. (2011). Functional analysis and treatment of coprophagia. *Journal of Applied Behavior Analysis, 44*(1), 151-155. https://doi.org/10.1901/jaba.2011.44-151

Issarraras, A., & Matson, J. L. (2018). Assessment of pica. In J. Matson (Ed.), *Handbook of childhood psychopathology and developmental disabilities assessment.* (pp. 289-300). Springer.

Iwata, B. A., Deleon, I. G., & Roscoe, E. M. (2013). Reliability and validity of the functional analysis screening tool. *Journal of Applied Behavior Analysis, 46*(1), 271-284. https://doi.org/10.1002/jaba.31

Jarmuz-Smith, S. (2011). Parent involvement in education. *Communique, 39*(9), 44-45.

Jennett, H., Jann, K., & Hagopian, L. P. (2011). Evaluation of response blocking and representation in a competing stimulus assessment. *Journal of Applied Behavior Analysis, 44*(4), 925-929. https://doi.org/10.1901/jaba.2011.44-925

Jessel, J., Borrero, J. C., & Becraft, J. L. (2015). Differential reinforcement of other behavior increases untargeted behavior. *Journal of Applied Behavior Analysis, 48,* 402-416. https://doi.org/10.1002/jaba.204

Karge, B. D., & Lasky, B. (2011). Involvement of language minority parents of children with disabilities in their child's school achievement (EJ955942). *Multicultural Education, 18*(3), 29-31. ERIC. https://files.eric.ed.gov/fulltext/EJ955942.pdf

Kearney, C., Linning, L., & Alvarez, K. (2005). Response blocking. In M. Hersen, J., Rosqvist, & A. M. Gross (Eds.), *Encyclopedia of behavior modification and cognitive behavior therapy* (pp. 1001-1002). Sage.

Kern, L., Starosta, K., & Adelman, B. E. (2006). Reducing pica by teaching children to exchange inedible items for edibles. *Behavior Modification, 30*(135). https://doi.org/10.1177/0145445505283414

Kurtz, P., Boelter, E., Jarmolowicz, D., Chin, M., & Hagopian, L. (2011). An analysis of functional communication training as an empirically supported treatment for

problem behavior displayed by individuals with intellectual disabilities. *Research in Developmental Disabilities, 32*(6), 2935-2942. https://doi.org/10.1016/j.ridd.2011.05.009

LeBlanc, L. A., Patel, M. R., & Carr, J. E. (2000). Recent advances in the assessment of aberrant behavior maintained by automatic reinforcement in individuals with developmental disabilities. *Journal of Behavior Therapy, 31*(2), 137-154. https://doi.org/10.1016/j.rasd.2011.01.023

Levy, A., & Perry, A. (2011). Outcomes in adolescents and adults with autism: A review of the literature. *Research in Autism Spectrum Disorders, 5*, 1271-1282. https://doi.org/10.1016/j.rasd.2011.01.023

Liu, Y. H., Pesch, M. H., Lumeng, J. C., & Stein, M. T. (2015). Pica in a four-year-old girl with global developmental delay. *Journal of Developmental and Behavioral Pediatrics 36*(9), 758-760. https://doi.org/10.1097/DBP.0000000000000228.

MacKenzie, E. P. (2007). Improving treatment outcomes for oppositional defiant disorder in young children. *Journal of Early and Intensive Behavior Intervention, 4*(2), 500-510. https://doi.org/10.1037/h0100387

Martins, Y., Young, R. L., & Robson, D. C. (2008). Feeding and eating behaviors in children with autism and typically developing children. *Journal of Autism and Developmental Disorders*, *38*, 1878-1887. https://doi.org/10.1007/s10803-008-0583-5

Matson, J. L., Hattier, M. A., Belva, B., & Matson, M. (2013). Pica in persons with developmental disabilities. Research in *Developmental Disabilities, 34*, 2564-2571. https://doi.org/10.1016/j.ridd.2013.05.018

Matson, J. L., Hattier, M. A., & Turygin, N. (2012). An evaluation of social skills in

adults with pica, autism spectrum disorders, and intellectual disability. *Journal of Developmental Physical Disability, 24,* 505-514. https://doi.org/10.1007/s10882-012-9286-0

Matson, J. L., & Koslowski, A. (2011). The increasing prevalence of autism spectrum disorder. *Research in Autism Spectrum Disorders, 5,* 418-425. https://doi.org/10.1016/j.rasd.2010.06.004

Mayes, S. D., & Zickgraf, H. (2019). Atypical eating behaviors in children and adolescents with autism, ADHD, other disorders, and typical development. *Research in Autism Spectrum Disorders, 64,* 76-83. https://doi.org/10.1016/j.rasd.2019.04.002

McAdam, B. D., Sherman, J. A., Sheldon, J. B., & Napolitano, D. H. (2004). Behavior interventions to reduce the pica of persons with developmental disabilities. *Behavior Modification, 28*(1), 45-72. https://doi.org/10.1177/0145445503259219

Mikami, A. Y., Hinshaw, S. P., Arnold, L. E., Hoza, B., Hechtman, L., Newcorn, J. H., & Abikoff, H. B. (2010). Bulimia nervosa symptoms in the multimodal treatment study of children with ADHD. *Journal of Eating Disorders, 43*(3), 248-259. https://doi.org/10.1002/eat.20692

Milano, K., Chatoor, I., & Kerzner, B. (2019). A functional approach to feeding difficulties in children. *Current Gastroenterology Reports, 21*(51). https://doi.org/10.1007/s11894-019-0719-0

Minshawi, N. F. (2008). Behavioral assessment and treatment of self-injurious behavior in autism. *Child and Adolescent Psychiatric Clinics of North America, 17,* 875-886. https://doi.org/10.1016/j.chc.2008

Morrison, H., Roscoe, E. M., & Atwell, A. (2011). An evaluation of antecedent exercise

on behavior maintained by automatic reinforcement using a three-component multiple schedule. *Journal of Applied Behavior Analysis, 44*(3), 523-541. https://doi.org/10.1901/jaba.201144-523

Nyakundi, J. K., & Wairungu, G. M. (2021). Autism spectrum disorder: Review of common challenging behaviors and appropriate intervention strategies. *International Journal of Research and Innovation in Social Science, 5*(8), 500-507. https://www.rsisinternational.org/journals/ijriss/Digital-Library/volume-5-issue-7/500-507.pdf

Oono, I. P., Honey, E. J., & McConachie, H. (2013). Parent-mediated early intervention for young children with autism spectrum disorders (ASD). *Evidence-Based Child Health: A Cochrane Review Journal*, *8*(6), 2380-2479. https://doi.org/10.1002/14651858.CD009774.pub2

Orhan, M., Korten, N., & Kupka, R. (2020). Reliability and validity of the functioning assessment short test for older adults with bipolar disorder (FAST-O). *International Journal of Bipolar Disorder*, *8*, 28-29. https://doi.org/10.1186/s40345-020-00193-2

Pandolfi, V., & Magyar, C. I. (2021). Vineland-3 structural validity and interpretability of domain scores: Implications for practitioners assessing adolescents with developmental conditions. *American Journal on Intellectual and Developmental Disabilities*, *126*(3), 216-229. https://doi.org/10.1352/1944-7558-126.3.216

Piazza, C. C., Adelinis, J. D., Hanley, G. P., Goh, H., & Delia, M. D. (2000). An evaluation of the effects of matched stimuli on behaviors maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 33,* 13-27. https://doi.org/10.1901/jaba.2000.33-13

Rincover, A., & Koegle, R. L. (1975). Setting generality and stimulus control in autistic children. *Journal of Applied Behavior Analysis, 8*, 235-246. https://doi.org/10.1901/jaba.1975.8-235

Rohde, J., Claussen, M. C., Kuechenhoff, B., Seifritz, E., & Schepbach, D. (2013). Combined symptomology of psychosis, pica syndrome, and hippocampal sclerosis: A case report. *International Journal of Eating Disorders, 46*(1), 89-91. https://doi.org/10.1002/eat.22064

Roscoe, E. M., Iwata, B. A., & Zhou, I. (2013). Assessment and treatment of chronic hand mouthing. *Journal of Applied Behavior Analysis, 46*(1), 181-198. https://doi.org/10.1002/jaba.14

Rosenfield, D., Strickland, M., & Fecteau, A. (2013). Magnet ingestion by a 3-year-old boy. *Canadian Medical Association Journal*, *185*(11), 972-974. https://doi.org/10.1503/cmaj.121847

Ruckle, M. M., Bednar, M. K., Suen, K., & Falligant, J. M. (2022). Brief assessment and treatment of pica using differential reinforcement, response interruption and redirection, and competing stimuli. *Behavioral Interventions*, *38*(1), 255-267. https://doi.org/10.1002/bin.1881

Singh, A. N., Matson, J. L., Mouttapa, M., Pella, R. D., Hill, B. D., & Thorson, R. A. (2009). Critical item analysis of the QABF: Development of a short form assessment instrument. *Research in Developmental Disabilities, 30*(4), 782-792. https://doi.org/10.1016/j.ridd.2008.11.001

Singh, N. N., & Bakker, L. W. (1984). Suppression of pica by overcorrection and physical restraint: A comparative analysis. *Journal of Autism and Developmental Disorders*, *14*(3), 331-341.

Skinner, B. F. (1965). *Science and human behavior.* Free Press.

Stasolla, F., Perilli, V., Damiani, R., Caffo, A. O., Di Leone, A., Albano, V., Stella, A., & Damato, C. (2014). A microswitch-cluster program to enhance object manipulation and to reduce hand mouthing by three boys with autism spectrum disorders and intellectual disabilities. *Research in Autism Spectrum Disorders, 8*, 1071-1078. https://doi.org/10.1016/j.rasd.2014.05.016

Stiegler, L. N. (2005). Understanding pica behavior: A review for clinical education professionals. *Focus on Autism and Other Developmental Disabilities, 20*(1), 27-38. https://doi.org/10.1177/10883576050200010301

Sturmey, P., & Williams, D. E. (2016). *Pica in individuals with developmental disabilities*. Springer.

Tabatabaei, S. H., Shahrokhi, H., Gholipour, K., Iezadi, S., Rezapour, R., Naghibi, D., & Azami-Aghdash, S. (2022). The characteristics and results of parent training interventions in children with autism spectrum disorder: A systematic review. *Iranian Journal of Public Health*, *51*(3), 518-519. https://doi.org/10.18502/ijph.v51i3.8927

Tarbox, R. S., Tarbox, J., Ghezzi, P. M., & Wallace, M. D. (2007). The effects of blocking mouthing of leisure items on their effectiveness as reinforcers. *Journal of Applied Behavior Analysis, 40*(4), 761-765. http://doi: 10.1901/jaba.2007.761-765

Van't Hof, M., Tisseur, C., Ester, W. A., Van Berckelear-Onnes, I., Van Nieuwenhguyzen, A., Daniels, A. M., Deen, M., & Hoek, H. W. (2021). Age at autism spectrum disorder diagnosis: A systematic review and meta-analysis from 2012 to 2019. *Autism*, *25*(4), 862-873. https://doi.org/10.1177/1362361320971107

Weston, R., Rittenhouse-Cea, H., Gauert, S., Crandall, M., & Radhakrishnan, S. (2023). Using reinforcement to prevent challenging behaviors. In J. L. Matson (Ed.), *Handbook of applied behavior analysis* (pp. 1215-1231). Springer.

Williams, D. E., Kirkpatrick-Sanchez, S., Enzinna, C., Dunn, J., & Borden-Karasack, D. (2009). The clinical management and prevention of pica: A retrospective follow-up of 41 individuals with intellectual disabilities and pica. *Journal of Applied Research in Intellectual Disabilities, 22*, 210-215. https://doi.org/10.1111/j.1468-3148.2008.00490.x

Williams, D. E., & McAdam, D. (2012). Assessment, behavioral treatment, and prevention of pica: Clinical guidelines and recommendations for practitioners. *Research in Developmental Disabilities, 33*(6), 2050-2057. https://doi.org/10.1016/j.ridd.2012.04.001

Williams, F., Gibbs, S., & Addo, A. S. (2022). The assessment and management of pica in people with intellectual disability. *BJPsych Advances, 28*(6), 383-392. https://doi.org/10.1192/bja.2022.24

Young, S. L., Wilson, M. J., Miller, D., & Hillier, S. (2008). Towards a comprehensive approach to the collection and analysis of pica substances, with emphasis on geographic materials. *PloS One, 3*(9), e3147. https://doi.org/10.1371/journal.pone.0003147

Appendix A

Participant Reinforcer Profile

Participant Reinforcer Profile

Client: Participant

Potential Reinforcer Profile

Client Name: Participant **DOB/Age**:
Person Completing Profile: Jennifer Lanham, M.A., BCBA **Date:**
Click or tap to enter a date.

Instructions:
Please fill in the child's favorites as well as dislikes for each category listed below. List as many as possible for each category. Mark highly preferred items with an asterisk or by using the highlighting feature in Word.

TV Shows/Movies/Video or computer games:

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Movement Play (i.e. Swings, bouncing, spinning, ect.):

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.

3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Sensory (ex: tickles, sand, rice, water, etc.):

Likes	Dislikes
1.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Audio (whistles, musical instruments, high/low pitch voices, singing songs, etc.):

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.

6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Imaginative play (ex: dress up, pretend food, masks, etc.):

Likes	Dislikes
1. Click or tap here to enter text.	1.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Toys (i.e., cars, blocks, dolls, etc.):

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.

9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Craft/School Supplies (i.e markers, crayons, white boards, stickers, etc.):

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Food:

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Other:

Client: Participant

Likes	Dislikes
1. Click or tap here to enter text.	1. Click or tap here to enter text.
2. Click or tap here to enter text.	2. Click or tap here to enter text.
3. Click or tap here to enter text.	3. Click or tap here to enter text.
4. Click or tap here to enter text.	4. Click or tap here to enter text.
5. Click or tap here to enter text.	5. Click or tap here to enter text.
6. Click or tap here to enter text.	6. Click or tap here to enter text.
7. Click or tap here to enter text.	7. Click or tap here to enter text.
8. Click or tap here to enter text.	8. Click or tap here to enter text.
9. Click or tap here to enter text.	9. Click or tap here to enter text.
10. Click or tap here to enter text.	10. Click or tap here to enter text.

Appendix B

Paired Stimulus Preference Assessment

Paired Stimulus Preference Assessment

Student Name: _____

Paired Stimulus Preference Assessment (8-Item)

This assessment is based upon the procedures described by Fisher et. al., 1992.

Assessment Start Date: _____
Assessment End Date: _____

Stimulus Number	Stimulus Name	Number of Times Each Stimulus was Approached
1		
2		
3		
4		
5		
6		
7		
8		

Directions: Record the student's selection by circling the appropriate number on the data sheet. Record "NR" for no response.

Trial	Left position	Right position	Notes
1	1	2	
2	3	4	
3	5	6	
4	7	8	
5	2	3	
6	4	5	
7	6	7	
8	8	1	
9	1	3	
10	2	4	
11	3	5	
12	4	6	
13	5	7	
14	6	8	
15	7	1	
16	8	2	
17	1	4	
18	3	6	
19	5	8	
20	7	2	
21	2	5	
22	4	7	
23	6	1	
24	8	3	
25	1	5	
26	2	6	

27	3	7	
28	4	8	

Trial	Left position	Right position	Notes
29	1	7	
30	2	8	
31	4	1	
32	6	3	
33	8	5	
34	2	7	
35	5	2	
36	7	4	
37	1	6	
38	3	8	
39	5	1	
40	6	2	
41	7	3	

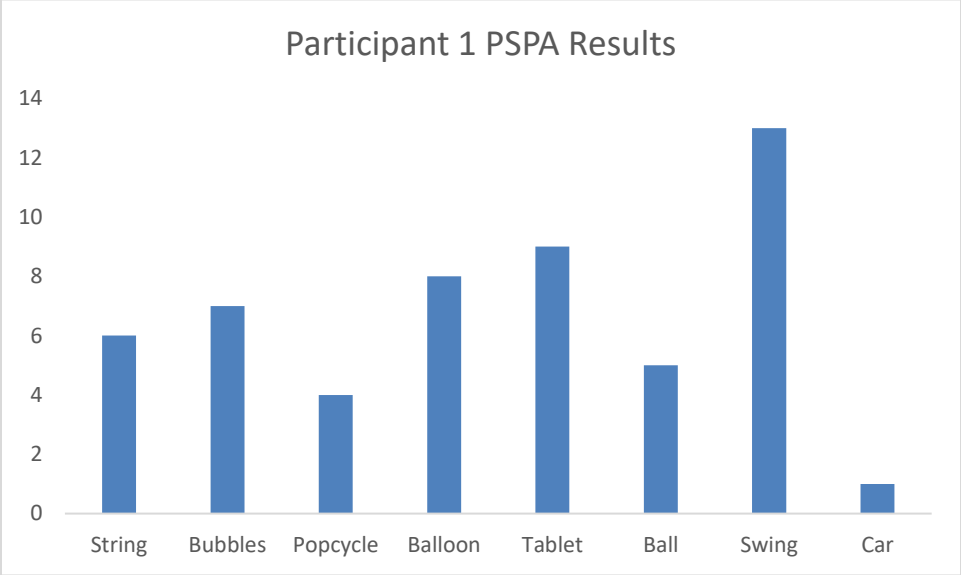
42	8	4	
43	2	1	
44	4	3	
45	6	5	
46	8	7	
47	3	2	
48	5	4	
49	7	6	
50	1	8	
51	3	1	
52	4	2	
53	5	3	
54	6	4	
55	7	5	
56	8	6	

Appendix C

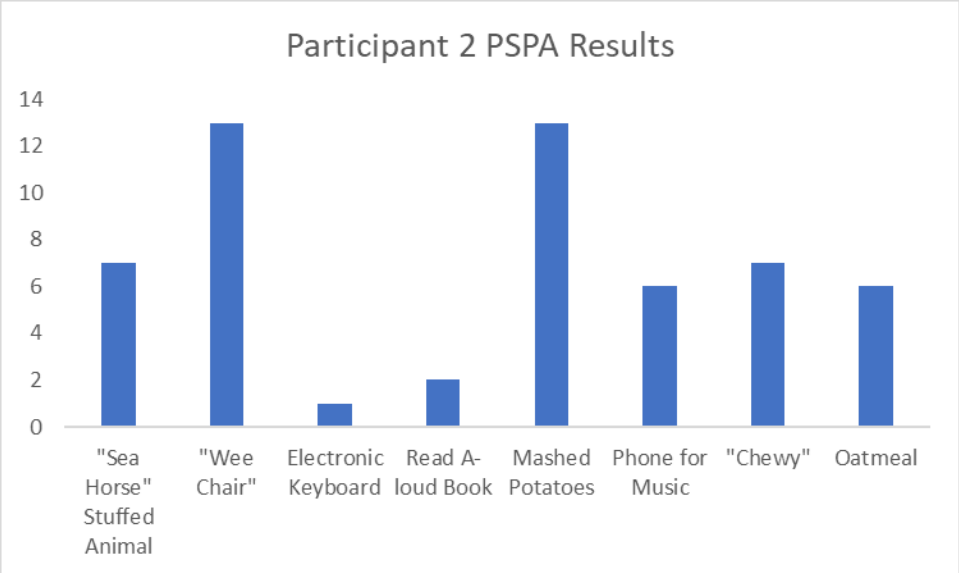
Results of Paired Stimulus Preference Assessment

Results of Paired Stimulus Preference Assessment

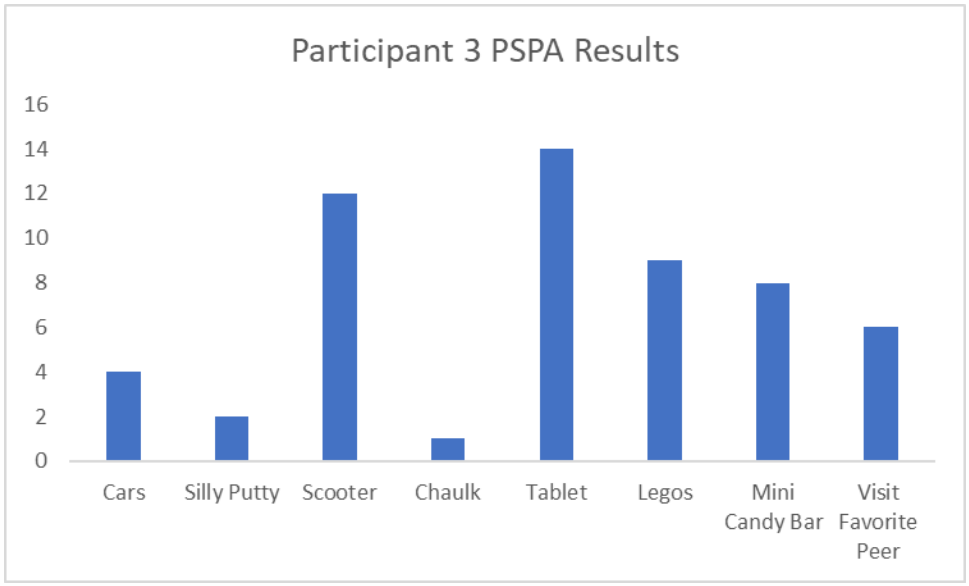
Participant 1 PSPA Results



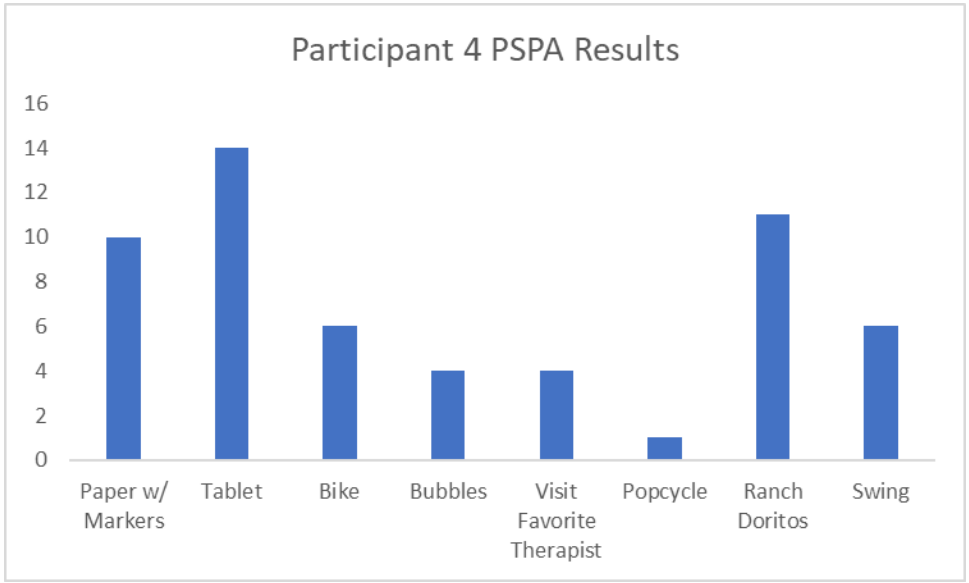
Participant 2 PSPA Results



Participant 3 PSPA Results



Participant 4 PSPA Results



Appendix D

Question About Behavioral Functions

Questions About Behavioral Functions

Student's Name_____ Date: _____

Behavior: _____ Respondent: _____

QUESTIONS ABOUT BEHAVIORAL FUNCTION (QABF)

Rate how often the student demonstrates the behaviors in situations where they might occur. Be sure to rate how often each behavior occurs, not what you think a good answer would be.

X = Doesn't apply 0 = Never 1 = Rarely 2 – Some 3 = Often

Score	Number	Behavior
	1.	Engages in the behavior to get attention.
	2.	Engages in the behavior to escape work or learning situations.
	3.	Engages in the behavior as a form of "self-stimulation".
	4.	Engages in the behavior because he/she is in pain.
	5.	Engages in the behavior to get access to items such as preferred toys, food, or beverages.
	6.	Engages in the behavior because he/she likes to be reprimanded.
	7.	Engages in the behavior when asked to do something (get dressed, brush teeth, work, etc.
	8.	Engages in the behavior even if he/she thinks no one is in the room.
	9.	Engages in the behavior more frequently when he/she is ill.
	10.	Engages in the behavior when you take something away from him/her.
	11.	Engages in the behavior to draw attention to himself/herself.
	12.	Engages in the behavior when he/she does not want to do something.
	13.	Engages in the behavior because there is nothing else to do.
	14.	Engages in the behavior when there is something bothering him/her physically.
	15.	Engages in the behavior when you have something that he/she wants.
	16.	Engages in the behavior to try to get a reaction from you.
	17.	Engages in the behavior to try to get people to leave him/her alone.
	18.	Engages in the behavior in a highly repetitive manner, ignoring his/her surroundings.
	19.	Engages in the behavior because he/she is physically uncomfortable.
	20.	Engages in the behavior when a peer has something that he/she wants.
	21.	Does he/she seem to be saying, "come see me" or "look at me" when engaging in the behavior?
	22.	Does he/she seem to be saying, "leave me alone" or "stop asking me to do this" when engaging in the behavior?
	23.	Does he/she seem to enjoy the behavior, even if no one is around?
	24.	Does the behavior seem to indicate to you that he/she is not feeling well?
	25.	Does he/she seem to be saying, "give me that (toy, food, item)" when engaging in the behavior?

Attention	Escape	Non-social	Physical	Tangible
1. Attention ☐	2. Escape ☐	3. Self-stim ☐	4. In pain ☐	5. Access to items ☐
6. Reprimand ☐	7. Do something ☐	8. Thinks alone ☐	9. When ill ☐	10. Takes away ☐
11. Draws ☐	12. Not do ☐	13. Nothing to do ☐	14. Physical problem ☐	15. You have ☐
16. Reaction ☐	17. Alone ☐	18. Repetitive ☐	19. Uncomfortable ☐	20. Peer has ☐
21. "Come see" ☐	22. "Leave alone" ☐	23. Enjoy by self ☐	24. Not feeling well ☐	25. "Give me that" ☐
Total	Total	Total	Total	Total

Revised 4-19-01

Appendix E

Functional Analysis Screening Tool

Functional Analysis Screening Tool

FAST

Functional Analysis Screening Tool

Client:_____ Date:_____

Informant:_____ Interviewer:_____

To the Interviewer: The FAST identifies factors that may influence problem behaviors. Use it only for screening as part of a comprehensive functional analysis of the behavior. Administer the FAST to several individuals who interact with the client frequently. Then use the results to guide direct observation in several different situations to verify suspected behavioral functions and to identify other factors that may influence the problem behavior.

To the Informant: Complete the sections below. Then read each question carefully and answer it by circling "Yes" or "No." If you are uncertain about an answer, circle "N/A."

Informant-Client Relationship

1. Indicate your relationship to the person: ___Parent ___Instructor
   ___Therapist/Residential Staff _____(Other)
2. How long have you known the person? ____Years ____Months
3. Do you interact with the person daily? ____Yes ____No
4. In what situations do you usually interact with the person?
   ___ Meals ___ Academic training
   ___ Leisure ___ Work or vocational training
   ___ Self-care _____(Other)

Problem Behavior Information

1. Problem behavior (check and describe):
   __ Aggression _____
   __ Self-Injury _____
   __ Stereotypy _____
   __ Property destruction _____
   __ Other _____
2. Frequency: __Hourly __Daily __Weekly __Less often
3. Severity: __Mild: Disruptive but little risk to property or health
   __Moderate: Property damage or minor injury
   __Severe: Significant threat to health or safety
4. Situations in which the problem behavior is most likely to occur:
   Days/Times_____
   Settings/Activities _____
   Persons present _____
5. Situations in which the problem behavior is least likely to occur:
   Days/Times_____
   Settings/Activities _____
   Persons present _____
6. What is usually happening to the person right before the problem behavior occurs?_____
   _____
   _____
7. What usually happens to the person right after the problem behavior occurs?_____
   _____
   _____
8. Current treatments_____
   _____
   _____
   _____
   _____

1. Does the problem behavior occur when the person is not receiving attention or when caregivers are paying attention to someone else?	Yes	No	N/A
2. Does the problem behavior occur when the person's requests for preferred items or activities are denied or when these are taken away?	Yes	No	N/A
3. When the problem behavior occurs, do care-givers usually try to calm the person down or involve the person in preferred activities?	Yes	No	N/A
4. Is the person usually well behaved when (s)he is getting lots of attention or when preferred activities are freely available?	Yes	No	N/A
5. Does the person usually fuss or resist when (s)he is asked to perform a task or to participate in activities?	Yes	No	N/A
6. Does the problem behavior occur when the person is asked to perform a task or to participate in activities?	Yes	No	N/A
7. If the problem behavior occurs while tasks are being presented, is the person usually given a "break" from tasks?	Yes	No	N/A
8. Is the person usually well behaved when (s)he is not required to do anything?	Yes	No	N/A
9. Does the problem behavior occur even when no one is nearby or watching?	Yes	No	N/A
10. Does the person engage in the problem behavior even when leisure activities are available?	Yes	No	N/A
11. Does the problem behavior appear to be a form of "self-stimulation?"	Yes	No	N/A
12. Is the problem behavior less likely to occur when sensory stimulating activities are presented?	Yes	No	N/A
13. Is the problem behavior cyclical, occurring for several days and then stopping?	Yes	No	N/A
14. Does the person have recurring painful conditions such as ear infections or allergies? If so, list:_____	Yes	No	N/A
15. Is the problem behavior more likely to occur when the person is ill?	Yes	No	N/A
16. If the person is experiencing physical problems, and these are treated, does the problem behavior usually go away?	Yes	No	N/A

Scoring Summary

Circle the number of each question that was answered "Yes" and enter the number of items that were circled in the "Total" column.

Items Circled "Yes"				Total	Potential Source of Reinforcement
1	2	3	4	____	Social (attention/preferred items)
5	6	7	8	____	Social (escape from tasks/activities)
9	10	11	12	____	Automatic (sensory stimulation)
13	14	15	16	____	Automatic (pain attenuation)

Appendix F

Initial and Final Parent Interviews

Initial and Final Parent Interviews

Initial Parent Interview

Date_____

Parent Name(s)_____

Participant Code_____

Study Start Date_____

Thank you for your participation in pica intervention with your child. This initial interview is to get your feedback on the concerns and goals regarding your child's current levels of pica behavior.

1) What is the current frequency of your child's pica behavior at home? _____

_____

2) What types of pica items does your child mouth, chew, or ingest? _____

_____

3) How do you currently manage your child's pica behavior? _____

_____

_____

4) What are your goals for the current pica behavior intervention? _____

_____

_____

_____

5) What new skills do your want your child to acquire during the study? _____

_____

_____

_____

6) What would you like to learn or discuss in parent meetings throughout the study? _____

_____

_____

_____

7) Do you have any additional questions or concerns prior to beginning the study? _____

_____

_____

Final Parent Interview Form for Participant 4

Final Parent Interview

Date_____

Parent Name(s)_____

Child Code_____

Study Start Date_____

Study End Date_____

Thank you for your participation in Pica intervention with your child. This final interview is to get your feedback on the outcomes resulting from the Pica treatment your child received and the parent training that you received during the study.

1) Did your child receive Pica treatment for the full 11 week study period?_____

2) Did you participate in all the parent meetings offered during the study? _____

3) Did you observe any behavior change during the treatment period? Please describe:

_____
_____
_____
_____

4) Did your child decrease the frequency of Pica behavior? Explain:

_____
_____
_____

5) What new skills did your child learn during the study?

_____
_____
_____

6) What did you learn in the parent training meetings, and did you apply the things you learned in your home environment?

_____
_____
_____

7) What Pica items did your child use prior to the study?

8) Which Pica items does your child current consume or taste, following the treatment?

9) What benefits do you believe, if any, resulted in Pica treatment?

10) Did you observe any negative impacts during the treatment period?

11) What feedback, if any do you have for the investigator?

Appendix G

Behavior Intervention Plan for All Phases

Behavior Intervention Plan for All Phases

Behavior Intervention Plan Sample

Participant: 1-4
Date of Birth:
Written By: Jennifer Lanham, M.A., BCBA
Date Written: 12/08/2021

Target Behavior: Pica Behavior- Intervention Phase 3: Response Blocking with a Verbal Reprimand, Discrimination Training, and Non-Contingent Access to Preferred Food

Function of Behavior: Automatic (Sensory)
Socially Mediated Attention

Antecedent Conditions: Pica behavior may occur at any time in any circumstance.

Phase 2 Date Range:

The operational definition of Pica behavior for this study includes:

- *Every instance* of licking, sucking, biting, tasting, putting Pica items past the plane of the mouth, or consuming non-food items or the attempt use Pica items (ex. Clothing, trash, food on the floor, toys, metals, paper, hair, fecal matter, picking nose and putting finger in mouth, dirt/sand, plant material, etc.)
- Pica behavior begins with the *first motion* in the chain of behaviors to attempt or complete the consumption of Pica items (ex. Bending to pick up an item with a hand motion to that item, grabbing or reaching for a known Pica item, putting item past the plane of the lips) and ends when the item is no longer in the participant's hand or mouth.
- Pica behavior will not include consuming food that is provided to him, that is approved by participant's family.

Response Blocking for this study includes:

- Block any attempt at Pica behavior at the first movement in the chain of behaviors that leads to Pica.
- While blocking state "No." Use a flat tone and affect when applying the verbal reprimand.
- Immediately begin discrimination training trials.
- *If* the participant gets the Pica item across the plane of the mouth or consumes and item, immediately state (with flat affect) "Spit it out."

Non-Contingent Access to Preferred Foods

- Throughout the treatment session, have a small plate with bite-sized pieces of a variety of preferred foods.
- Only keep 3-5 bites on the plate at a time and in a place it within reach and in sight of the client. If the client wants to eat all the food at once, reduce the number

of available bites on the plate to keep from satiation and interference with normal mealtimes.

Discrimination Training for this study includes:

- *Prep before each session:*
  1) Have a small trashcan in any room where the participant will be receiving treatment.
  2) Prepare of small box of items: preferred or tolerated foods or snacks (small pieces), pieces of trash (wadded up or shredded paper, pieces of any item that should be discarded, paper clips, etc.), a small plate (the same used throughout the study) with a total of 5 food items and 5 trash items for a total of 10 items per trial
  3) Keep Discrimination Training item box and trashcan ready throughout the treatment session

- *Discrimination Trials:*
  1) Immediately following any Pica attempt, prompt the participant to discard the Pica item into the trash, while stating "This is trash" or "Spit it out" with a flat affect. Do not say anything else and avoid eye contact or additional attention, beyond what is necessary to keep the participant safe. Record frequency data and topography, Pica item, and prompt level needed to discard.
  2) Immediately following the Pica discard, redirect to the Discrimination Training box and begin the 10-item trial. Record data on provided data sheet: topography, correct or incorrect response, prompt level required for trial
  3) When a food item is selected from the box, the RBT will state, "This is food" and prompt the participant to place the food on the plate and immediately select the next item. Provide verbal praise and eye contact with each correct response.
  4) When a trash item is selected from the box, the RBT will state, "This is trash" and prompt the participant to discard the item into the trash and immediately select the next item. Provide verbal praise and eye contact with each correct response.
  5) When all 10 items are complete, the RBT will provide verbal praise and the option to access a preferred item or activity, such as the tablet or playing in another room for a 3-5 min. reinforcement period.
  6) If at any time a Pica attempt or completion takes place during the reinforcement period, immediately begin the Redirection and Discrimination Trial protocol
  7) The 10-trial set should be completed at a rapid pace to keep the participant engaged
  8) Repeat with each Pica Attempt

Data Collection:

Frequency, topography, Pica item type and prompt level data will be collected for any attempt or completion of Pica Behavior. Data will be collected for each discrimination trial and recorded as a correct or incorrect trial throughout the full therapy day. A correct discrimination trial consists of the participant complying with the sorting of food and trash items by placing food items on a plate or discarding of trash items. Compliance for Phase 2 may be at any prompt level, which will also be included in the data collection. An unsuccessful discrimination trial will include the participant continuing Pica attempts, maladaptive behavior (i.e., tantrums, escape, aggression, SIB).

Preventative Strategies:

- Proximity: RBTs must remain within arm's length of the participant in order to redirect any attempts to place Pica items in or around the mouth

Replacement Behaviors:

- Spontaneous trash discarding for all Pica items is the replacement behavior for phase 2

Safety Measures and Protections:

- Always remain within 1 arm's length of your participant
- Implement redirection at the first movement in the chain of behavior that leads to Pica attempts, followed immediately by the Discrimination Training

Behavior Intervention Plan Evaluation:

The goal for phase 3 for Pica behavior intervention is to keep the participant safe using response blocking with a verbal reprimand and non-contingent access to preferred foods, while using discrimination training to develop the foundation for appropriate replacement behaviors. The overall goal of the total intervention is to reduce Pica behavior to safe or zero levels.