The Impact of Practical Functional Assessment and Skill-Based Treatment in Public School Classrooms

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Abstract

Students with autism who engage in severe problem behavior are more likely to be placed in restrictive environments, including separate schools. Research has been conducted to show that severe problem behavior can be decreased while increasing contextually appropriate behavior through the use of a performance-based practical functional assessment and skill-based treatment in a clinical setting or when pulled out from the classroom to receive intervention 1:1. However, the published research is not conducive to public school settings with a lack of space and a lack of staff. This study seeks to close this research gap by investigating the impact of the practical functional assessment and skill-based treatment when used in a public school classroom. Practical functional assessments and skill-based treatment were conducted in public school classrooms with seven students to determine their impact on the students' rate of problem behavior, mastery of contextually appropriate behaviors, percentage of participation across the school day, and ratings on the Behavioral Health Index. The study found that participation, mastery of contextually appropriate behaviors, and ratings on the Behavioral Health Index increased for all students. The rate of severe problem behavior decreased for five of the seven students and increased for two of the seven students. This study is a starting point for research on practical functional assessment and skill-based treatment in public school classrooms. Future researchers can continue this work to lend itself to a larger population.

PREFACE

Over the past twenty years, the author's favorite students were those most passionate about altering their environment and the behavior of those around them. This passion was often portrayed through severe problem behavior such as aggression, self-injurious behavior, and eloping. Working to understand these learners and supporting them in controlling their environment in a socially appropriate manner has become her life's work.

Four years ago, the author attended a webinar led by Dr. Gregory H. Hanley, focusing on implementing the Practical Functional Assessment (PFA) and skill-based treatment. This approach to supporting children focuses on gaining cooperation instead of relying on coercion and using compassionate care to teach skills vital to inclusion in society. The author immediately implemented these procedures and worked to improve her craft.

The work before you results from the author's passion for supporting students with autism spectrum disorder to attain critical functional communication and tolerance skills. Teaching from a place of joy when the student is happy, relaxed, and engaged has supported the author to embrace the following quote from Charles M. Blow: "One doesn't have to operate with great malice to do great harm. The absence of empathy and understanding are sufficient."

DEDICATION

To my students:

I have learned more from you than can be captured in a textbook the size of Texas. Through your guidance I learned how to harness my inner-clown, that curiosity and creativity open doors, and the importance of teaching from a place of joy.

ACKNOWLEDGMENTS

First and foremost, I thank God for providing me with the strength, stamina, and knowledge to complete this project. This endeavor would not have been possible without the people He has placed in my life.

My gratitude to my family, Joe, Anika, and Austin, for being my biggest cheerleaders. Their patience and encouragement were crucial to my success. Joe, thank you for your amazing dinners and hours straightening the house. I will now clean up the home office and my living room area, as promised over a year ago! Anika, thank you for taking a million hours of dance classes. Those classes caused me to begin this endeavor as I sat in the studio's parking lot during COVID-19. Austin, thank you for providing the hours I spent typing away in a corner at swim meets. Without each of you, this project would not have come to fruition.

Thank you to my fearless committee. Dr. Bieniek, thank you for rescuing me from ruin following the first semester of this endeavor. Your guidance, feedback, and positivity were crucial to my success. Thank you to Dr. Lynch for joining the committee (even if it required some arm-twisting from Dr. B!). I so appreciate your flexibility and willingness to join the team. Juliette, thank you for being my positive constant throughout the entire process. I would have given up long ago without the three of you, the dream team.

Thank you to all of my colleagues who have remained supporters and cheerleaders of this project. Thank you to Laura from IU13 for supporting and encouraging me to continue learning and implementing practical functional assessment and skill-based treatment. Courtney, your positivity and hugs pushed me forward when I wanted to have a tantrum! A special thank you to

all the teachers and paraeducators I work with – I appreciate each of you cheering me on and checking on my progress.

Thank you to the districts who agreed to allow me to use data from their programs for this project. Ondrea, Amy, Rachael, Marleigh, Julie, and Faith, thank you for allowing me to support your classrooms and trusting me to implement a novel approach to problem behavior. Thank you to the parents and guardians for allowing me to record sessions to support further learning for teams. Kelsey, Crista, and Emily, IOA would not have been possible without your willingness to watch hours of video.

The following quote refers to each of you and many more I don't have room to mention. "At times, our own light goes out and is rekindled by a spark from another person." (Schweitzer et al., 1997, p. 90). Thank you to everyone who rekindled my spark when I wanted to just take a nap!

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Impact of the Practical Functional Assessment and Skill-Based Treatment in Public School classrooms

Severe problem behavior includes behavior that is a danger to the individual, others, or property (Herman et al., 2018). According to Herman et al. (2018), it inhibits the person's quality of life and the family's quality of life due to increased parental stress. The authors also relate that severe problem behavior reduces the probability of successful inclusion of the student in school and society. In 2021, two percent of school-aged students in the United States served under the Individuals with Disabilities Education Act (IDEA) were enrolled in separate schools, according to the National Center for Education Statistics (2023). IDEA is a law that makes available public education that is free and appropriate for students with disabilities (United States Department of Education, 2017). Another two percent of school-aged students were placed in regular private schools by their parents, and one percent of the population was served in separate residential or correctional facilities, hospitals, or at home (National Center for Education Statistics, 2023). Thus, five percent of students across the United States were educated outside of inclusive settings. Researching new methods of working with students with severe problem behavior in less restrictive environments is paramount to students' inclusion in school and society.

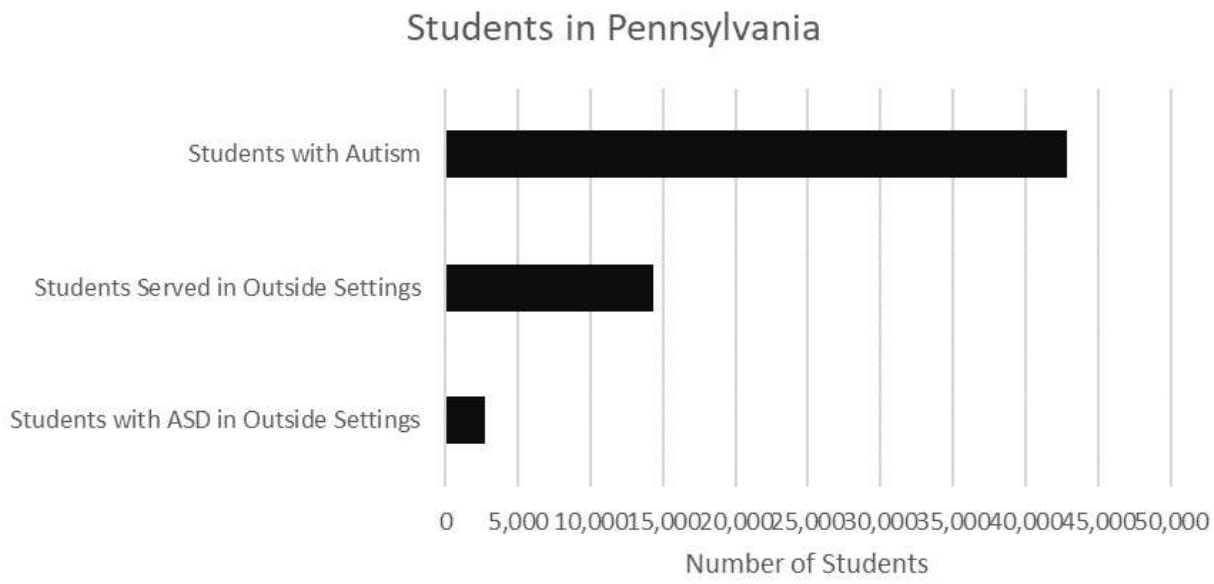
Pennsylvania Student Data

As of Pennsylvania Department of Education's (PDE) December 1, 2022 child count, 19.3% (324,720) of public school students in Pennsylvania received special education services (Pennsylvania Department of Education [PDE], 2023). Of these students, 13.2% were identified under the disability category of autism. Across all students who received special education services in Pennsylvania, PDE reported that 4.4% or 14,287 students were served in settings other than a regular public school, which is comparable to the findings of 5% across the United

States. Of those students receiving services in settings outside of the public school system, 2,691 were diagnosed with autism. When summarizing the data, PDE included placements in public and private separate facilities and public and private residential facilities (see Figure 1).

Figure 1.

Students in Pennsylvania



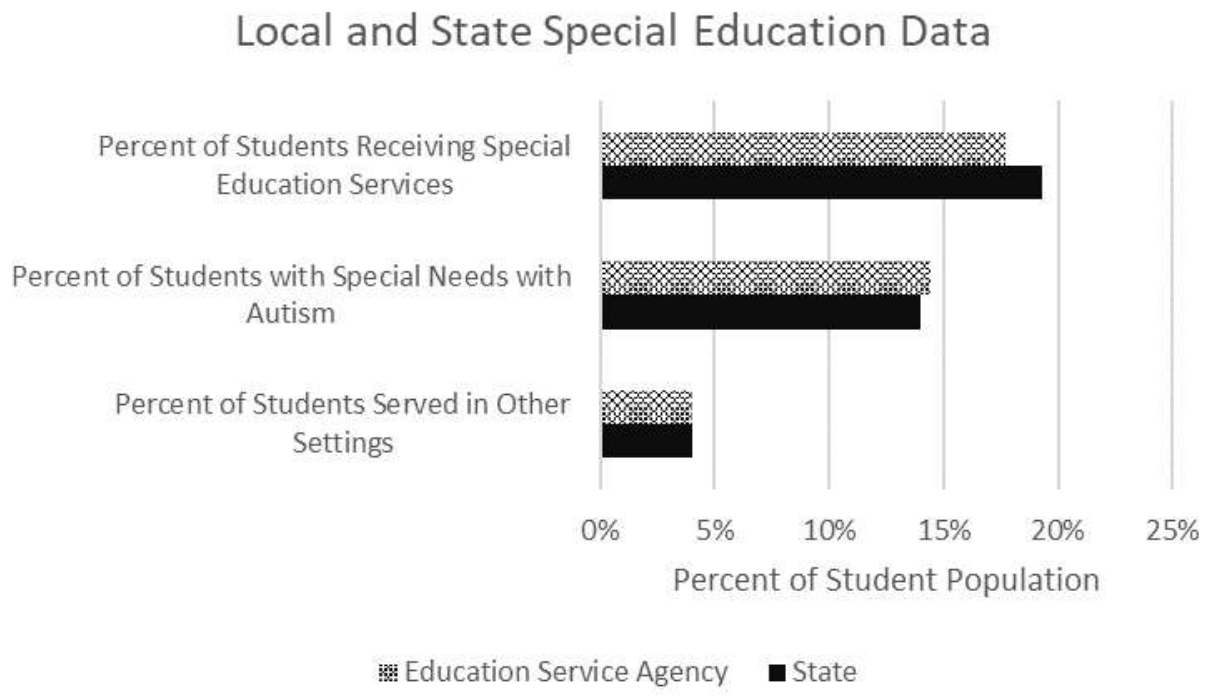
Local Student Data

The state data is comparative to the data of the setting of the education service agency used for this study. The education service agency encompasses two counties in Pennsylvania and provides services and supports to public school districts, non-public schools, education agencies, parents, preschools, adult learners, businesses, and municipalities (PDE, 2023). As of December 1, 2022, PDE reported that 17.7% of the total school-age population (14,866 students) received special education services in these two counties, which is comparable to the 19.3% of total Pennsylvania students. Of the students who received special education services in these counties,

14.4% of them were identified with autism, as compared to 14% in the state. According to PDE, four percent of the total special education population in the two counties received services in settings other than a public school, as they did at the state level (see Figure 2). The close comparison of data from the state to the local level allows the reader to consider the small sample within this study representative of a larger scale than the actual number of participants.

Figure 2.

Local and State Special Education Data



This study will focus on seven students in three school districts within the two county education service agency. These districts range from rural to suburban (PDE, 2023). During the 2021-2022 school year, the percentage of students in these districts receiving special education services diagnosed with autism spectrum disorder ranged from 13.6% to 16.6%, within a close

range of the state and local data collected by PDE. Due to the differing sizes of the districts, the actual number of students varied considerably from 32 to 218 (see Table 1).

Table 1

Number of Students Per Disability Category in Identified Districts

District	ASD	Students in other Settings
A	32 (13.6%)	1 (0.4%)
B	77 (15.7%)	17 (3.1%)
C	218 (16.6%)	65 (4.4%)
Total in Education Service Agency	2,321 (14.4%)	595 (4.0%)
Total in State	39,632 (12.61%)	14,288 (4%)

Note. % = percent of the special education population in the district

Within the three identified school districts, between one and sixty-five students received their education outside their home school district during the 2021-2022 school year (PDE, 2023). According to PDE, the percentage of students receiving special education services in outside placements ranged from <1% in District A (far below the state average) to 4.4% in District C, just slightly above the state average. About 4% of the special education students in the entire education service agency are serviced in outside placements and 4% of the special education students in Pennsylvania. Students with autism engaging in severe problem behavior are the focus of this study as this population comprises the largest population serviced in settings outside of the public school system, except for students with complex medical needs, according to PDE data.

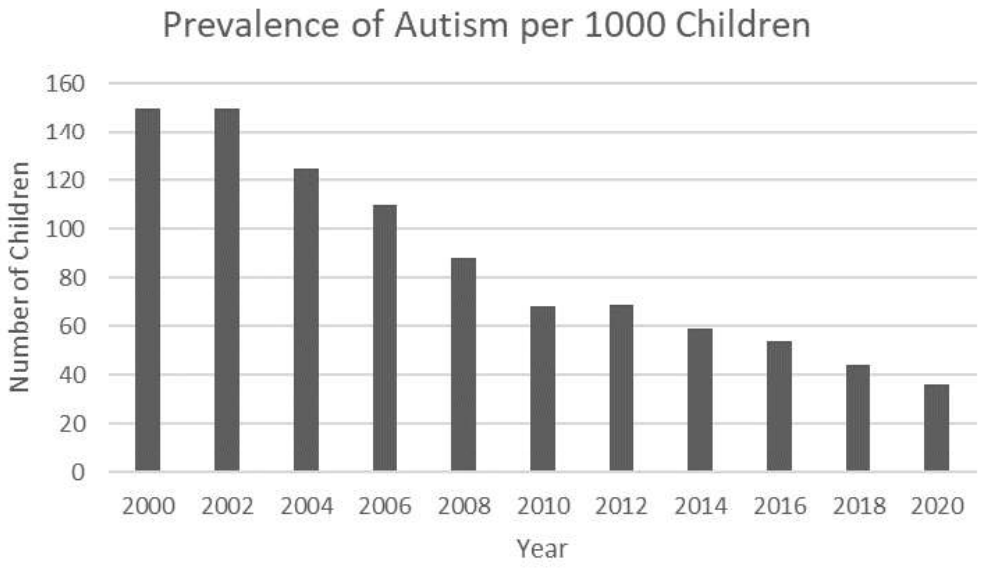
Students in placements outside their home school district do not often have the opportunity to interact with nondisabled peers or have access to good peer role models. This study involves supporting students with severe problem behavior in their home school districts to prevent more restrictive placements. To maintain students with severe problem behavior within their home school district, educators need to learn to safely manage problem behavior while teaching missing skills such as functional communication, tolerance, and cooperation. These skills are necessary for students to succeed in public education and the community. Each participant in this study engages in problem behavior that requires staff to significantly decrease demands to keep the student and the staff safe from harm. Due to these behaviors and the decrease in demands, little to no progress is occurring in other areas of instruction.

Students with Autism Spectrum Disorder

Students with autism spectrum disorder display deficits in social communication and social interactions and engage in stereotypical repetitive behaviors that interfere with daily life (American Psychiatric Association [APA], 2013). According to the Center for Disease Control (CDC), it is estimated that one in thirty-six children was identified with autism spectrum disorder among a sample of 8-year-olds in 2020 (CDC, 2023b). The prevalence of autism per one thousand children was 27.6 in 2020, compared to 6.7 in 2000. Thus, the population of students with autism spectrum disorder is increasing dramatically. Table 2 shows the rapid decrease in the ratio of one student with autism to the number of neurotypical students according to the CDC in 2023 (see Figure 3).

Figure 3

Prevalence of Autism Spectrum Disorder



Note. (CDC, 2023a)

Autism and Severe Problem Behavior

In 2014, Presmanes Hill et al. studied a sample of 400 children with autism enrolled in programming at Oregon Health and Science University. Within this group of children aged 2-16.9 years old, one in four scored within the clinical range on the Aggressive Behavior scale of the Child Behavior Checklist. This study further found that the level of aggressive behaviors was unrelated to sociodemographic factors. While studies ranged in the percentage of children with autism who engaged in severe problem behavior (8-68%), studies have suggested that aggressive behaviors are more likely to occur with students with autism than in any other disability category (Presmanes Hill et al., 2014; Santiago et al., 2016; Rose & Beaulieu, 2018; Warner et al., 2019).

Severe problem behavior is the primary cause of the need for residential placement for students with autism (Presmanes Hill et al., 2014). This type of placement can lead to exclusion from education and peers without disabilities. The authors relate that persons with autism engaging in severe problem behavior are more likely to receive rigorous medical interventions. Severe problem behavior can result in injury to the student, staff, or peers, property damage, or even death. Concerns of the high probability of problem behavior and the need for residential placement for students with autism made this population the focus group of the current study. Participants in this study engage in severe problem behaviors such as aggression (hitting with an open hand, kicking, scratching, pulling hair), property destruction (throwing chairs and heavy objects), and self-injurious behavior (hitting their head against a hard surface, biting themselves, hitting their head with their hand). Thus, these students are at risk for later placement in specialized schools and residential programs if the severe problem behavior is not addressed and replacement skills are not taught.

This chapter will now discuss the interventions implemented with students with autism and severe problem behavior. These interventions have ranged from evoking severe problem behavior to determine a single function to using precursor behaviors to identify synthesized contingencies maintaining problem behavior.

Approaches to Supporting Students Demonstrating Severe Problem Behavior

Behavior analysts historically relied on implementing a functional analysis to determine the antecedents and consequences controlling problem behavior (Iwata et al., 1994). Information gleaned from this analysis was used to create an effective treatment to decrease problem behavior and increase communication and other socially acceptable behaviors. Iwata et al. (1994) stated that functional analyses involved a single subject. They consisted of a control condition in

which the participant was given free access to reinforcement and at least one test condition in which reinforcement was provided contingent on problem behavior. When problem behavior reliably occurred in the test condition in response to the test contingency and problem behavior did not or rarely occurred during the control condition, one could imply that the test contingency had demonstrated control and treatment based on the function of this test condition could be developed.

When assessing functional analyses, one needs to consider the effectiveness of the analysis as well as the efficiency of the analysis. The procedures delineated in Iwata et al. (1994), the seminal article describing functional analyses, have been altered by researchers in various ways to create more effective and efficient analyses for different student behaviors. Although modifications have improved the traditional functional analysis, the procedures still have drawbacks for students with severe problem behavior (Flanagan & DeBar, 2018).

For the traditional functional assessment to properly analyze the behavior of concern, that target behavior must be evoked (Iwata et al., 1994). For instance, if the behavior of concern were self-injurious, the functional analysis would continue until self-injurious behavior occurred. Behavior analysts question the ethics of evoking severe problem behavior. The traditional functional analysis procedure relies on four generic test conditions with isolated reinforcers and thus does not allow for individualization of the procedures. Procedures are typically only individualized after unsuccessful implementation of the original method (Hanley et al., 2003). Traditional functional analyses may also be time-consuming as a separate functional analysis must be conducted for each behavior of concern. Due to these concerns, researchers sought an effective method to analyze behavior that was both ethical and efficient.

Due to the prevalence of severe problem behavior displayed by students diagnosed with autism spectrum disorder and the poor outcomes associated with severe problem behavior, creating effective treatment plans is crucial (Hanley et al., 2014). Analysts must perform functional analyses to identify the behavior's function and develop effective treatment plans. The practical functional assessment is a functional analysis designed for students engaging in severe problem behavior that is meant to be effective, efficient, and ethical (Jessel et al., 2016).

This assessment allows analysts to examine the variables maintaining problem behavior while keeping the safety of students and staff paramount (Jessel et al., 2016). According to the authors, the practical functional assessment is a variation of the traditional functional analysis procedures Iwata et al. wrote in 1994. This variation includes an open-ended interview. Following the interview, the analyst designs a single-test condition containing a synthesized contingency hypothesized to maintain problem behavior and a single control condition containing synthesized reinforcement. Skill-based treatment follows the practical functional assessment and includes teaching an omnibus mand for synthesized reinforcement (everything the student finds reinforcing), a tolerance response (how to respond when denied access to reinforcement), relinquishing reinforcement, transitioning, delay tolerance, and contextually appropriate behaviors (behaviors that are considered typical in the given environment).

Seminal Research Informing the Current Study

Seminal research for the current study consists of two studies in peer-reviewed journals. Iwata et al. (1994) conducted a seminal study containing procedures for the traditional functional analysis, and Hanley et al. (2014) conducted a seminal study for the practical functional assessment. Iwata et al. (1994) published the development of the traditional functional analysis, the first procedure to identify the function of behavior before the application of treatment. The

traditional functional analysis focused on evoking the behavior of interest within four contingencies (automatic reinforcement, escape, attention, and tangible) to determine the function of behavior. The second seminal study was conducted by Hanley et al. (2014). The Interview-Informed Synthesized Contingency Analysis (IISCA) originated from this study. When determining the function, the IISCA used an open-ended interview to create a single synthesized contingency in which precursor behaviors were evoked instead of severe problem behavior. Following the analysis, Hanley et al. (2014) described treatment, later referred to as skill-based treatment in the literature.

Statement of Problem

Severe problem behavior significantly impacts students with autism. These behaviors impede student progress and pose a danger to students and staff. Students who engage in severe problem behavior are at risk for residential and center-based placements, which significantly decrease the student's ability to be included with nondisabled peers and the community. Severe problem behavior must be addressed, and functional communication must be taught with contextually appropriate behaviors.

Articles published in peer-reviewed journals regarding the use of the Interview-Informed Synthesized Assessment (IISCA), practical functional assessment, or performance-based assessment in addition to skill-based treatment result in rapidly decreasing severe problem behavior while increasing functional communication responses and contextually appropriate behaviors (Hanley, 2014; Ghaemmaghami et al., 2015; Slaton et al., 2017; Beaulieu et al., 2018). Techniques have been included to align with trauma-informed practices and to add student assent to each session (Rajaraman et al., 2022a). However, of the published articles reviewed regarding the practical functional assessment and skill-based treatment outcomes, only one was conducted

in a public school setting (Taylor et al., 2018). Although the location of Taylor et al.'s 2018 study was a public school, the analysis and treatment were conducted in a separate conference room instead of in a classroom with other students. In addition, a Board-Certified Behavior Analyst (BCBA) completed each practical functional assessment in all of the published articles.

In conversation with Dr. Hanley, he shared that the practical functional assessment and skill-based treatment procedures were created to be implemented in a separate clinical setting. He recommended that practitioners only implement in a separate setting followed by generalization of skills into classroom settings (personal communication, November 30, 2022). Unfortunately, the schools within the two counties of this study are overcrowded and understaffed and cannot designate a room for treatment or a staff member to work one-on-one with a student for periods of time. Thus, the practical functional assessment and skill-based treatment need to be assessed and modified as necessary for implementation in the public school setting.

Dr. Vince Carbone called attention to a gap in the literature surrounding the practical functional assessment and skill-based treatment (personal communication, August 2, 2023). He remarked that each of the published studies ended as soon as the problem behavior was eliminated. None of the published studies continued beyond the cessation of problem behavior to identify if the rate of skill acquisition increased following skill-based treatment. Dr. Carbone shared that research was needed to show if the rate of skill acquisition increased following treatment or if the student plateaued in skills following the cessation of problem behavior.

Research Questions

This study seeks to answer the following questions due to the information gleaned from these conversations and the need for implementation in public schools.

- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, affect the rate of problem behavior for students with autism in a public school classroom?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to engaging in IT, flexible play, increasing tolerance)?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's percentage of participation in instruction?
- What changes will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, lead to on a student's rating on the Behavioral Health Index (BHI), indicating a change in critical skills, behavior management, and health repertoires?

This study seeks to close the gap in the literature between clinical and public school settings and the gap between treatment in 1:1 pull-out settings and treatment in special education classrooms. It also seeks to extend the previous literature by comparing progress based on students' percentage of participation in instruction across the school day and their rate of skill acquisition following the implementation of treatment.

This study is crucial for students with severe problem behavior and their instructional staff. The skills taught could increase opportunities to be included in general education classrooms and the community. It seeks to decrease severe problem behavior and improve safety

for students and staff. The students participating in this study need to acquire skills as staff have stopped or severely limited instruction to decrease problem behavior to a manageable level. The skills in this study are targeted to give students a greater opportunity to succeed in education, which could lead to success later in life.

Purpose of the Study

This study aims to extend results from Hanley et al. 2014 and the resulting literature to new environments to determine its effect on severe problem behavior in a public school classroom setting and the rate of skill acquisition. District special education administrators referred students within the study due to severe problem behavior, lack of academic progress, and lack of participation in instruction. Variables in this study that differ from Hanley et al. (2014) include the setting, the amount of staff, the amount of treatment time per day, and unlimited access to a Board Certified Behavior Analyst. In this extension, skill-based treatment will be implemented by general education teachers, special education teachers, and paraeducators. Coaching from a BCBA will be at most thirty minutes a day and will decrease to once a week following the criteria discussed in Chapter III. Skill-based treatment will occur in the special education classroom, general education classroom, and the public school hallway with other students present. The treatment settings allow for many unplanned variables from other students and staff. The success of implementing the practical functional assessment and skill-based treatment will be determined following the completion of treatment by comparing the frequency of severe problem behavior, the percentage of active participation in instruction, and the rate of skill acquisition.

Assumptions, Delimitations, and Limitations

An assumption in this study is that severe problem behavior is multiply controlled. For instance, few behaviors are solely maintained by escape. People engage in escape behavior to attain attention or a preferred item or activity. Adults take a personal day to avoid work but also to attain access to various activities and the attention of others.

Another assumption in this study is that all staff will agree to the philosophy behind the practical functional assessment and implement the treatment package with fidelity. In other settings, the researcher has observed staff refusing to implement the practical functional assessment and skill-based treatment due to differences in philosophies. This treatment package focuses on connecting with students, building trust, and attaining cooperation instead of forcing compliance.

A delimitation of this study is that all participants are from the same two Pennsylvanian counties. Thus, the participants may not fully represent the norm for all students with severe problem behavior diagnosed with autism spectrum disorder. A larger sample from various backgrounds may provide more insight into the efficacy of practical functional assessment and skill-based treatment in a public school setting. Despite this limitation, this study is still needed as it provides the basis for larger studies.

Another limitation is the researcher’s inability to control the classroom environment, including peers' behavior. This is a limitation cited by Dr. Hanley (personal communication, November 30, 2022) when responding to questions about implementing his procedures in public school classrooms. Despite this limitation, severe problem behavior in schools necessitates implementing innovative interventions. Public schools cannot consistently identify spaces within the school to implement 1:1 sessions with students. Paraeducators are not allowed to work with

students in isolation, and districts do not employ enough professional staff to dedicate themselves to the 1:1 implementation of treatment. Therefore, treatment needs to be conducted in the classroom.

The weaknesses of this study include the small sample size, which decreases the probability of the treatment being generalized to more of the population. This weakness leads to low external validity for this study. However, as the prevalence of autism and outside placements due to severe problem behavior are consistent across county, state, and national statistics, this study could entail a representative sample of a larger population. More studies need to be conducted with similar results to ensure the reliability of this study.

Definition of Terms

The following terms are defined to support the reader in understanding the context of each term in the study.

Applied Behavior Analysis: science of behavior that focuses on socially significant improvements; evidence-based practice

Autism Spectrum Disorder (ASD): a developmental disability affecting verbal (vocal and nonvocal) communication and social interactions, usually evident before age three, that impedes a child's educational achievement. (US Department of Education, 2017b)

Board Certified Behavior Analyst (BCBA): professionals who study behavior and create individualized plans to support persons in a socially significant manner; credential requires 2000 hours of supervised fieldwork in addition to a minimum of 15 master's level credits in Applied Behavior Analysis

Contextually Appropriate Behaviors (CABs): socially acceptable behaviors within a particular setting or circumstance. Examples: engaging in a leisure activity during free time, participating in academic activities during school, washing one's hands after using the bathroom

Control Condition: condition of a functional assessment in which variables influencing problem behavior are not present

Differentiated Results: problem behavior is elevated in one condition of a functional analysis leading the practitioner to a definitive conclusion as to the function of the behavior studied

Descriptive Assessment: consists of direct observation in the natural environment

Establishing Operation (EO): increases the value of a reinforcer and the frequency of the behavior that allows access to the reinforcer (e.g., if a student hits to gain access to a preferred item, then when the item is taken away, the student will hit to get it back. The EO is taking away the item, and the behavior is hitting.)

Functional Analysis: analysis to identify antecedents and consequences controlling problem behavior; three basic components – test condition with reinforcement provided contingent on problem behavior, control condition with free access to reinforcement, only one student analyzed at a time (Jessel et al., 2016)

Functional Assessment: process to identify potential variables influencing problem behavior; usually consists of a combination of indirect assessment (interviews), descriptive assessment (brief observation in one context)

Individuals with Disabilities Education Act (IDEA): a federal law that ensures children with disabilities receive a free appropriate public education in the least restrictive environment

IISCA (Interview-Informed Synthesized Contingency Analysis): A type of functional analysis of problem behavior based on an open-ended interview authored by Hanley et al. (2014) consisting of quickly alternating between a single control and test condition. The test condition is individualized to contain synthesized contingencies (see below) thought to evoke problem behavior. The control condition contains synthesized reinforcement (see below). Precursor behavior occurs before severe problem behavior is reinforced.

Omnibus Mand: a request for all the learners' favorite things, activities, and interactions

Picture Exchange Communication System (PECS): a method of alternative/augmentative communication in which people select cards with pictures, symbols, or words to present to listeners to make requests, comments, or responses to questions

Practical Functional Assessment: used to understand the function(s) of problem behavior and inform skill-based treatment (SBT). Consists of an interview and analysis of behavior based on the interview. Test conditions are individualized based on the interview and contain synthesized contingencies. The duration of sessions is based on the performance of the student.

Reinforcement: a consequence of behavior that increases the probability of the behavior occurring again

Response class: multiple responses that have the same effect on the environment

Severe Problem Behavior: behavior that directly affects the safety of the student or others (examples: aggression, self-injury, pica, elopement out of the building)

Skill-Based Treatment: consists of progressively teaching functional communication, toleration, and contextually appropriate behaviors (CABs)

Synthesized Contingencies: contingencies that are experienced simultaneously in the IISCA and practical functional assessment, such as relinquishing reinforcement and transitioning to a non-preferred task with reduced adult attention

Synthesized Establishing Operation: combining multiple evocative events into one scenario, such as relinquishing reinforcement and presenting demands

Synthesized Reinforcement: Access to multiple reinforcers at once as opposed to isolating reinforcers

Test Condition: condition of a functional assessment in which variables influencing problem behavior are present

Traditional Functional Analysis involves observation and measurement of problem behavior across multiple test conditions. These conditions typically include play, alone, tangible, escape, and demand. Play acts as the control condition, and each condition is isolated. Iwata et al. first described this method in 1994.

Undifferentiated Results: problem behavior occurs at about the same rate across all conditions of a functional analysis; it leads to an inconclusive analysis of the function of the behavior studied and requires further assessment

Verbal Behavior: All communication is verbal behavior, whether the student uses his vocal cords to speak or not. Verbal behavior includes sign language, gestures, using an AAC device, and vocalizations.

Vocal: using the vocal cords to speak

Summary

This study seeks to determine the effectiveness of the practical functional assessment and skill-based treatment when applied in public school classrooms by public school employees on

the frequency of severe problem behavior and the rate of skill acquisition. The study includes students with severe problem behavior diagnosed with autism. The results of this study may support students with severe problem behavior in gaining the skills required for access to the general education classroom. This study may support special education teachers in decreasing their students' severe problem behavior while teaching contextually appropriate behavior, leading to an increase in the rate of skill acquisition and the duration of participation in instruction. Ultimately, this study will help shape how educators view severe problem behavior and improve the interventions districts put in place to decrease severe problem behavior. Changing how others view problem behavior and providing training in ethical interventions will lead to better outcomes for students in the future.

This writing contains four additional chapters. Chapter II is a comprehensive review of the literature surrounding students with severe problem behavior, the transformation of the traditional functional assessment to the practical functional assessment, and the inclusion of skill-based treatment designed to support the findings of the practical functional assessment. This chapter brings to the forefront the neglected areas of research on how to apply the practical functional assessment and skill-based treatment in public school classrooms, as well as if the procedure is productive in this setting and leads to decreased severe problem behavior and increased skill acquisition and participation in instruction. Chapter III includes the research design and specific details of the study. Research results from this study are presented in Chapter IV, and Chapter V interprets the results.

Chapter II: The Literature

Purpose of the Study

This study aims to extend Hanley et al.'s 2014 study with students with autism in public school classrooms using modifications outlined in this chapter from research conducted through 2023. The impact of the practical functional assessment and skill-based treatment process on ratings of the Behavioral Health Index, frequency of severe problem behavior, rate of skill acquisition, and percentage of active participation in instruction will be assessed. Severe problem behavior places children at risk for restrictive educational placements and is a risk factor for poor outcomes later in life (Presmanes Hill et al., 2014). When students engage in severe problem behavior, eliminating this behavior to ensure the safety of students and staff is prioritized over acquiring skills, which can result in exclusion from educational activities (Taylor et al., 2018). Thus, this study is paramount to support students engaging in severe problem behavior to achieve academic success.

Need for the Study

Autism and Severe Problem Behavior

Severe problem behavior is common among children diagnosed with autism spectrum disorder. Problem behavior is delineated as "behavior…of such an intensity, frequency or duration as to threaten the quality of life and the physical safety of the individual or others and is likely to lead to responses that are restrictive, aversive or result in exclusion" (Banks et al., 2007, p. 10). It is thought that behaviors are learned through a history of interactions with others and the environment (Mace, 1994). Problem behavior increases stress in the family, strains on financial provisions, and demands on caregivers (Presmanes Hill et al., 2018).

Aggressive behaviors in children with autism can lead to removal from the general education classroom, placement in a full-time special education classroom, placement in a specialized school, or placement in a residential facility (U.S. Department of Education, 2020). Estimates of the prevalence of aggressive behavior in children with autism spectrum disorders vary from 8% to 68% (Presmanes Hill et al., 2014; Santiago et al., 2016; Rose & Beaulieu, 2019; Warner et al., 2019).

Researchers attribute the wide range of estimates to different definitions of aggression and measures utilized (Presmanes Hill et al., 2014). The authors used the Child Behavior Checklist (CBCL) in a large clinical sample of 400 children between the ages of two and eighteen diagnosed with autism spectrum disorder. The CBCL is a well-validated parent questionnaire that measures behavioral and emotional problems. T-scores >70 indicate the clinical range of aggressive behavior and correspond to a score above the 98th percentile. The prevalence of aggressive behavior in children with autism was 25%, according to this study of 400 children. The presence of aggressive behavior problems was not correlated with any sociodemographic measures. However, a significant association between an IQ score lower than eighty-five and aggressive behavior was identified. The authors also found that comorbid conditions increased aggressive behavior problems in children with autism. Long-term consequences for children engaging in self-injurious behavior include contusions, permanent scars, soft tissue lacerations, and formations of calluses (Lundy et al., 2021).

Evolution of Function-Based Intervention

Before the development of functional analyses, practitioners relied on rating scales as well as the use of reinforcers and punishers thought to compete with the aberrant behavior (Jessel

et al., 2018b; Mace, 1994). Researchers have found rating scales such as the Motivational Assessment Scale (MAS) and Questions About Behavioral Function (QABF) to be unreliable and highly inferential, which leads to a mismatch between the function of the behavior and the treatment. Mismatches resulted from these closed-ended indirect assessments because the lack of reliability led to the lack of validity. These assessments could not help practitioners ensure the identified function was correct. Descriptive assessments are helpful in displaying the occurrence and prevalence of environmental variables, but a functional analysis is required to determine their significance (Hanley, 2012; Jessel et al., 2018b).

Without identifying the function of the problematic behavior, practitioners relied on subjective reinforcers to increase desired behavior and haphazard punishers to diminish the production of problematic behavior (Mace, 1994). Using reinforcers and punishers to supersede motivation for aberrant behavior could lead to an overreliance on these procedures without determining the actual variables controlling the behavior. Practitioners may also rely solely on extinction (withholding reinforcement from a behavior) without a functional analysis. Pelios et al. (1999) studied how treatment choice was impacted by implementing a functional analysis and found that practitioners were much more likely to design treatments focusing on reinforcement following a functional analysis.

Extinction, the cessation of reinforcing problematic behavior, can be dangerous in isolation (Staubitz et al., 2022). Extinction procedures entail not allowing the student to escape a demand, which can lead to the practitioner continuously representing the demand and providing physical prompting to ensure the student complies with the original demand. The provision of physical guidance may act as a trigger for students who have experienced previous trauma, such as physical abuse. The use of physical guidance may lead to aggression from the student and

may be unintentionally misused by instructors when more intense physical guidance is utilized than is needed. Lerman et al. (1999) found that an increase in problem behavior and other aggressive behaviors occurred in approximately fifty percent of the forty-one cases in their 1999 study. Target problem behavior and aggression decreased substantially when extinction was not used in isolation but as part of a treatment package.

Traditional Functional Analysis

Functional analyses have been referred to as the "hallmark of applied behavior analysis" (Arndorfer & Miltenberger, 1993, p. 82). First introduced by Iwata et al. in 1994, functional analyses were designed to aid practitioners in verifying hypotheses regarding functional relations between environmental events and problem behavior by systematically altering an aspect of the environment and directly observing the impact on behavior. In functional analyses, the effects of the antecedents and consequences from the person's environment are coordinated so that analysts can observe and measure their distinct effects on problem behavior (Cooper et al., 2020). While the antecedents and consequences are comparable to those in the natural environment, this analysis is not conducted in the natural context. Instead, the antecedents and consequences are presented systematically in a controlled environment. A functional analysis aims "to identify effective, precise, personally relevant, and humane treatments for problem behavior" (Hanley, 2012, p. 55).

Four conditions typically encompass a traditional functional analysis (Cooper et al., 2020). Three are test conditions - contingent escape, contingent attention, and alone – and one is a control condition. In the control condition, problem behavior is expected to be low to nonexistent as no demands are placed and reinforcement is freely available. Each condition is

presented systematically in isolation in an alternating sequence during all functional analyses while problem behaviors are recorded. A functional analysis aims to determine under which condition problem behavior occurs more consistently than other conditions.

Following data collection pertaining to problem behavior, the function of the problem behavior can be verified through a visual analysis of a graph of the results (Cooper et al., 2020). Therefore, if behaviors are elevated in the contingent attention condition, it is suggested that the problem behavior is maintained by positive social reinforcement. Higher behaviors in the contingent escape condition indicate that the problem behavior is maintained by negative reinforcement, and higher behaviors in the alone condition suggest that the problem behavior is maintained by automatic reinforcement. However, problem behavior may be maintained by more than one source of reinforcement. Problem behavior may be elevated in one condition or all conditions. If increased problem behavior occurs across all conditions, the result is regarded as undifferentiated. This result may also occur when problem behavior is maintained by automatic reinforcement.

Functional analyses identify a well-defined illustration of variables that affect problem behavior (Mace, 1994; Slaton & Hanley, 2018). According to the authors, functional analyses have decreased practitioners' reliance on punishment procedures and increased the development of treatments based on reinforcement contingencies. Practitioners have moved from using arbitrary reinforcers to supersede the controlling contingencies to teaching replacement behaviors that are functionally equivalent to the problematic behavior. When creating treatment plans using functional analyses, practitioners focus on weakening the aberrant behavior and strengthening or establishing a relationship for behavior that achieves the same function (Mace,

1994). Implementing the traditional functional analysis helped change the trajectory of behavior analysis.

Weaknesses of the Traditional Functional Analysis.

While traditional functional analyses support professionals in connecting functions to problematic behavior, they are not without downfalls. A web-based survey of 724 BCBAs found that less than one-half of the respondents used functional analyses in their current practice, with 63% stating that they had never or rarely identified the function of behavior through a functional analysis (Oliver et al., 2015). The survey responses revealed that the primary barriers to implementing functional analyses included lack of time, needing more space or materials, and being prohibited from using functional analyses by administrative policies.

Functional analyses can necessitate up to several weeks, not including the extensive training required. In Iwata et al.'s (1994) seminal paper, fifteen-minute sessions were conducted for each condition once a day. These procedures continued until stability in the data occurred, five days of unstable data across conditions was collected, or twelve days of data were collected. The average length of functional analyses in the seminal article for the nine participants in this study was eight days, with an average of thirty sessions per student. The number of days ranged from four to eleven, with a range of twenty-four to fifty-three sessions. Tincani et al. (1999) also related concerns of students needing to be removed from the educational setting for this extended period. Further, they pointed to the need for additional staff trained to implement a functional analysis. The expertise and time needed to identify and manipulate the variables and measure their effects on behavior caused a functional analysis to be complex to carry out in most applied settings (Arndorfer & Miltenberger, 1993).

Implementation of a functional analysis may temporarily increase problematic behavior due to the assessment process (Cooper et al., 2020). The problem behavior may begin to develop new functions, and some behaviors may not be responsive to functional analyses due to factors such as the setting when staff do not have the proper training or materials to keep the student and staff safe. Contrived settings may not fully capture the variables present in the natural environment as practitioners may need to develop the appropriate conditions represented in the natural environment. Research on alleviating these concerns has led to variations and alternative methods of functional analysis implementation.

Functional analyses may not be appropriate for dangerous problem behavior (Hanley, 2012). According to Iwata et al. (1994), observing the targeted problem behavior is a crucial part of a traditional functional analysis. Analysts determine the behavior's function by observing the identified aberrant behavior. If analysts need to determine the function of dangerous problem behavior, they must observe it to complete a traditional functional analysis. This may make the traditional functional analysis unsafe and unethical (Hanley, 2012).

Finally, multiply controlled behavior may not be fully addressed through a traditional functional analysis (Hanley, 2012). When a student engages in problem behavior for more than one function, the effects of the functions combined may not be realized when each function is tested in isolation. For instance, the aberrant behaviors demonstrated by the student in Ghaemmaghami et al. (2015) did not cease until three functions were addressed simultaneously through functional communication training.

Interview-Informed Synthesized Contingency Analysis (IISCA)

To increase the efficiency and effectiveness of a functional analysis, Hanley et al. (2014) designed an interview-informed synthesized contingency analysis (IISCA). This analysis is instrumental when the traditional functional analysis is ineffective, as multiple contingencies maintain problem behavior. Relevant variables influencing problem behavior are identified through an open-ended interview. This interview guides the creation of a single individualized test condition and a matched control condition with synthesized reinforcement. The single test condition contains all possible variables identified through the open-ended interview, and the control condition contains all possible reinforcers.

The IISCA was first utilized by Hanley et al. in 2014, with three children with developmental disabilities attending a university-based outpatient clinic. Each of the children engaged in problem behavior multiple times a day and had previously been receiving services based on applied behavior analysis from another entity. Each student could speak in short sentences and received special education services. Following open-ended interviews with the children's parents, the researcher identified that the children's problem behavior occurred when they were denied access to preferred items/activities, asked to wait, and directed to relinquish reinforcers. Caregivers had each gone to great lengths to appease the children, but severe problem behavior ensued. The open-ended parent interviews included questions about the student's behavior, parent responses to behavior, and the student's current abilities to support the analysts in designing a unique IISCA for each child.

The IISCAs implemented in this study consisted of the experimenter alternating between each child's individualized test and control conditions. Every thirty seconds reinforcers were removed and were returned contingent on problem behavior. Test conditions were used as

baselines for each of the children. A multi-element design was used to compare the test and control conditions during the analysis. Following differentiated results from the analysis, treatment to reduce problem behavior and increase the amount of time the students adhered to adult instructions occurred over eight to fourteen weeks in the outpatient clinic at the university. Skill-based treatment included teaching a simple functional communication response to replace problem behavior, increasing the intricacy and age-appropriateness of the response, introducing a tolerance response to delays and denials of requests, chaining simple and then more complex responses during denial and tolerance training, and finally extending the treatment to the natural environment.

Each student visited the clinic three to four times weekly for treatment and stayed about one hour. Sessions lasted five minutes and were conducted three to six times per visit. The instructor began using behavior skills training (BST – instruction, modeling, role play, and feedback) to teach each child a simple functional communication response. At this time, problem behavior ceased to result in reinforcement. The instructor ensured that at least five seconds passed between the problem behavior and the reinforcement of the simple functional communication response. Once the student emitted the simple functional communication response without prompting for at least two sessions, the adult increased the response's complexity to become more age-appropriate. The complex functional communication response involved teaching the student to say, “Excuse me,” while making eye contact with an adult, waiting for the adult to respond, and then stating an appropriate functional communication response. The instructor provided a vocal prompt if the response was not emitted within five seconds. Access to reinforcement was withheld if the student engaged in problem behavior.

The next phase consisted of delay- and denial-tolerance training. The instructor used behavior skills training to teach the student a response to emit when his request was denied. This response consisted of the child taking a deep breath and saying, “Okay,” while looking toward the adult. During this training, two of every five FCRs were followed by immediate reinforcement. Three of every five FCRs led to a delay or denial response from the instructor. Extinction was used for all problem behavior.

In the next phase of treatment, the delay to reinforcement was systematically increased by requiring the student to engage in a required response. Students were instructed to engage in a less preferred activity, follow adult directives, or tolerate redirection and follow instructions. Delays were only increased when the students independently emitted the functional communication response, and problem behavior did not occur. The instructor systematically increased the delays until the students complied for approximately 67% of each session.

The final phase consisted of three levels. Instructions in level one consisted of motor imitation and engaging in less preferred activities for up to twenty seconds. The instructions in level one were gradually increased in complexity and duration until each child engaged in long chains of responding. Level two requirements were simple academic tasks, transitions, and engaging in less preferred activities for up to ninety seconds. Requirements in level three consisted of alternate play, challenging academic or pre-academic tasks, and self-help activities.

Following the final phase of delay and denial training, the treatment was extended to other contexts. Generalization occurred in one student’s home, while generalization sessions for two students occurred around the university building before moving to their homes. During this phase, parents and teachers were coached in the clinic to implement the treatment prior to implementing it at home.

Throughout each phase of treatment, trained observers collected data during continuous ten-second intervals and summarized the data as a number of responses per minute. The number of problem behaviors, functional communication responses, and tolerance responses were recorded, as well as the duration of reinforcement. The duration, type, and compliance with instructions were also recorded. Tone and volume were considered when determining if responses were correct. Interobserver agreement was measured in 20% of the sessions. After the entire treatment was complete, parents were asked to answer a questionnaire regarding the social validity of the treatment.

Following the eight-to-fourteen-week treatment, no problem behavior was observed by any subjects at home or the clinic. Each of the children engaged in functional communication responses, tolerance responses, and cooperation with adult directives. Each of the parents related that the assessment, treatment, improvement of problem behavior, and consultation were highly acceptable.

Even though socially validated treatment gains were identified by Hanley et al. (2014), it is important to note that Board Certified Behavior Analysts implemented the treatment in a clinical setting. Training for parents and teachers only occurred to gain generalization following the successful implementation of treatment. Problem behavior was subject to extinction, which may lead to an increase in problem behavior in the form of an extinction burst for some students. This extinction burst may lead to dangerous problem behavior.

Hanley et al.'s (2014) study is important to the current research as it represents the seminal study completed using the practical functional assessment and skill-based treatment. It will be the basis for the current study. While some aspects of the procedures related to Hanley et al.'s 2014 seminal paper have been modified by later researchers, other elements remain static. The current study continues to use an open-ended interview (although modified from its original version) to guide the creation of a single test condition with synthesized reinforcement and a matched control condition. The test condition of the IISCA is used as a baseline for each student, and skill-based treatment follows the same progression as the original study. However, the current research implements changes made in the literature from 2014 to 2023. These changes, which will be discussed in the section entitled *Replications Applicable to the Current Study*, outline procedures to include students using augmentative and alternative communication (AAC), increase generalization, expand implementers and settings, increase time delays, use micro-shaping, include trauma-informed practices, and implement a performance-based assessment. Modifications unique to the current study include the utilization of public school classrooms and staff for analysis and intervention and the calculation of the rate of skill acquisition and percentage of participation across the school day in relation to treatment.

Weaknesses of the IISCA.

While numerous studies posed the practical functional assessment and skill-based treatment as a worthwhile assessment and program, other studies have concluded that the traditional functional analysis (FA) is better suited to determine the function of student behavior. Coffey et al. (2020b) pointed to several weaknesses in the literature regarding the IISCA. Only one out of ninety participants in the articles reviewed were identified as diagnosed with an

intellectual disability, and 75% of the population communicated vocally. Thus, the authors concluded that this procedure has not been thoroughly vetted with students diagnosed with intellectual disabilities or using AAC. Minimal data regarding treatment fidelity, treatment acceptability, and the generalization of skills have been collected across the published papers. This study seeks to add to this literature by including students using AAC as well as students dually diagnosed with autism and intellectual disabilities.

Strengths of the IISCA.

The practical functional assessment allows for the control and test conditions to mimic the natural contingencies typically surrounding problem behavior (Hanley et al., 2003). Slaton et al. (2017) related that the practical functional assessment leads to more effective treatments than those gleaned from the isolated contingencies of the traditional functional assessment. Without the ability to design an individualized test condition, a "cookbook approach" may result from standardizing the procedures of functional analyses (Jessel et al., 2020a, p. 205). According to the authors, this could ensue in practitioners who can follow the recipe but cannot think flexibly and problem-solve when the first attempt at a functional analysis is unsuccessful.

Layman et al. (2023) reviewed thirty-nine studies published between 2014 and 2022 across ten peer-reviewed journals. These studies included 111 analyses, each of which led to a reduction in problem behavior following the implementation of the practical functional assessment and skill-based treatment. When levels of problem behavior from the last five treatment sessions were compared to baseline levels, problem behavior was reduced by an average of 97%. In 31% of the treatment analyses reviewed, problem behavior was reduced to zero. Inter-observer agreement was taken in 93% of the analyses for at least 20% of the sessions.

Seventeen articles reported over 90% inter-observer agreement, supporting the published measurements' reliability and validity.

Comparison of Functional Analysis and Practical Functional Analysis

Many factors differ between the functional analysis and the practical functional analysis. For instance, the traditional functional analysis is rarely individualized, and when it is individualized, it is usually after an unsuccessful implementation of the traditional analysis. In contrast, the practical functional assessment allows for multiple levels of individualization, from altering the materials used to the interactions programmed. The test condition is individualized to better correspond with the context of the problematic behavior as deemed necessary through the interview. The purpose of a functional analysis is to identify the function of a behavior. In contrast, the practical functional analysis aims to identify the environmental causes of the identified problem behavior, create a baseline to utilize when evaluating treatment effects, and generate a motivating situation in which one can teach contextually appropriate behaviors to replace the problem behavior (Jessel et al., 2018b). Slaton et al. (2017) stated that it is essential to note that each modification utilized to create the practical functional assessment has a precedent in the literature. However, the specific combination of the changes is unique. These differences are further discussed in this section.

Test Conditions.

The traditional functional assessment consists of one control condition (typically conducted as a play condition) and four test conditions labeled as escape, sensory, attention, and tangibles (Slaton et al., 2017). The practical functional assessment consists of one synthesized test condition and a matched control condition in which all synthesized reinforcers are readily

available. Therefore, the traditional functional examination consists of four generic test conditions with isolated reinforcers, while the practical functional assessment consists of a single idiosyncratic test condition with combined reinforcers. As traditional functional analyses are conducted using generic contingencies, the conditions may not parallel the contingencies controlling the problem behavior closely enough.

The practical functional assessment is comprised of shorter sessions than the traditional one. The seminal functional analysis article (Iwata et al., 1994) utilized fifteen-minute daily sessions for each generic condition, with an average analysis lasting eight days. The authors continued the procedures until the data was stable, five days of unstable data were collected, or twelve total days of data were collected. Students needed to be removed from educational programming for the time it took to conduct a functional analysis to insure a tightly controlled environment.

The traditional functional analysis consists of procedures applied similarly in each condition (Jessel et al., 2020a). In contrast, the IISCA consists of unique test conditions designed following an open-ended interview and an observation of the student. Reinforcement contingencies are also different between the two procedures. The traditional functional analysis consists of isolated reinforcers arranged in each condition, while the IISCA synthesizes reinforcement into one contingency for the single test condition. As described in Jessel et al. (2020a), the control conditions differ between the two types of analyses. The play condition in the functional analysis attempts to control for all the test conditions, while the IISCA uses a matched control condition in which the offering or withholding of reinforcement is the only difference between the test and control.

Contingency Classes.

The traditional functional analysis focuses on assessing only one behavior at a time, whether dangerous or not (Iwata et al., 1994). This focus on a single behavior is referred to as a closed contingency class. The IISCA, in contrast, assesses multiple topographies of behavior simultaneously as long as they belong to the same response class (Hanley, 2012). This focus on multiple behaviors is referred to as an open contingency class. The open contingency class includes precursor or low-level behaviors as well as severe problem behaviors. Precursor behaviors and behaviors of the same response class are reinforced in the practical functional assessment, while only the prioritized behavior is reinforced in the traditional functional assessment. A separate functional analysis must be conducted for each behavior in the traditional functional assessment. Several studies have been conducted to assess the use of open and closed contingency classes during functional analyses.

Opening the contingency class led to safer analyses in studies conducted by Warner et al. (2019), Jessel et al. (2021), and Smith and Churchill (2022). The open contingency classes included both dangerous and non-dangerous precursor behaviors. In the twenty-two analyses reviewed by Jessel et al. (2021), the participants were more likely to engage in the precursory non-dangerous behaviors than the dangerous behaviors in 82% of the analyses. However, if the analyses in the reviews did not include non-dangerous precursor behaviors in the contingency class and only focused on the identified severe problem behaviors, problem behavior could worsen from the non-dangerous topography to behaviors requiring restraint or seclusion. Smith and Churchill (2002) published similar findings relating to the effectiveness of focusing on non-dangerous precursor behaviors. These findings are important as targeting only the dangerous problem behavior requires the analyst to persist until the dangerous behavior is observed. This

practice may require a more extended period in the evocative context before the dangerous problem behavior occurs. Closing the response class may also increase non-dangerous behaviors until the student emits the dangerous target behaviors.

Caregivers in Jessel et al.'s 2021 study also related their preference for an open response class as they could not successfully cease severe problem behavior once it had started, and their children tended to engage in long bouts of severe problem behavior. This research supports opening the contingency class to make the practical functional assessment a safer alternative than the traditional functional analysis when dealing with severe problem behavior. In fact, Jessel et al. (2021) found that since 1994, 57% of the published studies in peer-reviewed journals included non-dangerous behavior in analyses using open-contingency classes to improve student and analyst safety.

Using an open contingency class for problem behavior supports code 2.15 in the Behavior Analyst Certification Board's Code of Ethics (2020), titled "Minimizing Risk of Behavior-Change Interventions" (p. 12). By identifying precursor behaviors to severe problem behavior and including them in the assessment, the analyst decreases the likelihood of severe problem behavior occurring and increases the safety of the client and analyst. The current study utilizes open-contingency classes with each participant to increase safety for students and implementors. Non-dangerous behaviors identified as members of the contingency class were acknowledged and reinforced before the students engaged in dangerous behaviors.

Open Ended Interviews.

The practical functional assessment was the first assessment used by behavior analysts to include an open-ended assessment with caregivers (see Appendix B). Typical assessments, such

as the Motivation Assessment Scale, required responses on a Likert scale instead of open responses. Due to this modification in procedures, researchers questioned the reliability and validity of such an assessment (Saini et al., 2020).

The first study to determine the interrater reliability of the open-ended functional assessment interview was by Saini et al. (2020). Interrater reliability refers to the consistency of data taken by multiple people. Two practitioners take data independently on the same condition to determine interrater reliability. Following the observation, the practitioners compare their data. The more alike their data, the higher the interrater reliability. The open-ended interview from Hanley et al. (2014) was conducted for each participant with a caregiver or a lead therapist. The concurrent validity of the interviews was assessed using a functional analysis with a matched control condition (Jessel et al., 2016). The average interrater reliability was 75% (Saini et al., 2020). The researchers found that this score significantly increased from the 29% reliability of the Motivation Assessment Scale (MAS) and the 64.8% of the Functional Analysis Screening Tool (FAST). The authors surmised that one reason may be the opportunity to ask deeper questions in the open-ended interview, which can lead to a better understanding of contextual variables. The authors related that the open-ended interview possesses several advantages over the closed-ended indirect assessments. The open-ended interview supports identifying contextual factors, allows the interviewer to ask follow-up questions for more information, and allows the analyst to establish rapport with the interviewee. The use of the open-ended interview supports beginning the process with a less intrusive assessment method.

Rajaraman et al. (2022b) replicated Saini et al.'s 2020 procedures with the addition of an extension to evaluate the reliability of the results of the practical functional assessments. Data from the treatment was collected to compare the baseline data collected during the practical

functional assessment. Each of the treatment designs was successful in eliminating problem behavior and increasing skill acquisition. Rajaraman et al.'s (2022) results established a 97% reliability when evaluated using the same method as Saini et al. (2020), whose reliability results were 75%. These findings demonstrated the reliability of the open-ended assessments utilized in the IISCA/practical functional assessment.

The current study utilizes a modified version of the original open-ended interview found in Hanleyet al. (2014). In 2023, Canniello et al. introduced new questions into the original interview to give further information about student escalation. These questions included the frequency and history of problem behavior related to the length of time the student had exhibited the problem behavior. The authors also asked the caregivers to describe the dangerous problem behavior, identify the speed with which the student escalated, and share the types of injuries and damage caused by the problem behavior. The current study will utilize these additional questions for further information about the participating students.

Omnibus Mands.

Skill-based treatment begins by teaching the student an omnibus mand (Hanley et al., 2014). This type of mand gives the learner immediate access to all identified forms of reinforcement. The purpose of teaching an omnibus mand is to eliminate problem behavior as quickly as possible. However, some researchers questioned this practice and feared repercussions when the implementor later attempted to teach specific mands.

Ward et al. (2021) replicated the treatment process with three students to determine if teaching an omnibus mand prevented students from acquiring distinct mands for specific wants and needs. In this scenario, an omnibus mand was used to cease all adverse events and access all

identified reinforcers. While research has shown the omnibus mand to be effective in decreasing problem behavior, studies had yet to identify if teaching an omnibus mand made students less likely to attain individual mands. Before the publication of Ward et al. (2021), researchers warned that teaching an omnibus mand may lead to problem behaviors when specific mands were taught, as the omnibus mand would be placed on extinction. These researchers believed that instruction of an omnibus mand would also limit the number of listeners to whom the students could mand, as novel listeners would need help understanding the omnibus mand.

The students' communication in Ward et al. (2021) ranged from one-word phrases to complete vocal fluency and from using modified American Sign Language to a speech-generating device. Each student was taught an omnibus mand before using six to fourteen steps to shape specific mands. The students began manding for “My way” (the omnibus mand), and by the end of the study, each manded for specifics such as “Play with me,” “All done,” “I want to stop working,” “Please stop talking,” and “I want to take a break, can we hang out?” (Ward et al., 2021, p. 253). Problem behavior rate remained at near-zero levels throughout the intervention, and specific mands were quickly acquired with the progressive shaping procedure. This study supported using the omnibus mand to eliminate problem behavior quickly. It demonstrated that teaching an omnibus mand will not impede the later teaching of distinct mands. Omnibus mands will be used for all students participating in the current study to quickly eliminate problem behavior at the beginning of skill-based treatment. Some students will return to specific mands during the current study, while others will be taught specific mands following the culmination of the study.

Comparison of Results. Three studies were located in peer-reviewed journals that compared the results of the traditional functional analysis with the practical functional analysis.

Slaton et al. (2017) conducted IISCAs and traditional functional analyses for nine children with autism aged seven to eighteen. The authors ensured that the session duration, analyst, specific demands, and specific types of attention remained constant across both analyses. The IISCAs were differentiated for each student, as was the standard functional analysis. The authors assessed the results of the IISCAs and functional analyses by testing the corresponding treatments with four of the nine children. Treatments based on the IISCA were effective for all four children, while treatments based on the traditional functional analysis were effective for two students.

Slaton et al. (2017) related that the synthesis of contingencies supports evaluating the function of problem behavior in the natural context and concluded that the traditional functional analysis may fail to identify the interactive effects of contingencies, which would make treatments unsuccessful. The percentage of differentiation in practical functional assessments in this study is 44%, similar to the 47% found in Hagopian et al. (2013). Thus, using the practical functional assessment alleviates the possibility of needing to complete a second functional analysis when the first analysis results are inconclusive. Suppose practitioners cannot identify the function of problem behavior during the first analysis. In that case, a second attempt is more time-consuming and may require more expertise than is available. Slaton et al. (2017) concluded that using the practical functional assessment leads practitioners to an effective treatment regardless of whether single or multiple synthesized contingencies maintain the problem behavior.

Trial-based and traditional functional analyses were compared with the IISCA in a study by Curtis et al. (2020). This study was conducted with three children between the ages of three and four who communicated by pointing and leading adults. Sessions were conducted in a

university clinic setting. The authors completed the FAST-rating scale during the study, followed by a trial-based functional analysis, the IISCA, and the traditional functional analysis. Curtis et al. (2020) identified the IISCA as the most efficient analysis with the least number of instances of problem behavior. The trial-based functional analysis was found to be more appropriate in a classroom setting, but its length was comparable to that of traditional functional analysis. The traditional functional analysis was problematic due to the longer duration and the requirement of evoking severe problem behavior in each test session. Corresponding results were identified across each of the assessments. While Curtis et al. (2020) stated that the synthesized contingency in the IISCA makes it challenging to determine the amount of influence from each variable and may lead to unnecessary treatment components, the IISCA led to the fastest decrease in problem behavior. Thus, "a sacrifice in precision may be acceptable if it results in a more timely decrease in problem behavior" (Curtis et al., 2020, p. 13).

Summary of the Comparison

The use of open-ended interviews to support the creation of one unique test condition and a matched control condition in a practical functional assessment is in direct contrast to the use of four generic test conditions in the traditional functional analysis. This change dramatically decreases the amount of time required for the analysis and allows for the analyst to quickly identify behaviors that are multiply controlled. Opening the contingency class to assess non-dangerous precursor behaviors alongside dangerous behaviors not only decreases the amount of time required for an assessment but also makes the analysis safer for the implementor and the student. The aforementioned research clearly demonstrates the importance of using these procedures in the practical functional assessment.

Literature with Modifications Applicable to the Current Study

The original IISCA has evolved since its first publication in Hanley et al. (2014). This section includes studies with modifications included in the current study's procedures. Procedures have been modified to include students using AAC (Lundy et al., 2021; Jessel et al., 2018a), alter the type of prompting procedure utilized (Ghaemmaghami et al., 2016; Jessel et al., 2018b; Coffey et al., 2020b), and support generalization across stimuli, people, settings, and time (Beaulieu et al., 2018; Lundy et al., 2021). Replications have been conducted with modified procedures to include settings other than clinics (Santiago et al., 2016; Taylor et al., 2018; Lundy et al., 2021), implementors who are not BCBAs (Santiago et al., 2016; Taylor et al., 2018) and students with protective equipment (Santiago et al., 2016). Finally, procedures have been altered to increase the time delay (Ghaemmaghami et al., 2016), micro-shaping responses (Coffey et al., 2020b; Taylor et al., 2018), incorporating trauma-informed practices (Rajaraman et al., 2022) and implementing procedures based on the student's performance (Iovino et al., 2022; Jessel et al., 2023). Each modification has been incorporated into the current study with at least one participant. These changes will be discussed in the next section.

Students Using Augmentative and Alternative Communication (AAC)

According to Coffey et al.'s (2020a) literature review, 75% of the students assessed using the practical functional assessment and skill-based treatment before 2020 used vocalizations to communicate. All of the participants in Hanley et al.'s 2014 seminal study communicated vocally. Studies by Jessel et al. (2018a) and Lundy et al. (2021) set the groundwork for using the practical functional assessment and skill-based treatment with students using augmentative and alternative communication (AAC). In Jessel et al.'s 2018 study and Lundy et al.'s 2021 study,

students used the Picture Exchange Communication System (PECS) to communicate. One student in Lundy et al.'s 2021 study used the Proloquo app to communicate. Both studies used most-to-least prompting and shaping to teach functional communication responses. For instance, one student's functional communication response was taught using a three-step shaping procedure. The first step was tapping a large (10.2 cm) square picture card in the instructor's hand, the second step included picking up the card and handing it to the instructor, and the third step required the student to pick up a smaller (5.1cm) square picture card attached by Velcro to his wristband and hand it to the instructor. The rest of the treatment by Lundy et al. (2021) followed Hanley's 2014 procedures. Student 2 in the current study uses a pictorial communication binder to communicate with others. He takes a listener to the binder and points to the picture of the desired item or activity. An icon representing the omnibus mand "My Way" was added to the front of his binder and taught using most-to-least prompting. Student 3 uses the Proloquo app programmed on an iPad to communicate. The omnibus mand and the tolerance response were added to his device and were taught using most-to-least prompting. The modifications described in Lundy et al., 2021 and Jessel et al., 2018a were beneficial when planning the current study.

Prompting or Behavior Skills Training

The seminal article describing the practical functional assessment used Behavioral Skills Training (BST) to teach students functional communication and tolerance responses (Hanley et al., 2014). BST consists of explanation of the steps of the skill, the instructor modeling the skill, the student role-playing the skill, and the instructor providing the student feedback. Ghaemmaghami et al. (2016) used most-to-least prompting to teach functional communication

and tolerance responses instead of BST, as did Jessel at al. (2018a) when working with students communicating via AAC.

The current study will use most-to-least prompting when teaching the functional communication response and the toleration response with students 1, 2, 3, 6, and 7. These students communicate vocally or via AAC (picture board or Proloquo), engage in limited language skills, and communicate using one to two words at a time. Adults interacting with these students simplify their language and give directions using no more than four-word utterances. Behavior skills training will be used for students 4 and 5. These students are vocal and speak in full sentences. They follow multiple-step directions, ask and answer wh- questions, and are reinforced by social praise and social interactions.

Extinction was implemented when problem behaviors occurred in Hanley et al.'s 2014 procedures. These procedures were altered by Coffey et al. (2020b), who prompted students using least-to-most prompting if problem behavior occurred during instruction. The current study utilized least-to-most prompting across all students instead of extinction if problem behavior occured during sessions. Extinction will not be used in this study to avoid an extinction burst leading to more intense behavior. Instead, least-to-most prompting will be utilized, and the trial will end if severe problem behavior occurs.

Generalization

Generalization of skills across stimuli, people, settings, and time can be difficult for students with autism. Often, children with autism engage in skills only under the precise conditions in which they are taught. (Bak et al., 2021) To encourage generalization, the implementers in Lundy et al. (2021) varied their denial cues. When the students in the study did

not generalize the omnibus mand across novel instructors and environments, the authors suggested future researchers could explicitly teach the omnibus mand in multiple novel situations or teach specific mands following the acquisition of the omnibus mand to support generalization. Student 3 in the current study historically does not generalize skills across people, settings, and materials. Therefore, this study will ensure that his implementors vary their cues and that he is instructed across staff, environments, and materials from the beginning of treatment.

Plans were also implemented to support generalization for the other students in the study, even though they did not have a documented history of failing to generalize without specific instruction. These plans were determined based on the level of staffing and staff comfortability with treatment. Students 1, 6, and 7 immediately began treatment with two implementors taking turns across the school day. Two more implementors were added to the rotation for these students once they mastered CAB 3, which consists of emitting the functional communication response and the tolerance response, relinquishing reinforcement, transitioning to the work area, and completing 1-3 mastered responses. When Student 2 mastered CAB 3 (as described above), three other implementors began implementing treatment at the tolerance response. Student 5 worked with only one implementor until he mastered transitioning to the work area (CAB 2). During this time, paraeducators in the room were given time to observe sessions and ask questions. Following his mastery of CAB 2, the paraeducators began implementing at the tolerance level. Student 4 began treatment in the special education room with the special education teacher, but treatment was moved to the kindergarten classroom, where the special education teacher and the kindergarten teacher implemented treatment at the same time. Following Student 4's mastery of transition to the work area (CAB 2), a para was also rotated into the kindergarten classroom to provide treatment.

Settings of Implementation

Hanley et al.'s 2014 seminal article was conducted in the controlled setting of a clinic treatment room. Few published studies have taken place outside of a clinical setting. Santiago et al. (2016) replicated Hanley et al.'s (2014) study in a classroom of a specialized school and a student's bedroom. Lundy et al. (2021) conducted the initial practical functional assessment at students' desks in their classroom within a specialized school, while generalization was assessed in the gym.

Taylor et al. (2018) conducted the only study in a public middle school. However, the assessment and the treatment were implemented in a separate conference room and not in a classroom. Therefore, the environment was much easier to control. In this study, the procedures were implemented over an entire school day for about four hours and twenty minutes instead of one hour per day, which was typical in previous clinical publications. With the drastic increase in treatment intensity, this student's treatment lasted only five days as opposed to Hanley et al. (2014), in which students required two months of treatment to make the same gains.

In the treatment extension phase of Taylor et al. (2018), the goal was for the student to spend at least 80% of his academic schedule participating in preferred activities that did not include any activities on his iPad. In the general education classroom, the original functional communication response was expanded to requesting a choice or going to "his" room. The extension period lasted five weeks. This study most closely aligns with the setting of the current study.

The setting of the current study includes classrooms in public schools. Students 1, 2, 3, 5, 6, and 7 are served in full-time autistic support classrooms with no more than eight students per room. Student 4 is placed in a general education kindergarten classroom. This study seeks to

determine if the procedures are able to be utilized in a public school classroom setting and remain effective even though all variables cannot be controlled.

Implementers

Prior to a study conducted by Santiago et al. (2016), the IISCA treatment package had only been utilized by board-certified behavior analysts (BCBAs). In Santiago et al.'s (2016) study, the entire treatment package was implemented by teachers without training in Applied Behavior Analysis who were supervised remotely by a BCBA. In 2018 Taylor et al. extended treatment to a general education classroom in a middle school by involving teacher aides and a general education teacher in the implementation of the intervention. Teacher aides implemented procedures for target skills after each skill was mastered in a separate location with a behavior analyst. The general education teacher implemented more of the intervention as the student spent more time in the general education classroom. At first, the teacher aide responded to functional communication responses by asking the student to check with the teacher. During this phase, the teacher reinforced each response before gradually increasing the required responses during the delay. The teacher's assistant then faded her presence altogether and the general education teacher conducted the intervention.

Other studies included implementers during the extension phase of treatment. In Ghaemmaghami et al. (2016), the treatment extension involved teaching home care providers and teachers to implement the intervention following success at a clinic with behavior analysts. Each teacher observed a session of skill-based treatment and was presented with a written script containing all possible contingencies and precise wording. Teachers were coached by a lead

teacher using behavior skills training to demonstrate all skills during role plays before working with the student.

The current study will not be implemented by a BCBA. Special education teachers, special education para-educators, and a general education teacher will implement the practical functional assessments and skill-based treatment. None of these implementers are trained in applied behavior analysis. The researcher will remotely supervise the implementers via Zoom for approximately thirty minutes a day during skill-based treatment through CAB 4. Following mastery of CAB 4 the students will engage in three new contextually appropriate behaviors individualized for each student. During the supervised sessions the BCBA will provide prompts and feedback through a bluetooth ear piece worn by the implementer. Following the instructor's ability to implement the procedures for CAB 4, the supervised sessions will be reduced to once per week. This study will also use the training procedures from Ghaemmaghami et al. (2016). Teachers and para-educators will be taught the procedures through behavior skills training and provided wall cues to support their implementation.

Increasing the Time Delay

The seminal research article by Hanley et al. (2014) is not specific in the type of time delay contingency utilized. At times the students were required to play independently and at other times they were required to follow instructions. Therefore, one can infer that a mixture of contingency-based and time-based delays were utilized. The current study will follow the findings of Ghaemmaghami et al. (2016) and Iannaccone and Jessel (2020) by implementing only a contingency-based time delay. Contingency-based time delays give students access to

reinforcement based upon the number of responses in which the student engaged without problem behavior instead of an amount of time without problem behavior.

Ghaemmaghami et al. (2016) assessed the implementation of a contingency-based time delay and a time-based progressive delay to determine which could support students when waiting for reinforcement for extended periods without the resurgence of problem behavior. Time-based progressive delays were ineffective as they led to a resurgence of problem behavior for 75% of the cases within the first sixteen seconds of a delay. Contingency-based time delays successfully taught students to tolerate waiting for reinforcement. The use of contingency-based time delays maintained a low level of problem behavior in conjunction with teaching a functional communication response while increasing the time the students were engaged in activities. Iannaccone and Jessel (2020) also found contingency-based progressive delays to be the most effective method of schedule thinning. The authors also related that this method may be most helpful in classrooms as students are required to complete tasks while tolerating the delay in reinforcement.

Microshaping

Microshaping involves breaking larger behaviors down into minute steps and reinforcing tiny movements towards the desired end behavior. For instance, Coffey et al. (2020b) differentiated cooperation responses into three levels. Level one consisted of simple motor tasks, level two included academic tasks and level three included self-help skills. If problem behavior occurred during instruction, the student was prompted using least-to-most prompting. The student needed to complete the entire sequence of requirements without problem behavior to attain access to reinforcement. By breaking down cooperation into smaller increments instructors

are able to reinforce the student more often while building toward the culminating behavior. Another example of microshaping comes from Taylor et al. (2018), who state that their intensive treatment consisted of ten steps. Within these ten steps, relinquishing reinforcement was broken down into six steps. Typically, relinquishing reinforcement is only one step during skill-based treatment. Microshaping will be used in the current study for students who are unable to successfully acquire skills without engaging in problem behavior. When this occurs, the researcher will use microshaping to ensure the student contacts reinforcement and success.

Trauma-Informed Care

Rajaraman et al. (2022c) explored incorporating trauma-informed care into applied behavior analysis using the practical functional assessment and skill-based treatment. The Center for Disease Control (CDC) (2023d) states that approximately 64% of adults in the United States conveyed that they had experienced at least one adverse childhood experience. In comparison, 17.3% had experienced four or more adverse childhood experiences according to the CDC. Trauma-informed care incorporates acknowledging trauma and the possible impact on the client, guaranteeing the client's safety and trust, encouraging choice, and accentuating the acquisition of skills. To align the practical functional assessment with trauma-informed care, Rajaraman et al. (2022) recommend that analysts prioritize trust and emotional safety to the same extent that physical safety is prioritized.

In the Enhanced Choice Model (ECM), students consent to participate in treatment throughout each session by remaining in the treatment area (Rajaraman et al., 2022c). If the students wish to refrain from participating, they have the choice to enter the hang out area to hang out with the analyst or leave the environment altogether. While the current study will not

use these precise choices, each participant will have the opportunity to assent to treatment throughout each session. Sessions will have an open-door policy so students can leave the area if they do not want to continue the session. If the learner shows distress during the session, the staff will discontinue the session.

To prioritize trust, behavior analysts need to eliminate the need for physical management. Rajaraman et al. (2022a) related that this can be achieved by reinforcing low levels of problem behavior so it does not escalate to dangerous levels. This is in contrast to the extinction procedure utilized in the seminal version of skill-based treatment in which students' problem behavior was not reinforced, and instructors continued to prompt students using a prompt hierarchy to emit the appropriate response until they cooperated (Hanley et al., 2014). The use of extinction for problem behavior can escalate behavior to unsafe levels (Rajaraman et al. 2022c). While reinforcing lower levels of problem behavior may seem counterproductive, preventing problem behavior from escalating to a dangerous level may be necessary. This procedure serves to continue to build trust with the student, by teaching the student that their behavior has power. In the current study staff will be instructed to reinforce low levels of problem behavior by removing the evocative situation and returning the student to synthesized reinforcement. This safety measure is in place to decrease the possibility of dangerous behavior occurring during the study.

Physical guidance to gain cooperation should also be eliminated as this procedure may act as a trigger to students who have endured trauma (Rajaraman et al. 2022a). In Hanley et al. (2014), staff used physical prompting if the students did not respond with vocal or gestural prompting. For some students, repeated prompts may escalate the behavior until physical guidance is needed to attain cooperation. The use of physical guidance may lead to an escalation

in behavior for students with histories of physical trauma and may not be appropriate for all students, especially students who are larger and older. Instead of using physical management techniques in Rajaraman et al.'s 2022c study, staff represented vocal or gestural prompts every five to ten seconds. Instructors will not be using physical guidance in the current study. If students do not respond to vocal and gestural prompts, the evocative situation will be removed and the student will be returned to synthesized reinforcement. The analyst and the staff will then further investigate the trial to determine if a modification such as microshaping may be necessary.

Performance-Based Assessment

Iovino (2022) modified the practical functional assessment and skill-based treatment into what would later be referred to as the performance-based assessment. The procedures outlined in the study focused on ensuring that the student is happy, relaxed, and engaged for at least three minutes before the first presentation of the establishing operation and at least thirty seconds before re-presenting the establishing operation thereafter in the session. Thus, the student's behavior guides the analyst's decision-making rather than the passage of time. This modified assessment lasted 17.6 minutes, with the mean duration of the student contacting the establishing operation lasting only 0.008 minutes and 0.45 minutes. The therapist was typically able to observe low-level problem behavior within ten seconds of presenting the establishing operation and successfully eliminate the problem behavior within five seconds. The analyst's skill is of the utmost importance in this assessment as implementors need to make quick, informed decisions based on their observations of the student.

Jessel et al. (2023) replicated the performance-based IISCA by basing the removal and presentation of reinforcement on the student's performance to decrease the possibility of escalating problem behavior. Establishing operations were only introduced to students after they exhibited happy, relaxed, and engaged behavior for some time. The production of any problem behavior in the evocative condition resulted in access to synthesized reinforcement.

Following the implementation of the practical functional assessment, the authors conducted the original IISCA with students and compared the results. The results of the two assessments showed similar conclusions. Five students then engaged in skill-based treatment designed based on the IISCA to show treatment validity. Each result led to valid treatments for each student. However, the original IISCA required sixteen minutes to conduct, while the performance-based IISCA concluded in seven minutes. Thus, the performance-based IISCA is 56% more efficient than the original based on this study. Jessel et al. (2023) found that although nondangerous behavior occurred more frequently when using the practical functional assessment, dangerous behavior still occurred with 68% of the participants at some point. In this study, dangerous problem behavior only occurred in 33% of the performance-based assessments. The performance-based IISCA may therefore be more advantageous for students who engage in severe problem behavior due to its efficiency in decreasing dangerous problem behavior emitted during the assessment.

As the performance-based assessment is more efficient, leads to students engaging in less dangerous behaviors, and results in similar conclusions as the original IISCA, this study will utilize the performance-based assessment with all participants. The progression of the establishing operation will depend upon the student's performance, and measures will be taken to determine student assent as well as if the student is happy, relaxed, and engaged before each trial.

The initial establishing operation will not be presented throughout the intervention until the student is happy, relaxed, and engaged for at least five minutes. Following the first trial the implementors will ensure that the student is in HRE for a minimum of forty-five seconds prior to placing the next establishing operation.

Happy, Relaxed, and Engaged

To successfuly implement the performance-based assessment implementors need to possess a good understanding of the phrase happy, relaxed, and engaged (HRE) and what that looks like for their particular student. This phrase entered the applied behavior analysis literature following Dr. Hanley's workshops entailing the PFA process (Hanley, 2021). The first published mention in a peer-reviewed journal was by Iovino et al. in 2022. The author relates that the practical functional assessment begins with the instructor creating an environment in which the student is "happy, relaxed, and engaged" (Iovino et al., 2022, p. 4). Iovino et al. (2022) described HRE as the lack of problem behavior in addition to relaxed facial and shoulder muscles with the hands of the student interacting with an object or moving in a self-stimulatory manner. Students with autism may not present their emotional states in the same manner as neurotypical students due to "idiosyncratic mood indicators" (Ramey et al., 2022, p. 194). One of the hallmarks of autism is a delay in language development. Thus, Ramey et al. (2022) remarked, that practitioners cannot use typical quality-of-life measures, typically presented to individuals in a Likert scale format, and rely on responses from the individual in question. These typical questionnaires rely on abstract questions involving advanced language skills and a comprehensive understanding of emotions. When quality-of-life rating scales are presented to

students with autism and their caregivers, the caregivers will typically report considerably lower scores than the students with autism.

Happiness is difficult to operationalize as it is a private event that presents differently across the population. Traditional indices such as smiling may not depict happiness in students with autism, and actions such as hand flapping may indicate happiness for some individuals and anxiety for others. Therefore, Ramey et al. (2022) believe that individualized definitions of happiness are required. Creating an individualized context for each student that contributes to them feeling happy, relaxed, and engaged requires analysts to study their students to determine an individualized operational definition of happiness.

Gover et al. (2022) related that taking the time to identify the activities, interactions, and materials that make students happy will foster trust and improve connections between the analyst and the student. Relaxed behavior will look different for each student, but active engagement typically conveys that they enjoy the activity, which can be thought of as reinforcing. Promoting engagement can be achieved by ensuring enough materials are available and varied often. Instructors also need to be supportive and ready to engage with the student, but not interfere unless the student requests. The concept of happy, relaxed, and engaged is crucial to the implementation of the performance-based assessment and skill-based treatment. The authors relate that implementors need to be able to identify when their learner is happy, relaxed, and engaged as well as how to make each learner feel happy, relaxed, and engaged when they are not.

In the current study implementors will use the open-ended interview to identify HRE for each of their learners. Prior to the beginning of each session and prior to the progression of each establishing operation the implementors will ensure that the student has been in HRE for a prescribed period of time. Throughout sessions staff will work to identify if anything needs to be

added or removed from the environment to keep their student happy, relaxed, and engaged. This includes attending to the students' reactions to the instructors' behavior as well. A timer will be used through the IISCA+ app to determine the duration of time the student was in HRE prior to the progression of a trial. The use of this app was trialed in Canniello et al. (2023).

Summary

The creation of the practical functional assessment eliminated the limitations identified in the traditional functional analysis such as the time needed to administer the assessment, the volume of resources, inflexible contingencies, and potential harm to the student or staff when applying the procedures to severe problem behavior (Coffey et al., 2020a). A review of seventeen published uses of the practical functional assessment and skill-based treatment showed that problem behavior was eliminated for one-half of the participants. The PFA decreased the amount of time required by 75% and increased experimental control from the traditional functional analysis by 44%. Following the PFA/SBT process caregiver concerns decreased by 76%. In a review of literature from 2014 to 2022 across ten peer-reviewed journals, problem behavior was reduced by 97% on average when comparing the last five sessions with the baseline level gathered during the assessment (Layman et al., 2023).

Layman et al. (2023) related that data across eight years showed that the reduction in problem behavior is probable using the IISCA and skill-based treatment. However, only one teacher (0.3% of the total number of implementors) and nine parents have implemented the IISCA. One student of the 235 participants was provided treatment in a non-specialized school classroom. This treatment began in a separate room and was generalized into the general education classroom. Fifteen percent of the analyses reviewed took place in a specialized school

setting. To provide this treatment in public schools, more work must be done to train teachers and to ensure the process will generalize outside the clinic and specialized school setting. The purpose of the current study is to assess the applicability of the procedures in public school settings and to determine if implementation leads to an increase in skill acquisition, participation across the school day, and ratings on the Behavioral Health Index.

Research Questions

- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, affect the rate of problem behavior for students with autism in a public school classroom?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, within a public school classroom affect a student's criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to, engaging in IT, flexible play, increasing tolerance)?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, within a public school classroom affect a student's percentage of participation in instruction?
- What changes will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, lead to on a student's rating on the Behavioral Health Index (BHI) indicating a change in critical skills, behavior management, and health repertoires?

Need for the Study

Public schools often face students engaging in severe challenging behavior, and it is one of the most referenced barriers to inclusion for students with special needs. If teachers in public schools access the practical functional assessment and skill-based treatment, fewer discipline referrals may need to be written. In that case, fewer students may be recommended for placement in specialized schools and residential programs, and more students may be able to access the general education classroom.

Many studies have been conducted in the last decade that successfully decreased severe problem behavior while increasing appropriate behavior using the practical functional assessment and skill-based treatment first described in Hanley (2014). However, each published study was conducted by a Board-Certified Behavior Analyst in a clinical or pull-out setting. For public schools to access this treatment and its positive outcomes, researchers need to conduct this process in public school settings with public school teachers. Implementing this process may lead to fewer referrals to specialized schools and greater access to the general education program. Specialized schools servicing students in the two counties of the focus education service agency are currently at capacity. Students requiring this level of intense service as of January 2024 are placed on waiting lists lasting over one year. During this wait school districts are unable to program successfully for these students.

Students engaging in severe problem behavior do not acquire skills quickly due to insufficient time spent participating in instruction. Each published study referenced in this literature review focuses on the cessation of problem behavior. However, none of the studies have assessed the rate of skill acquisition following the cessation of severe problem behavior. It is crucial that educators focus not only on stopping severe problem behavior but also on

increasing the rate of skill acquisition. This study may support special education teachers in public schools to support their students to stay in public schools and to gain better access to the general education classroom.

Chapter III: Methods

Introduction

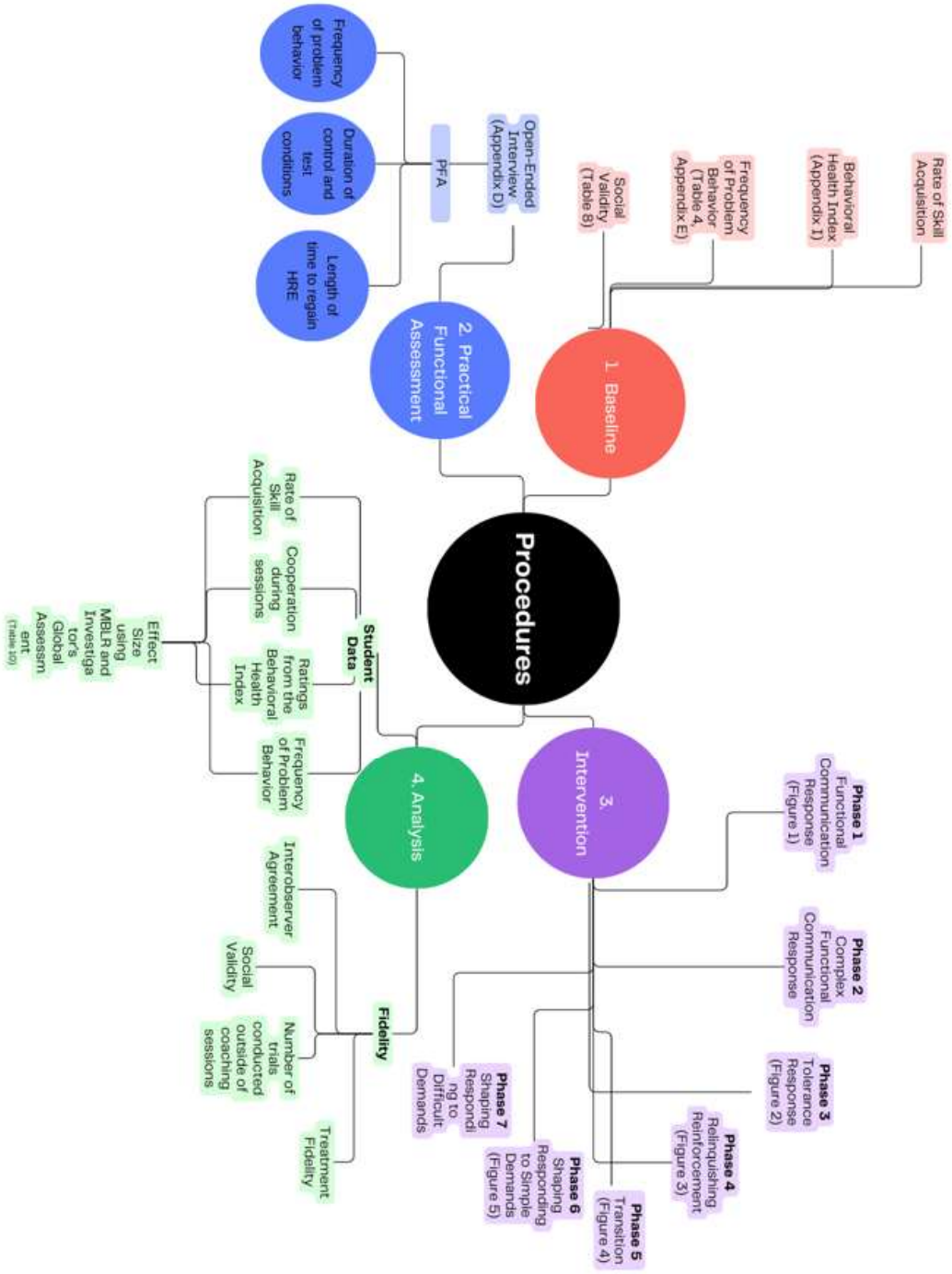
This study aims to extend Hanley et al.'s 2014 study with students with autism in public school classrooms using modifications outlined in Chapter II from research conducted through 2023. Figure 4 depicts the methods utilized from baseline to data analysis for each participant. Baseline was conducted across four areas prior to the open-ended interview and practical functional assessment. Following the practical functional assessment a seven-phase intervention was conducted with each student beginning with teaching a functional communication response and ending with responding to difficult demands. See Figures 6-10 for a visual of the components in each phase. Student data was analyzed using the nonparametric statistical analysis mean baseline reductions (MBLR) and the Investigator's Global Assessment Scale (see Table 8). Interobserver reliability and treatment fidelity were also assessed throughout the intervention, while social validity was assessed using questions with a seven-point Likert Scale prior to the study and after the completion of the study (see Table 4 and Table 7). Also included in the data analysis was the number of trials conducted per day outside of the thirty-minute coaching sessions. This chapter follows the progression of the study beginning with the selection of participants followed by a description of baseline procedures and implementation of the practical functional assessment and individualized interventions. This chapter culminates with a description of how the collected data was analyzed by the researcher to answer the following research questions.

- How will a replication of Hanley et al.'s 2014 study including modifications from the subsequent literature affect the frequency of problem behavior for students with autism in a public school setting?

- What changes will a replication of Hanley et al.'s 2014 study including modifications from the subsequent literature lead to on a student's rating on the Behavioral Health Index (BHI) indicating a change in critical skills, behavior management, and health repertoires?
- How will a replication of Hanley et al.'s 2014 study including modifications from the subsequent literature within a public school setting affect a student's criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to engaging in IT, flexible play, increasing tolerance)?
- How will a replication of Hanley et al.'s 2014 study including modifications from the subsequent literature within a public school setting affect a student's percentage of participation in instruction?

Figure 4

Methods flowchart



Participants

Participants for this study were selected via convenience sampling. See Figure 5 for a visual representation of the sampling process. The students in the study resided in school districts within the education service agency where the researcher provided consultation. Each student was identified as exhibiting severe problem behavior that created a barrier preventing access to instruction, interactions with typically developing peers, and the general education classroom. To be included in the study staff needed to implement skill-based treatment with the identified student during the 2023-2024 school year, collect data following the protocol developed by the researcher, and superintendents needed to agree to share student data with the researcher. Districts within the education service agency implemented practical functional assessments and skill-based treatment with ten students during the 2023-2024 school year. Of these ten students each team implemented the procedures with consultation from the researcher, however permission to use student data from the superintendents was only given for seven students across three districts. Each of the seven students was diagnosed with autism spectrum disorder. See Table 2 for specific participant characteristics.

Figure 5

Criteria for Inclusion in the Study

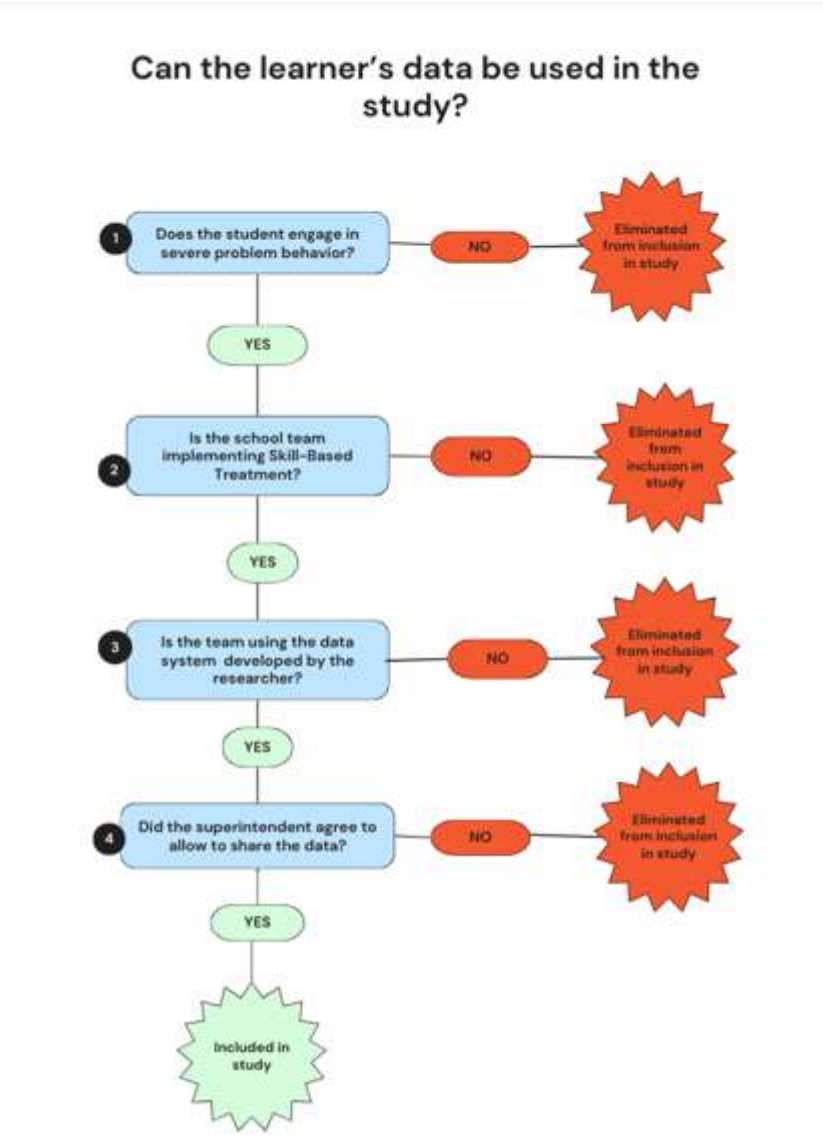


Table 2

Student Characteristics

Student	Age	Sex	Language Ability	Communication Mode	Problem Behavior
1	10	Male	2	Vocal	Agg, Dis, E, PD, SIB
2	7	Male	1	PS	Agg, E, PD, SIB
3	10	Male	1	SGD	Agg, PD, SIB
4	6	Male	4	Vocal	Agg, E, PD, SIB
5	5	Male	4	Vocal	Agg, E, PD
6	8	Female	3	Vocal	Agg, E, PD
7	9	Male	2	Vocal/SGD	Agg, E, PD, SIB

Note. Language Ability: 1 = nonvocal; 2 = single-word utterances; 3 – short sentences; 4 = full fluency
Communication Mode: SGD = speech generating device; PS = Picture Selection
Problem Behavior: Agg = aggression; Dis = disrobing; E = Elopement; PD = property destruction; SIB = self-injurious behavior

Setting

Data collected for this study was taken during the 2023-2024 school year in autistic support and general education classrooms in public schools. Typically practical functional assessments and skill-based treatment are conducted in a clincal setting or by pulling the learner out of the classroom to conduct sessions in a controlled environment without other students. Participating school districts were not able to use this type of setting due to lack of space and staffing. Teachers were not able to leave their classroom to provide 1:1 instruction in a separate area and paraeducators were not allowed to conduct sessions when not in the presence of a teacher or administrator. Schools also did not have the capacity to create a separate treatment room containing all of the reinforcers required for the students. Empty classrooms are a commodity and staff did not have the resources to set up and tear down a borrowed room each day.

Due to these limitations the practical functional assessment and skill-based treatment needed to be implemented in the special education or general education classroom. Conducting treatment in the classroom could allow for unplanned establishing operations (EOs) such as divided attention, behavior from other students, and sensory input such as loud speaker announcements. Teams attempted to control for unplanned EOs by creating defined areas in their classrooms, assigning staff to other students to limit divided attention, and conducting sessions when all staff were present. However, not all establishing operations can be planned for.

Baseline

Prior to assessment and treatment, classroom staff collected baseline data on problem behavior for each student across a minimum of three school days. Problem behaviors were operationally defined and sorted into dangerous or non-dangerous categories. Dangerous behaviors were labeled R1 and identified as behavior that could injure a person or damage property. Non-dangerous behaviors were labeled R2 and identified as behaviors that could not injure a person or damage property (see Table 3). Behavior data was collected via two mechanical counters. One mechanical counter totaled the frequency of dangerous behaviors per hour, and the second totaled the frequency of non-dangerous behaviors per hour. At the top of each hour, the number on each mechanical counter was noted on the data sheet (see Appendix C). These frequencies were then divided by sixty to determine the dangerous and non-dangerous behavior rate per minute.

Table 3

Type of Problem Behavior Per Student

Participant	R1 (Dangerous Behavior)	R2 (Non-dangerous Behavior)
1	Disrobing Kicking Hair pulling Grabbing and throwing glasses Hitting - open hand at any body part Grabbing arm, shirt and pulling Currently pretending to bite, but not pressure Climbing dangerously on furniture Eloping out of classroom (has eloped out of house; has not had the opportunity to make it out of the school building)	Ripping materials - cards, paper Pressing on chin Swiping materials off of table Attemping to leave area
2	Chin hitting Head banging Heel stomping Tail-bone hopping Biting Eloping	Property destruction Moving away from staff Crying Yelling
3	Pushing staff and students Hitting head with open hand Hitting chest with open hand Grabbing arms of staff and students	Crying Whining Vocal refusal Yelling Stomping/Jumping Grabbing items Slamming SGD on table

Table 3 (continued)

Participant	R1 (Dangerous Behavior)	R2 (Non-dangerous Behavior)
4	Run from staff in hallway Property disruption - push chairs over Throwing materials (hard materials thrown into play area towards other students) Refusing to enter building Open and closed fist hitting adults	Vocal protests Leaving instructional area but remaining in room Drop to floor, refuse to walk Loud yell in staff's face - escalation from vocal protest Ripping worksheets
5	Eloping out of room Aggressive contact with students (running into, pushing with open hands, grabbing)	Vocal refusals/protests Leaving the instructional area Yelling Dropping to the floor Throwing toys
6	Eloping out of the room Hitting with open hand Kicking Pinching	Dropping to the floor Hiding under furniture and in her cubby Yelling Vocal refusal Grabbing toys from other students Throwing toys Ripping cards
7	Eloping out of the room Hitting with open hand Kicking Climbing on furniture Biting Scratching	Eloping from instructional area Yelling Hiding under furniture Vocal refusals Grabbing toys from other students Throwing materials

The duration of student participation across the school day was collected across a minimum of three school days via five-minute interval recordings (see Appendix D). Staff shaded each five-minute interval in which the student was engaged in instruction throughout the entire interval. If the student was engaged for part of the interval, staff listed the approximate amount of time engaged during that interval. The total number of minutes spent participating in instruction throughout the school day were divided by the total number of instructional minutes

possible and multiplied by 100 to determine the percentage of time the student participated each day. This data was used to determine the percentage of time the student participated in instruction throughout the school day prior to treatment. Participating in classroom activities was defined as making on-topic comments, remaining in the instructional area, responding to teacher directives, and manipulating materials. Not participating in classroom activities was defined as being outside of the expected area, making off-topic comments, placing their head down on the desk, and using materials inappropriately.

The rate of skill acquisition per day prior to treatment was identified for students instructed in verbal behavior programming using cold probe data (see Appendix E). Each school day, prior to providing instruction, teachers probed each targeted skill and circled yes or no on the cold probe data sheet to indicate a correct or incorrect response. Mastery criteria were set at three correct responses across three consecutive school days in which the student was in attendance. As soon as a skill was mastered, a new skill was selected and targeted in place of the mastered skill. The number of targeted skills at one time remained the same before and after treatment. The rate of acquisition was determined by collecting three weeks of mastery data across verbal operants. The total number of skills mastered was divided by the total number of days data was collected to represent the rate of skill acquisition per day.

Open-Ended Interview

After collecting baseline behavioral data, the researcher conducted an open-ended interview with staff members who spent the most time with students. The interview aimed to further identify and operationally define the students' severe and precursor problem behaviors. The interview also identified the establishing operations that were most challenging for each student and items, activities, and interactions that were reinforcing for each student. The

open-ended functional assessment interview was first written by Dr. Gregory Hanley in 2002 and revised in 2009 and 2022. It contains twenty-one questions and was developed to support a behavior analyst in designing a practical functional assessment for a student (see Appendix B). Following the interviews, the researcher observed the student for fifteen to twenty minutes to gather any further pertinent information.

Teams also scored each student using the Behavioral Health Index (BHI) (see Appendix F). The BHI uses a rating scale from one to four to track critical skills such as leisure, functional communication, and delay tolerance. The scale also measures behavior management and health repertoires including the need for the use of restraint or seclusion, injuries to self or others, and sleeping. A score of one indicates a highly restricted daily life due to the high risk for severe problem behavior. A score of four indicates an unrestricted daily life with a low risk for severe problem behavior.

Social Validity

Before the beginning of assessment and treatment, caregivers and classroom staff were asked to answer the three questions based on a seven-point Likert scale (1 = *not at all*, 4 = *not sure*, 7 = *very much so)*. These questions pertained to the school staff's concern regarding the target student's behavior and their comfortability in working with the student (see Table 4). The same questions were asked following the intervention to determine social validity.

Table 4

Pre-Treatment Social Validity Questions

1. Rate how concerned you are about your student's ongoing problem behavior.
2. How comfortable are you taking away your student's preferred activities and asking him/her to do something else?
3. Rate the extent of your comfortability in handling your student's problem behavior.

Procedures

Performance-Based Practical Functional Assessment

After the open-ended interview, the researcher designed test and control conditions for each student based on the responses from staff during the interview and the brief observation. The identified control conditions for each student contained all possible reinforcers identified for each student via the interview. The test conditions contained conditions thought to evoke problem behavior as determined by the interview. Each student's control and test condition was individualized based on the interview responses from the classroom staff. Problem behavior for each student continued to be categorized as dangerous or non-dangerous and operationally defined as during baseline.

Two areas were identified in each classroom to signify the evocative test condition and the control condition. The area designated for the evocative test condition contained a desk or table, student chair, and work appropriate for that student. A carpet or tape designated the area for the control condition on the floor if furniture was not available to designate a visual

boundary. All identified reinforcers were located within this area. When possible the test and the control areas were no more than five feet apart to lessen the response effort for transitioning.

Following the creation of the control and test areas, a performance-based practical functional assessment was conducted for each student using a multielement design for contingency analysis. The teacher conducted the assessment in the defined areas of the classroom while the researcher viewed the assessment via Zoom from another location. The teacher wore Bluetooth earbuds to hear the researcher's directives. As the researcher was not physically present during the assessment, her presence did not affect the student's behavior. The researcher used the IISCA+ app on an iPad to take moment-by-moment data throughout the assessment. Students were identified on the app through a pseudonym for privacy. During the practical functional assessment, the frequency of dangerous and non-dangerous problem behavior was collected, as well as the amount of time each student spent in each condition. The practical functional assessment aims to ensure that the proper contingencies have been identified to turn on and turn off problem behavior safely.

The assessment began with the teacher sitting on the floor or in a chair in the designated control area. The teacher made herself highly available to any bids for attention but did not interact with the student except to encourage them unless the student requested the teacher to interact. The teacher allowed the student to explore and engage with the materials in the control area. Once the teacher identified the student as happy, relaxed, and engaged, the teacher gave the researcher a thumbs up. The researcher then began a timer to track the duration of time the student was happy, relaxed, and engaged (HRE). If the student became frustrated or was no longer HRE, the teacher gave the researcher a thumbs down. The researcher then stopped the timer and restarted the timer only after the student regained HRE and the teacher gave a

thumbs-up signal. After five consecutive minutes in which the student was HRE, the researcher directed the teacher to progress the establishing operation (EO).

The teacher stood up, clapped her hands, moved closer, and introduced the EO by saying, “Time to clean up and get to work.” If the student engaged in any form of problem behavior, the teacher said, “Never mind. You can have it your way,” sat on the floor, and gave the student access to synthesized reinforcement in the control condition. If the student did not engage in problem behavior, the teacher continued to progress the EO through the planned steps of skill-based treatment until the student engaged in problem behavior. As soon as the student engaged in any form of problem behavior, the teacher immediately removed all demands, sat down, and gave access to synthesized reinforcement in the control area. The teacher repeatedly alternated between test and control conditions with guidance from the researcher until the teacher successfully evoked problem behavior by progressing the EO and quickly stopped the problem behavior five times by giving access to synthesized reinforcement. The time allotted to the control condition following the evocative condition varied depending on the student's performance. If it took the student more than thirty seconds to achieve HRE following the test condition, the researcher elongated the time spent in the control condition as per the performance-based practical functional assessment. However, once the behavior was turned off promptly and the student immediately returned to HRE, the duration of time in the control condition was decreased to thirty to sixty seconds. Assessment data was collected regarding the amount of time spent in the control and the test conditions, as well as the amount of time required for the student to regain HRE following problem behavior. The frequency of problem behavior and the type of problem behavior (dangerous or non-dangerous) were also collected.

Intervention

Intervention for each student consisted of a changing criterion design. The teacher or other staff member ran at least one thirty-minute session daily. At the same time, the researcher observed via Zoom and gave immediate feedback and direction via Bluetooth earbuds. Staff were asked to continue running skill-based treatment as often as possible throughout the day when the researcher was unavailable. The number of trials that exceeded the thirty-minute session each day was documented. The intervention consisted of eight phases. The criteria for moving to the next phase was three independent consecutive responses of the current target behavior chain without the occurrence of problem behavior. Problem behavior was operationally defined for each student and classified as dangerous (R1) or nondangerous (R2).

The number of trials presented within each phase across mastered and target chains was predetermined for each phase. Following the initial phase, trials were mixed and varied between mastered and target skills, and the order of the types of trials was randomized prior to the beginning of each session. See Table 5 for the breakdown of the ratio of tasks.

Table 5

Ratio of Requirements per Phase

Phase 1/2 FCR	Phase 3 Tolerance Response	Phase 4 Relinquishing Reinforcement	Phase 5 Transition	Phase 6/7 Task Chaining
100% FCR	40% FCR 60% Tolerance	30% FCR 30% Tolerance 40% Giving up R+	30% FCR 10% Tolerance 20% Giving up R+ 40% Transition	20% FCR 10% Tolerance 10% Giving up R+ 20% Transition 40% Task Chain

Each session in each phase began with the student in the control condition. Within this condition, the student had free access to synthesized reinforcement. Items and activities in this

condition were altered according to student responses. Once the student was happy, relaxed, and engaged, the instructor began timing for at least five minutes. If the student became agitated during the control condition, the timer stopped and reset as soon as the student returned to HRE.

Test conditions were initiated following a range of thirty to ninety seconds in the control condition. The implementation of each test condition began with the instructor standing, clapping, and stating, “It is time to clean up and get to work.” The instructor used full prompting for the first trial in each phase and least to most prompting in all subsequent trials. Data was collected via the IISCA+ app. The app collected data for the duration of reinforcement and the duration of the progression of the establishing operation. The frequency of problem behavior was collected and divided into two categories – dangerous (R1) and nondangerous (R2). Also of note was the time it took the student to return to HRE following the presentation of the establishing operation. Each phase is described in detail below, and each student’s expectation is described in each phase in Table 6.

Table 6

Expectations for Each Phase per Student

Student	FCR	Tolerance	Relinquish Reinforcement	Transition	CAB 3 1-3 easy responses	CAB 4 Branches
1	"My Way" while patting chest	"Good" with thumbs up	Pressing pause on video, putting materials away in a different order, standing up when sitting on staff's lap or bouncing on therapy ball	Walk to table	Mastered skills across echoic, listener response, and tact repertoires	Tolerating error-correction across operants Using materials (i.e. blocks) in a different way Engaging in a new leisure activity with staff
2	Tapping icon on the front of his commun-ication binder	High-five with staff	Entering classroom, giving items to staff, standing up when bouncing on the therapy ball	Walking to his area and sitting down	Simple inset puzzles and put-ins	Engaging in independent leisure skills for longer periods of time Listener Responses in the natural environment (i.e. Go to desk) Increasing independence in toileting

Table 6 continued

Student	FCR	Tolerance	Relinquish Reinforcement	Transition	CAB 3 1-3 easy responses	CAB 4 Branches
3	Selecting "My Way" on SGD	Selecting "Okay" on SGD	Pausing the computer and closing the lid; Placing cars in a bin and securing the lid; standing up from the therapy ball; stepping off of the trampoline	Walking to the table of high expectations	Mastered skills across listener response and motor imitation operants	Tolerating staff playing with the car ramp; Sharing cars; Tolerating staff searching for and watching a less preferred video
4	"Can I have more time, please?"	"Okay"	Putting materials away, Giving materials to the teacher	Walking to the table of high expectations	Tacting mastered letter, color and number identification	Identifying letters, printing his name, rote counting to 15
5	"Can I have more time, please?"	"Okay"	Putting materials away, standing up from bean bag or therapy ball	Walking to his desk	Tacting mastered letters, colors, and picture cards	New academic skills: letter identification, printing his name, and rote counting to 10 Cutting on curved lines Printing his name

Table 6 continued

Student	FCR	Tolerance	Relinquish Reinforcement	Transition	CAB 3 1-3 easy responses	CAB 4 Branches
6	"My Way"	"Okay"	Putting materials back in their bins	Walking to her work table	Mastered listener response, intraverbal, tact and echoic skills	Engaging in a variety of work across all subject areas in the classroom
7	"My Way"	"Okay"	Putting materials back in their containers	Walking to his work area	Mastered echoic, listener response, and echoic skills	Engaging in intensive teaching Tolerating items missing Manding for missing items

Functional Communication Response (FCR).

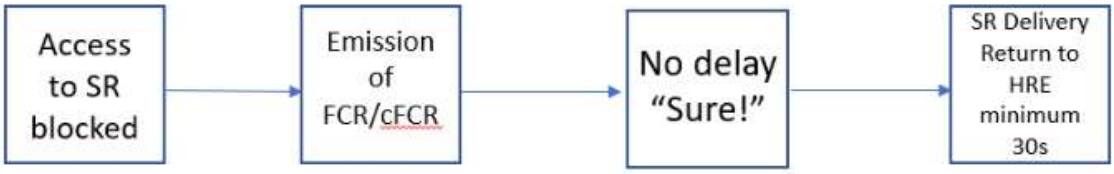
The goal of phase one was to teach the student to emit a simple functional communication response to attain immediate access to synthesized reinforcement (control condition) and the cessation of the establishing operation. The functional communication response included students vocalizing, "My way," pressing a button on an AAC device that states, "My way," tapping their chest as a sign for "My way," or pointing to the My Way icon on the front of a picture communication binder. Following at least five minutes in the control condition with the student actively engaging with the materials, the instructor stood, clapped, and stated, "Time to clean up and get to work." The instructor encouraged the student and progressed the establishing operation until the student engaged in low-level problem behavior. Immediately following low-level problem behavior, the instructor used a full model or vocal prompt to

support the student in producing the functional communication response (FCR). The instructor used an imitation prompt for students who communicated via sign language or AAC or a vocal prompt for vocal students. As soon as the student emitted the response, the instructor said, “Okay! You can have it your way!” while moving back to the control condition. It is important to note that in the test condition, the teacher stood up straight, and in the control condition the teacher was at or below the student’s eye level and responsive to all bids for attention. The researcher used the IISCA+ app to denote the duration of time in the EO and the amount of time it took for the student to become happy, relaxed, and engaged following the ending of the EO.

The instructor continued alternating reinforcement and progressing the EO throughout the rest of the session. The control condition lasted thirty to ninety seconds, and the test session lasted until the student engaged in the simple functional communication response. The instructor continued to prompt the functional communication response while fading the prompts as soon as possible. Once the student responded independently to the progression of the EO with the functional communication response in the absence of problem behavior on three consecutive trials, the student’s programming was changed to phase two. Figure 6 is a visual representation of the first phase.

Figure 6

Functional Communication Response



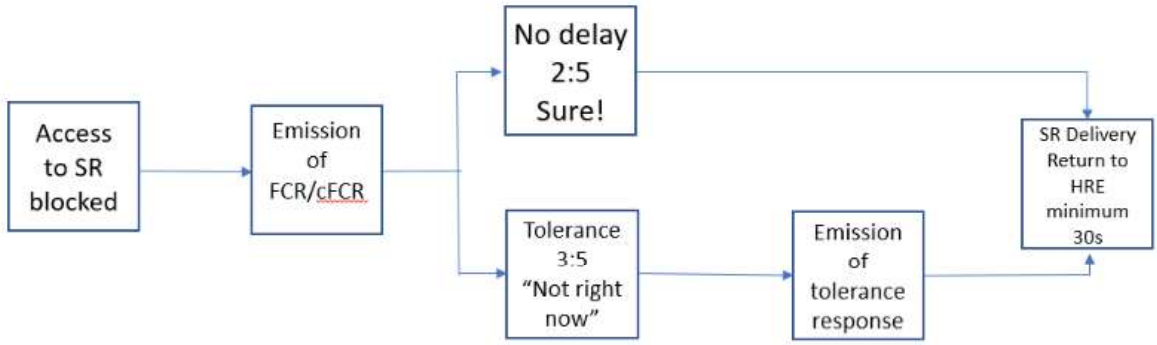
Tolerance Response (TR).

The goal for the next phase was to add a tolerance response to the communication chain. Tolerance responses included “Okay,” “Got it,” and giving a thumbs up. To teach the tolerance response, the student and instructor began in reinforcement for at least five minutes. In the reinforcement condition, the student had full access to all identified reinforcers, and the instructor sat at or below student level while attending to all requests and bids for attention. Following five minutes in reinforcement with the student happy, relaxed, and engaged, the instructor stood up, clapped, and stated, "Time to clean up and get to work." The student engaged in the functional communication response as was taught in phases one and two. On two of every five trials, the instructor continued reinforcing the functional communication response by stating, “Sure! You can have it your way!” On three of every five trials, the instructor shaped the toleration response by saying, “Not right now,” and prompted the student’s toleration response. The instructor faded prompts for the toleration response until the student responded

independently. Mastery criteria continued to be three independent consecutive responses of the functional communication chain, including the tolerance response without the occurrence of problem behavior.

Figure 7

Tolerance Response



Relinquishing Reinforcement.

The goal of phase three was for the student to give up reinforcement. Giving up reinforcement consisted of the student giving the item they were holding to the instructor, placing the item in a bin, or standing up if the student was on a swing or chair. Like all other phases, this phase began in the reinforcement condition for at least five minutes with the student happy, relaxed, and engaged. In the reinforcement condition the student had full access to all identified reinforcers, the instructor sat at or below student level, and the instructor attended to all requests and bids for attention.

After at least five minutes in the reinforcement condition, the instructor stood up, clapped, and stated, "Time to clean up and get to work." The student responded using the simple or complex functional communication response to request my way. The instructor said, "Not

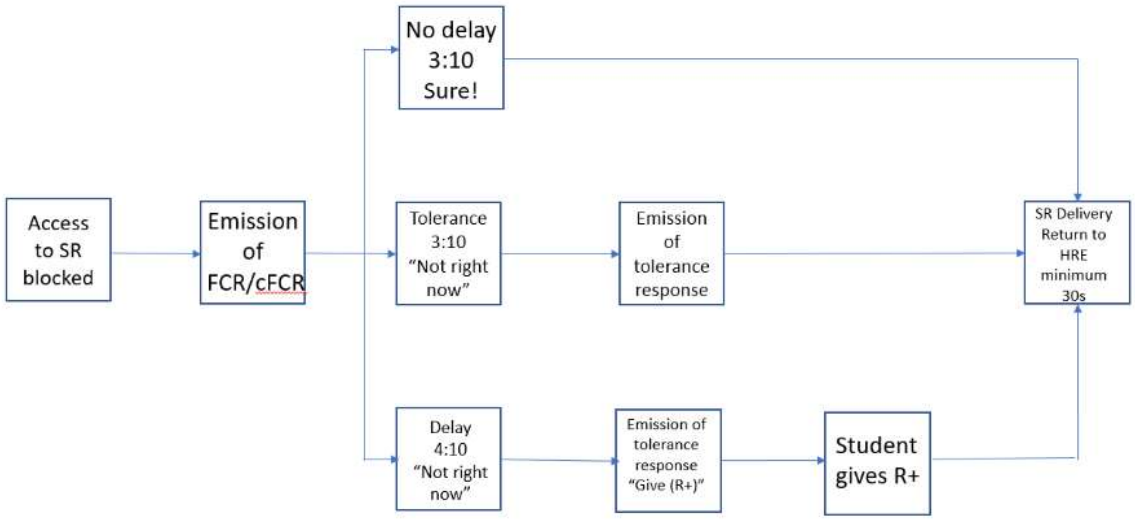
right now," and the student responded with the tolerance response, "Okay," or gave a thumbs up/high five. If the student held an item, the instructor held out his hand or a bin and said, "Give." If the student was on a swing or a preferred chair and not holding an object, the teacher said, “Stand up,” to relinquish the swing/chair. If the student relinquished the reinforcement, the teacher immediately reinforced the student by returning the item and saying, "You can have it your way!" while moving back into the reinforcement condition.

During this phase, thirty percent of the trials terminated following the functional communication response and thirty percent terminated following the toleration response. Forty percent of the trials terminated after the student relinquished reinforcement. The type of trial was mixed and varied so that the student did not know which response would be reinforced during each trial. The instructor also had the autonomy to change the order of the trials in response to student behavior. For instance, if the student engaged in problem behavior, the instructor may have reinforced more functional communication responses and not progressed the EO to relinquishing reinforcement.

If the student engaged in any level of problem behavior during any trial, the teacher said, "It looks like you want it your way," removed demands, and moved back into the reinforcement condition. Once the student was happy, relaxed, and engaged, the instructor started the timer and continued to present trials varying the intervals between thirty and ninety seconds. The criteria for mastery of this phase was three independent consecutive trials of the student using the functional communication response, the toleration response, and relinquishing reinforcement without problem behavior.

Figure 8

Relinquishing Reinforcement



Transition.

The goal of the next phase was to physically transition the student from the reinforcement condition to the work area. The work area consisted of a desk or table with academic, functional, or vocational tasks chosen for each student. Once the student transitioned to the work area, he was required to sit in a chair with his legs under the desk and hands resting on his lap or the table. This was called the “ready-to-learn” position.

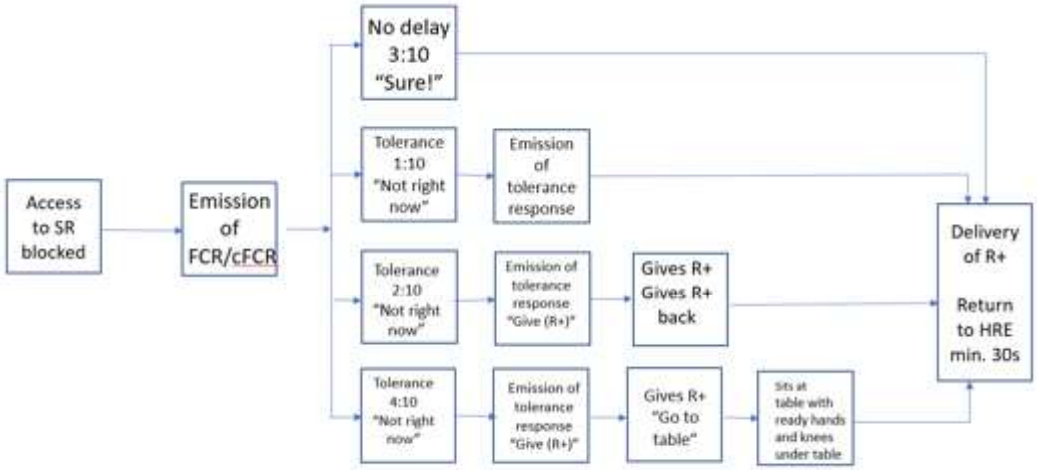
The instructor began each session in the reinforcement condition for at least five minutes with the student happy, relaxed, and engaged. In the reinforcement condition, the student had full access to all identified reinforcers, the instructor sat at or below student level, and the instructor attended to all requests and bids for attention. Following five minutes in the control condition, the instructor stood, clapped, and stated, "Time to clean up and get to work." The student used the functional communication response "My way." The instructor stated, "Not right now," and

the student emitted a tolerance response by saying, "Okay" or giving a thumbs up. The instructor then held out his hand and said, "Give" if the student was using an item or directed the student to stand up if he was on a swing or chair. After the student relinquished reinforcement, he was directed to transition to the work area and sit on the chair with his knees under the desk and his hands folded on his lap or the table. The instructor began by prompting the response, but faded the prompts as soon as possible to encourage independence. As soon as the student sat properly, the instructor said, "You can have it your way!" and returned to the reinforcement condition.

If the student engaged in any level of problem behavior during the steps, the instructor said, "It looks like you want it your way," removed demands, and moved back into the reinforcement condition. The student was required to transition on forty percent of the trials. Trials ceased at the functional communication response on thirty percent of the trials, the tolerance response on 10%, and the relinquishing of reinforcement on twenty percent. The criteria for mastery of this phase was three independent consecutive responses of transitioning without the occurrence of problem behavior during a single session.

Figure 9

Transition to Work Area



Shaping Responding to Simple Demands.

The goal of the next phase was to teach students to respond to a variable number of simple demands. The demands were different for each student depending on their academic level. Some students' demands included motor imitation, echoic, and listener response skills. For other students, the demands were academic skills, including one-digit math facts, letter or number identification, and reading sight words. This phase required a student to follow the sequence in the previous phase, including engaging in five simple demands without problem behavior.

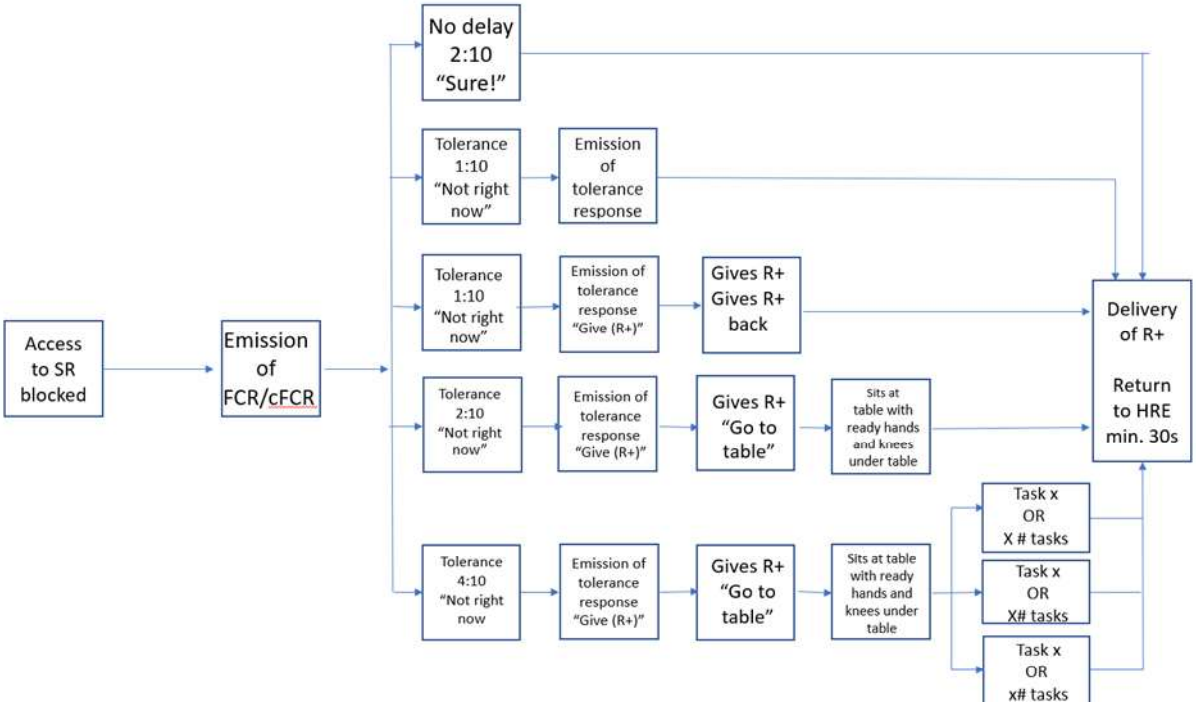
Sessions began in the reinforcement condition for at least five minutes with the student happy, relaxed, and engaged. In the reinforcement condition, the student had full access to all identified reinforcers, and the instructor was sitting at or below student level while attending to all requests and bids for attention. The instructor stood, clapped, and stated, "Time to clean up and get to work," following at least five minutes in the reinforcement condition. The student

responded with his functional communication response, "My way." The instructor responded by stating, "Not right now," and the student said, "Okay," while giving a thumbs up. The instructor held out her hand and said, "Give" if the student was using an item or directed the student to stand up if he was on the swing. The student was then required to physically transition to the work area and sit in a chair with his knees under the desk and his hands folded. Once the student was seated appropriately, staff engaged the student in easy/known demands while continuing to stand. These demands consisted of mastered skills that required a low response effort. The instructor began this phase by requiring one response and slowly shaped the student's participation into three responses. Once the student engaged in the required responses, the teacher said, "You can have it your way!" and returned to the reinforcement condition.

If the student engaged in any level of problem behavior during the trial, the instructor said, "It looks like you want it your way," removed demands, and moved back into the reinforcement condition. The student was required to perform demands on forty percent of the session's trials. Twenty percent of the trials required the student to transition, ten percent ended following relinquishing reinforcement, ten percent ended after the tolerance response, and twenty percent ended following the functional communication response. Mastery criteria for this phase was three consecutive independent completions of the entire sequence ending with three responses to directives without the occurrence of problem behavior.

Figure 10

Chaining Task Requirements



Shaping Responding to Difficult Demands.

The following phase aimed to introduce the student to teaching trials and challenging directives. The instructor began each session in the reinforcement condition for at least five minutes with the student happy, relaxed, and engaged. In the reinforcement condition, the student had full access to all identified reinforcers, the instructor was sitting at or below student level, and the instructor attended to all requests and bids for attention. Following five minutes in the reinforcement condition, the instructor stood, clapped, and stated, "Time to clean up and get to work." The student responded with the taught functional communication response, "My way." The instructor stated, "Not right now," and the student emitted the tolerance response, "Okay," or

gave a thumbs up. The instructor then held out his hand and said, "Give" if the student was using an item or directed the student to stand up if he was on a swing or chair. After the student relinquished reinforcement, he was directed to transition to the work area and sit on the chair with his knees under the desk and his hands folded on his lap or the table. The instructor then gave one directive that consisted of a teaching trial or a challenging demand. The instructor began with one challenging demand and slowly increased the number of responses required to three responses. Once the student responded to all required directives, the instructor said, "You can have it your way!" and returned to the control condition.

At this point, instructors began tracking skills acquired through teaching trials. Instructors identified language or academic skills to teach for this phase and collected data on a cumulative graph to calculate the rate of skills acquired. Mastery of skills was defined as three consecutive correct responses on the first trial across three days. Skills were listed on a cold probe sheet (see Appendix E). Data was recorded on the first opportunity to respond each day. When a skill was identified as mastered, another skill was added to the cold probe sheet, and the instructor began running teaching trials. Cumulative graphs were kept for a visual analysis of the rate of skill acquisition.

If the student engaged in any level of problem behavior during any of the steps, the instructor said, "It looks like you want it your way," removed demands, and moved back into the reinforcement condition. The student was required to respond to challenging directives in forty percent of the trials. Twenty percent of the trials required the student to transition, ten percent ended following relinquishing reinforcement, ten percent ended after the tolerance response, and twenty percent ended following the functional communication response. The criteria for mastery

of this phase was three independent consecutive responses of challenging responses without the occurrence of problem behavior during a single session.

Data Collection

Behavior and Skill Acquisition

Six dependent variables were measured during the study. The dependent variables included problem behavior (broken into precursor/non-dangerous behavior and severe problem behavior), the criteria for each phase in the intervention (simple functional communication responses, functional communication responses, tolerance responses, transition to the work area, cooperation with simple demands, cooperation with difficult demands and teaching trials), skill acquisition, interobserver agreement, social validity, and fidelity with treatment.

Problem behavior was separated into two categories – precursor/non-dangerous behavior and severe problem behavior. Behaviors were identified and defined for each student based on responses from the open-ended interview with staff. Precursor/non-dangerous behaviors included lower-level behaviors that typically preceded severe problem behavior and would not result in staff or student injury. Severe problem behavior was also explicitly defined for each student and included any behavior that may cause injury to staff or students. Both types of behaviors were measured by frequency using two mechanical counters. Staff used one colored counter for precursor behavior and one colored counter for severe problem behavior. The frequency count was written on a data sheet at the beginning of every hour, and the rate was calculated by dividing the total number of behaviors by sixty minutes.

Mastery criteria for each phase of the intervention were also counted hourly during the sessions with the researcher. This data was collected by circling a + each time the student

independently engaged in the desired behavior chain without prompting. A – was circled each time the student required prompting to emit the appropriate response. An x was circled if the instructor needed to stop the trial due to problem behavior. The percentage of cooperation was determined beginning in phase six when the student was introduced to demand requirements from the teacher. During any trial with a demand requirement, the researcher noted a + if the student cooperated within three seconds or a – if the student did not cooperate within three seconds. The number of +'s was added together and divided by the total number of opportunities to cooperate. This number was then multiplied by 100 to create a percentage of cooperation for each session.

Staff were only required to implement skill-based treatment during the half hour per day supervised by the researcher. However, many classrooms requested to continue to implement the intervention throughout the rest of the school day. To offset the increased number of practice trials, classrooms were directed to tally the number of trials run and the duration of sessions implemented when the researcher was not present (see Appendix G). This data was added to the number of trials and duration of sessions implemented with the researcher to determine the total number of trials to mastery of each phase and the total duration of treatment required for mastery of the phases.

Once the student reached phase seven, target skills were identified and taught during skill-based treatment. Data was collected on the first probe for each skill each day. The instructor circled *yes* if the student responded independently and correctly and circled *no* if the student responded incorrectly. The skill was considered mastered when the student responded correctly three days in a row. Skill acquisition data continued for three weeks to attain a rate of acquisition

following treatment. Finally, the number of sessions and trials to mastery within each phase was calculated.

Interobserver Agreement

Interobserver agreement was conducted for at least 20% of each student's recorded sessions throughout treatment. Sessions were recorded throughout treatment based on the classroom schedules and the researcher's schedule. Seventeen videos were record for Learner 1, twenty-one videos for Learner 2, twelve videos for Learner 3, seventeen videos for Learner 4, and one video for Learner 6. Parents/guardians of learners 5 and 7 did not permit video-recording of their child's session, so no interobserver agreement data was collected for these learners. Data was collected using the data sheet in Appendix J. Data collected was separated by the time spent in synthesized reinforcement and the time spent in the establishing operation. During synthesized reinforcement, the duration was noted and the frequency of behaviors separated into dangerous (R1) and non-dangerous (R2) problem behavior. During trials of the establishing operation, the target response and the duration of the trial were noted as well as the frequency of behaviors (separated into dangerous (R1) and non-dangerous (R2) problem behaviors) cooperation with teacher demands, and if the learner's response was independent or prompted. Duration was considered in agreement when the responses were within seven seconds due to buffering and response times. Interobserver agreement was calculated by dividing the number of agreements within each interval by the total number of responses and multiplying by 100.

Social Validity

Questions based on a seven-point Likert scale (1 = *not at all*, 4 = *not sure*, 7 = *very much so*) were asked following the intervention to determine social validity by comparing the

responses to the questions asked prior to intervention. Table 7 depicts the questions asked following intervention, while Table 4 depicts the questions asked prior to implementation.

Table 7

Post Treatment Questions

1. Rate the extent to which you are satisfied with the amount of improvement seen in your student's problem behavior.
2. Rate the extent to which you have found the assessment and treatment provided by the researcher helpful to your classroom situation.
3. Rate the extent to which you feel confident applying the same strategies you have used in the practice sessions when addressing your student's problem behavior.
4. Rate the extent to which you found the treatment feasible for use in your classroom during regular activities.
5. Rate the extent to which you found the training process helpful.
6. Rate the likelihood that you would agree to participate in this process again with another student with similar needs.

Treatment Fidelity

Fidelity with the treatment protocol was assessed at least once during each phase for each student. The percentage of steps completed with fidelity was calculated by dividing the total number of steps completed correctly by the total number of steps. This calculation was then multiplied by one hundred to create a percent accuracy for each phase (see Appendix H).

Post-Treatment Data

Data Analysis

The rate of problem behavior per hour will be calculated three days prior to implementation of skill-based treatment as well as three days following the end of intervention or

the last three days of skill-based treatment. The effect size was calculated using the nonparametric statistical analysis mean baseline reductions, the same procedure used by Fiani et al. (2022) (MBLR; Kahng et al., 2002). The mean rates of challenging behavior in baseline and the outcome were utilized. MBLR was calculated by the following equation:

$$(1 - (\text{M of Final } 3_{\text{Treatment}} / \text{M of Final } 3_{\text{Baseline}})) \times 100$$

Final 3_{Baseline} refers to the mean of the final three data points from baseline, and Final $3_{\text{Treatment}}$ refers to the mean of the final three data points in the final phase. If the outcome is negative, it indicates that the treatment worsened the severe problem behavior. If the outcome is 100%, it indicates that severe problem behavior was eliminated.

The investigator's global assessment (IGA; Rao et al., 2004) was modified by Fiani et al. (2022) to act as an outcome assessment tool for challenging behavior. This assessment has been used for over 35 years and has "shown high clinical construct validity and test/retest reliability" (Fiani et al., 2002, p. 10). It categorized outcomes ranging from *worse* (negative MBLR values) to *complete improvement* (100% MBLR value). The list of categories and their respective definitions are located in Table 8.

Table 8

Investigator's Global Assessment

Scale	Designation	Definition
0	Complete improvement	100% reduction in challenging behavior from baseline performance
1	Excellent Improvement	90% reduction in challenging behavior from baseline performance
2	Marked Improvement	75% reduction in challenging behavior from baseline performance
3	Moderate Improvement	50% reduction in challenging behavior from baseline performance
4	Minimal Improvement	25% reduction in challenging behavior from baseline performance
5	No change	Similar challenging behavior to baseline performance
6	Worse	Any increase in challenging behavior from baseline performance

Note: Modified by Fiani et al., 2022 for Behavioral Intervention

Data will be presented using a changing criterion design throughout the phases of skill-based treatment. The y-axis will denote the phases of the treatment and the x-axis will denote the days in which treatment was conducted. This graph will denote the number of days required to reach the mastery criteria for each phase. For a school day to be counted, school-based treatment needs to be implemented for at least one twenty-minute session. Students who complete skill-based treatment will re-enter programming in place prior to the implementation of the intervention. For these students the rate of skill acquisition following intervention will be compared to the rate of skill acquisition prior to intervention. This data will

only be collected if programming and teaching methods following intervention align with programming and teaching methods used at the beginning of the current school year. Rate of acquisition will be measured for each operant or type of skill by dividing the number of skills mastered by the number of days the skills were listed as instructional targets. Mastery criteria for skills is three consecutive days correct on the first probe of the day.

The percent of participation across the school day will be collected for each learner for three days prior to intervention and three days following intervention. These percentages will be compared and the percent increase or decrease for each student will be calculated using the following formula.

$$(Mean_{Treatment} - Mean_{Basline}) / Mean_{Baseline} \times 100$$

The Behavioral Health Index Rating Scale will be completed by each learner's teacher prior to implementation and following implementation. The change in ratings will be compared and the percent increase will be calculated.

Site Permission

Students were chosen from a pool of classrooms that implemented practical functional assessments and skill-based treatment during the 2023-2024 school year. Superintendents from all districts that implemented the procedures were asked if the researcher could include their students' redacted data in the study. Superintendents from three districts permitted the researcher to utilize the redacted data. None of the districts have an on-site IRB.

Presentation of Results

Results will be shared with district stakeholders in a formal presentation following the completion of the study. Findings from this study will be submitted in poster presentations at The Second Biennial Contemporary and Compassionate Approaches to Supporting People with IDD

Conference presented by Upstate Caring Partners, the National Autism Conference presented by PaTTAN, and the 19th Annual Autism Conference presented by the Association for Behavior Analysis International (ABAI). The entire study will be presented to the dissertation committee.

Limitations

Limitations of this study include the small sample size, and that all participants were from the same two Pennsylvanian counties. Therefore, the participants do not fully represent the norm for all students diagnosed with autism spectrum disorder who engage in severe problem behavior. Despite this limitation a need still exists for this study as it provides the basis for larger studies. Another limitation includes the inability of staff to control the classroom environment. Therefore, each classroom possesses its own unique barriers to implementation of the intervention depending on the unplanned establishing operations that occur. Despite these limitations this study will still benefit practitioners as it serves as a guide for implementation of the intervention in a public school classroom.

CHAPTER IV

Chapter four reviews the demographics of the participants and their respective settings. It then presents social validity measures, treatment fidelity, and inter-observer agreement, followed by summative results for each research question. Notable findings will be identified following the summative results and further explored in Chapter Five.

Research Questions

- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, affect the rate of problem behavior for students with autism in a public school classroom?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to engaging in intensive teaching, flexible play, increasing tolerance)?
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's percentage of participation in instruction?
- What changes will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, lead to on a student's rating on the Behavioral Health Index (BHI), indicating a change in critical skills, behavior management, and health repertoires?

Participant Demographics

Seven students were included in the study. Requirements for participation included permission from the district superintendent, staff agreement to collect baseline, intervention, and post-treatment data according to researcher specifications, and the target students' engagement in severe problem behavior. (See Table 3 for specific problem behavior per student.) Assessment and intervention for six of the seven students took place in full-time autistic support classrooms. Assessment and intervention for student 4 took place in a general education kindergarten classroom. Students 1, 6, and 7 attended the same autistic support classroom. The staff-to-student ratio for students 1, 2, 6. and 7 was 4:8. The staff-to-student ratio for learner 3 was 3:8. Student 5 received intervention in an autistic support classroom without other students present as much as possible. Special education teachers and paraeducators implemented interventions for all students. A kindergarten general education teacher was also an implementor for student 4.

Test conditions for all students included escape from demands. Students escaped demands to access stereotypy, adult mand compliance, preferred environments, peers, and undivided attention. The number of days with session data ranged from 29 to 95, with a median of 38 and a mean of 45. Time spent in sessions ranged from twenty minutes to two hours per day. Intervention for students 1 and 5 was discontinued due to placement changes that were planned before the intervention began. Intervention for student 3 was discontinued when the teaching staff changed in the classroom. The terminal schedule of responses for students ranged from 10 responses during gameplay to eight intensive teaching run-throughs to the completion of a twenty-minute kindergarten center. (See Table 9.)

Table 9

Intervention Characteristics per Student

Learner	Age	Language Ability	Comm'n Mode	Setting	Staff: Student Ratio	Test Condition	Implementers	Days with Session Data	Terminal Schedule
1	10	2	Vocal	AS	4:8	1, 4, 5	SET 3 Para	29	10 Game 10 IT
2	7	1	PS	AS	4:8	1, 2, 5, 6	SET	95	5 IND 5 IT
3	10	1	SGD	AS	3:8	1, 4, 5	SET 2 Para	34	30 sec. Flex
4	6	4	Vocal	K	2:18	1, 3, 5, 7	SET Gen Ed Para	43	20 min. Center; Challenge
5	5	4	Vocal	AS	3:8	1, 5, 8	SET	40	10 IND
6	8	3	Vocal	AS	4:8	1, 5, 8	SET 2 Para	38	8 IT Print
7	9	2	Vocal/ SGD	AS	4:8	1, 4, 5	SET Para	38	3 IT Mand

Note: Language Ability: 1 = nonvocal; 2 = single-word utterances; 3 = short sentences; 4 = full fluency
Communication Mode: SGD = speech generating device; PS = picture selection
Setting: AS = full-time autistic support class; K = kindergarten class

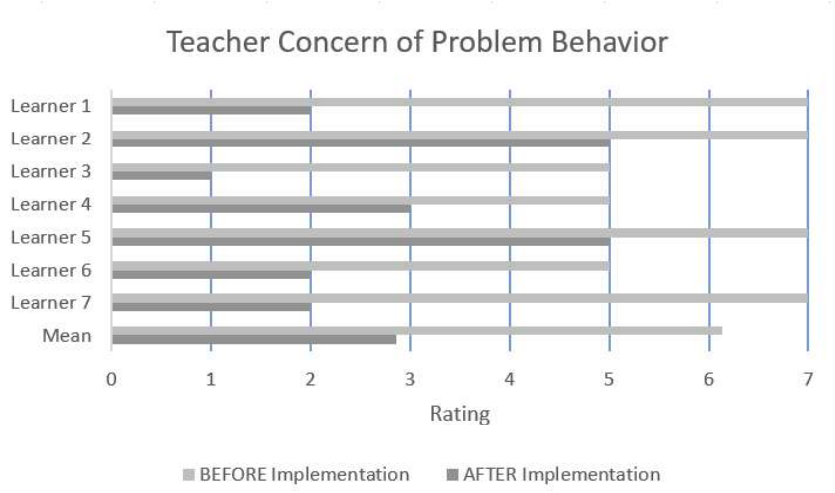
Test Condition: 1 = escape demands; 2 = escape classroom environment; 3 = escape presence of teacher; 4 = access stereotypy; 5 = access mand compliance; 6 = access to hallway; 7 = access peers; 8 = access undivided attention
Implementers: SET = Special Education Teacher; Para = Paraeducator; Gen Ed = General Education Teacher
Terminal Schedule: IT = intensive teaching run-through; Game = turns of game play; IND = independent work; Flex = flexible play; Center = kindergarten center; Print = printing name; Mand = manding for missing items; Challenge = challenged by teacher
One Intensive Teaching Run-Through encompasses errorless-teaching for one target skill using prompt-transfer-distract-check. Distract trials ranged from one to three responses

Social Validity Measures

The first two social validity measures asked the teachers to rate their concern about each learner's problem behavior before and after implementation of skill-based treatment on a seven-point Likert scale with 1 = not at all, 4 = not sure, and 7 = very much so. Ratings of concern decreased for teachers across all learners. The mean rating of concern before implementation was 6.14, which decreased to a mean of 2.86 following the implementation of skill-based treatment. Before implementation, the teachers' ratings depicted the highest concern for learners 1, 2, 5, and 7. Following implementation, Learner 3's teacher gave him the lowest rating, showing little concern, while the teachers of Learners 2 and 5 rated their concern a five on the Likert scale. The most significant decrease of concern occurred for Learners 1 and 7, who both decreased five points on the Likert scale. (See Figure 11).

Figure 11

Ratings of Teacher Concern of Problem Behavior



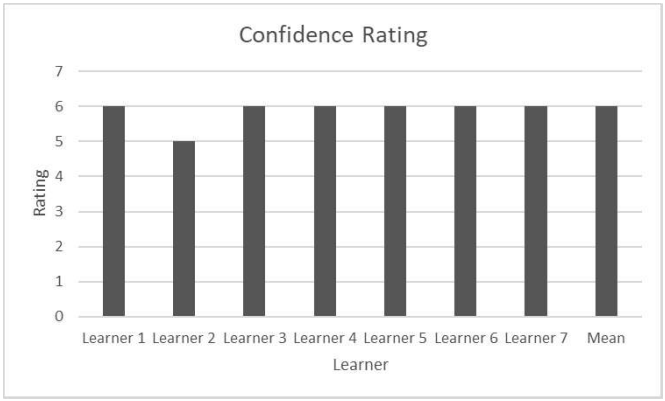
Note: 1 = not at all
4 = not sure
7 = very much so

The remaining set of social validity questions were related to the use of skill-based treatment in the classroom. Teachers were asked to rate their responses on a seven-point Likert

scale on which 1 = not at all, 4 = not sure, and 7 = very much so. See Figures 11 to 14 for the results for each learner and a mean of the responses. See Table 7 for the complete post-intervention social validity questions.

Figure 12

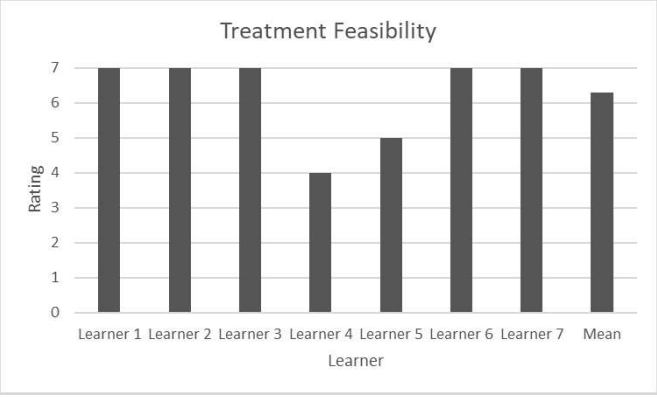
Confidence Rating



The first question asked teachers to rate their confidence in continuing to apply the strategies in skill-based treatment to address problem behavior. All teachers rated themselves a six except for the teacher of Learner 2, who rated herself a five. These responses show the teachers' high confidence level in using skill-based treatment.

Figure 13

Treatment Feasibility



The second question asks teachers to rate the feasibility of the intervention in their classroom. Teachers of Learners 1, 2, 3, 6, and 7 rated the feasibility of the intervention at a seven, the highest rating. The teacher of Learners 4 and 5 rated the feasibility a four for Learner four and a five for Learner 5. Learner 4 received skill-based treatment in the general education kindergarten classroom. Learner 5 required all other students

to leave the special education classroom for skill-based treatment to be effective. This caused scheduling issues and increased the aberrant behaviors of other students.

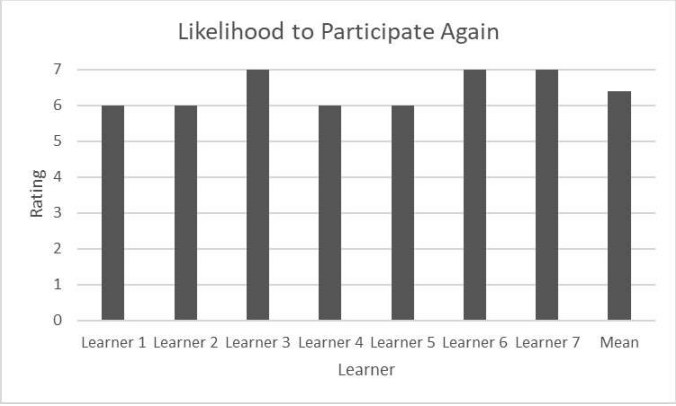
Figure 14

Training Helpfulness

The third question asked the teachers to rate how helpful they had found the training process. Teachers for Learners 1, 2, 3, 6, and 7 scored the highest in helpfulness. The teacher for students 4 and 5 rated the training process a four and a five, respectively. It is important to note that the teacher for Learners 4 and 5 was completing an internship at a clinic and implementing skill-based treatment with clients there.

Figure 15

Likelihood to Participation Again



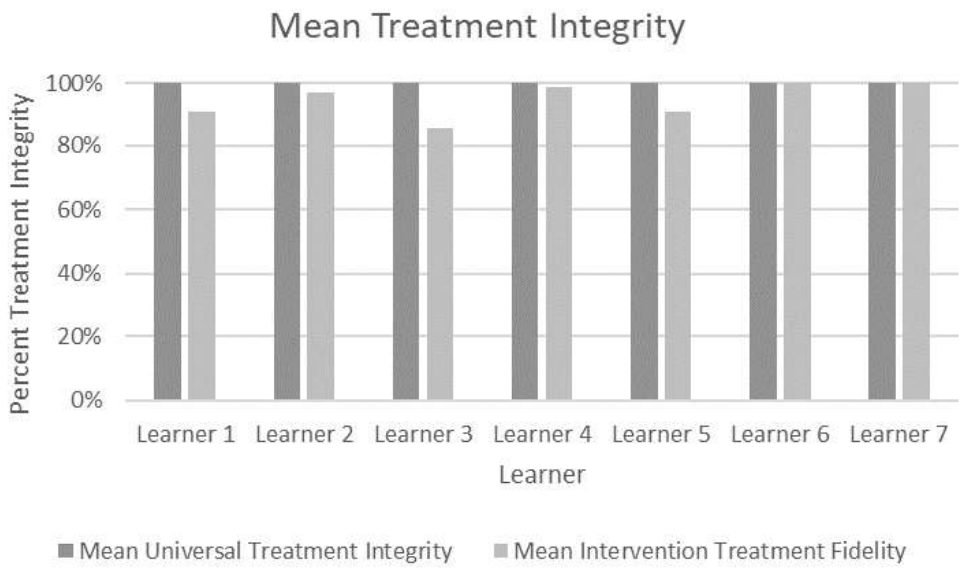
The final question asks the teachers to rate the likelihood that they would agree to participate again with another student with similar needs. The teachers of Learners 3, 6, and 7 said they would participate in the process again. The teachers of Learners 1, 2, 4, and 5 each rated six.

Treatment Fidelity

The researcher assessed treatment fidelity at least once for each learner during each phase of skill-based treatment. Staff engaged in 100% treatment fidelity across all students when following the universal protocol. Fidelity during skill-based treatment ranged from 79% to 100% across all students and phases. Mean fidelity across each student for intervention ranged from 86% to 100%, with an overall mean of 95%. (See Figure 16.) See Appendix M for raw data.

Figure 16.

Mean treatment integrity scores



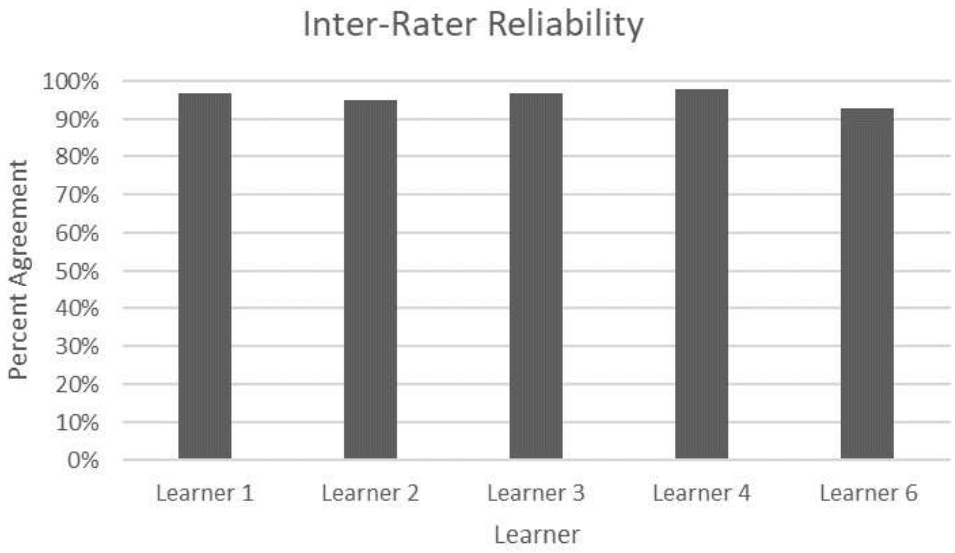
Inter-rater Reliability

Inter-rater reliability was taken for at least 20% of the recorded sessions across the intervention. The criteria for video inclusion included that the session be at least twenty minutes long and that permission must be obtained from the learner's parent/guardian for video recording. The parents/guardians of Learner 5 and Learner 7 did not permit their child to be recorded. Therefore, there are no inter-rater reliability scores for those learners. See Appendix N

for raw data. Mean inter-rater reliability ranged between 93% and 98%, with a mean of 96% showing high reliability. (See Figure 17.)

Figure 17

Inter-rater Reliability per Learner



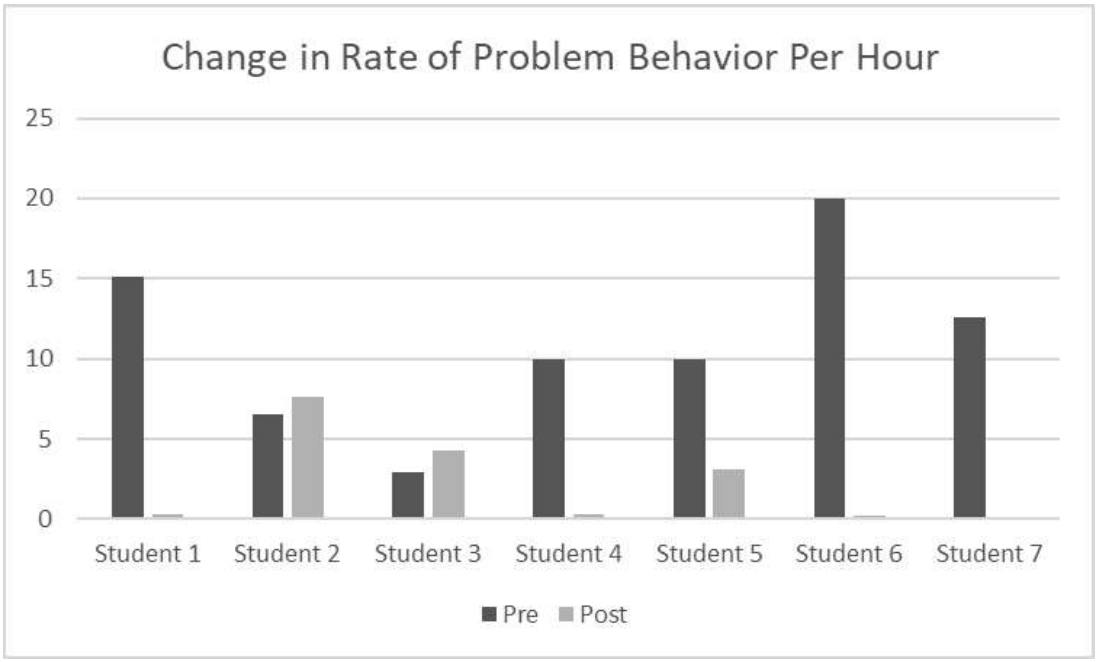
Research Question 1

- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, affect the rate of problem behavior for students with autism in a public school classroom?

The rate of problem behavior per hour decreased for Learners 1, 4, 5, 6, and 7. The rate of problem behavior per hour increased for Learners 2 and 3. (See Figure 18.) The percentage change was calculated. The percentage decrease in problem behavior ranged from 69% to 100%, with a mean of 92.6% decrease for Learners 1, 4, 5, 6, and 7. The percent increase for Learners 2 and 3 was 16.9% and 32.5%, respectively, with a mean of 24.7% increase in problem behavior.

Figure 18

Change in Rate of Problem Behavior per Hour

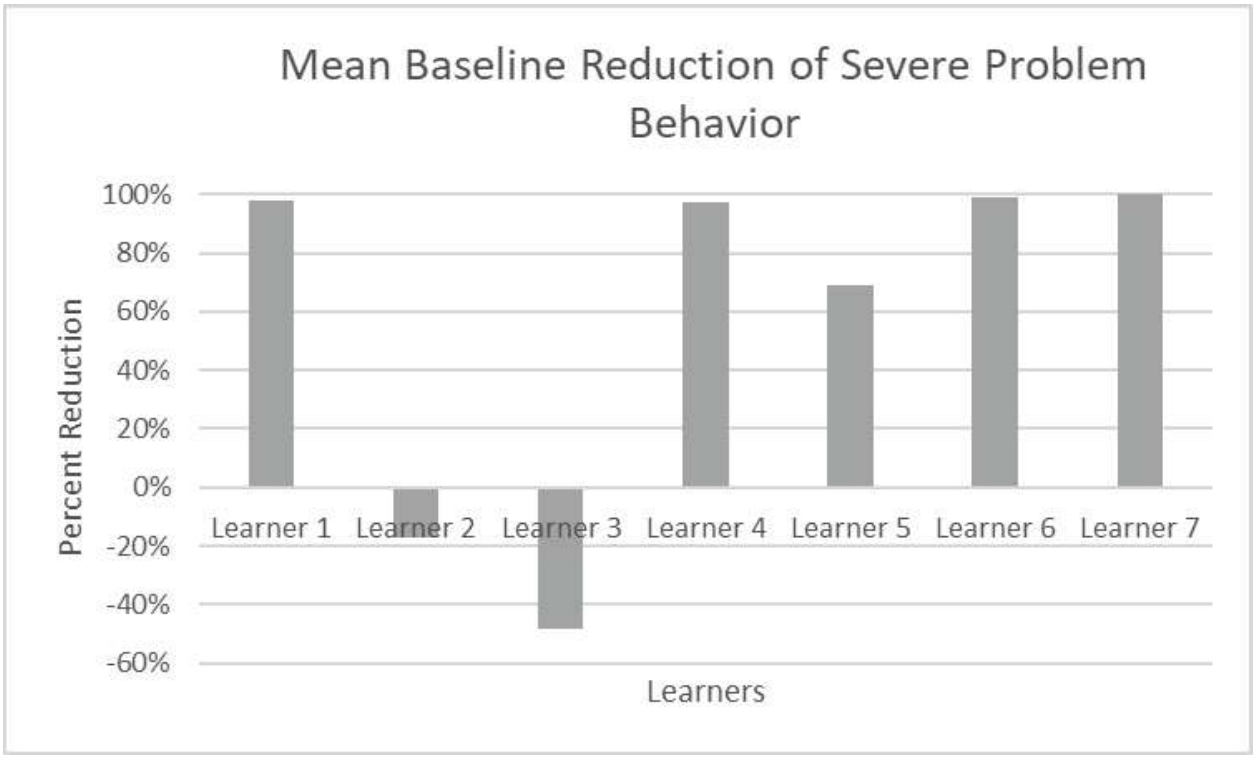


Note: Pre-intervention data includes the average of three data points immediately before intervention
Post-intervention data includes the average of three data points immediately following intervention

The mean baseline reduction in severe problem behavior was calculated for each student (See Figure 19). Learner 7 reduced his baseline mean by 100%, which indicates that problem behavior was no longer occurring following treatment. Learners 1, 4, and 6 reduced their baseline means by 98%, 97%, and 99%, respectively. Learners 2 and 3 engaged in worsening severe problem behaviors with mean baseline reductions of 16.9% and 48%, respectively.

Figure 19

Mean Baseline Reduction of Severe Problem Behavior



Note: Mean Baseline Reduction Equation = (1 - (M of Final $3_{Treatment}$ / M of Final $3_{Baseline}$)) x 100

A modified Investigator's Global Assessment (Fiani & Jessel, 2022) was utilized to determine a designation of improvement or worsening behavior in relation to the reduction of challenging behavior from baseline performance. (See Table 10.) According to this assessment tool, Learners 2 and 3 engaged in worsening behavior. Learner 5 showed moderate improvement, while Learners 1, 4, and 6 showed excellent improvement, and Learner 7 demonstrated complete improvement. (See Figure 20.)

Table 10

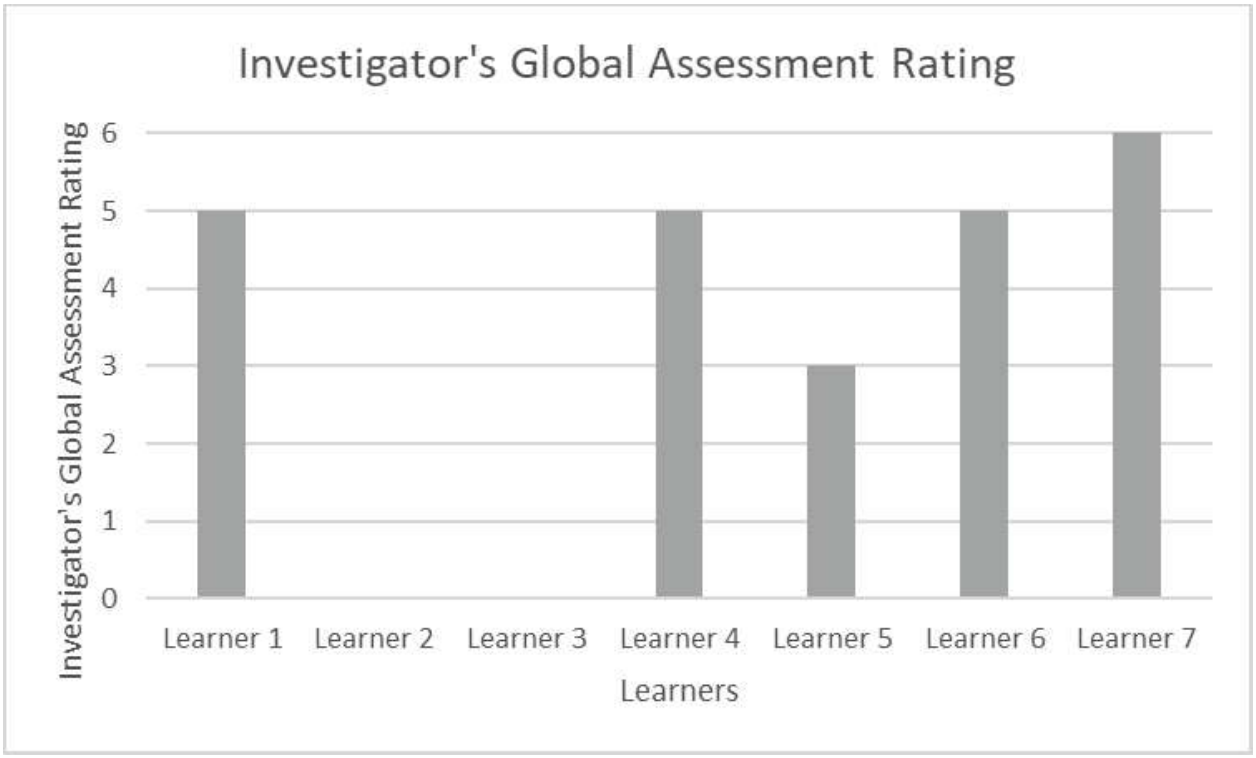
Investigator's Global Assessment

Scale	Designation	Definition
6	Complete improvement	100% reduction in challenging behavior from baseline performance
5	Excellent Improvement	90% reduction in challenging behavior from baseline performance
4	Marked Improvement	75% reduction in challenging behavior from baseline performance
3	Moderate Improvement	50% reduction in challenging behavior from baseline performance
2	Minimal Improvement	25% reduction in challenging behavior from baseline performance
1	No change	Similar challenging behavior to baseline performance
0	Worse	Any increase in challenging behavior from baseline performance

Note: Modified by Fiani et al., 2022 for Behavioral Intervention

Figure 20

Investigator's Global Assessment Rating



Note: See Table 10 for the Investigator's Global Assessment Rating Scale

Learners 2 and 3 engaged in increased rates of problem behavior following skill-based treatment. Learner 3 engaged in the highest behavior increase, with an increase of 48%. The problem behaviors of Learners 1, 4, 6, and 7 decreased to zero or near zero levels, recognized as complete or excellent improvement according to the Investigator's Global Assessment Scale. Learner 5 was the only learner whose problem behavior decreased, but not to near-zero levels. According to the Investigator's Global Assessment Scale, Learner 5's behavior improved moderately.

Research Question 2

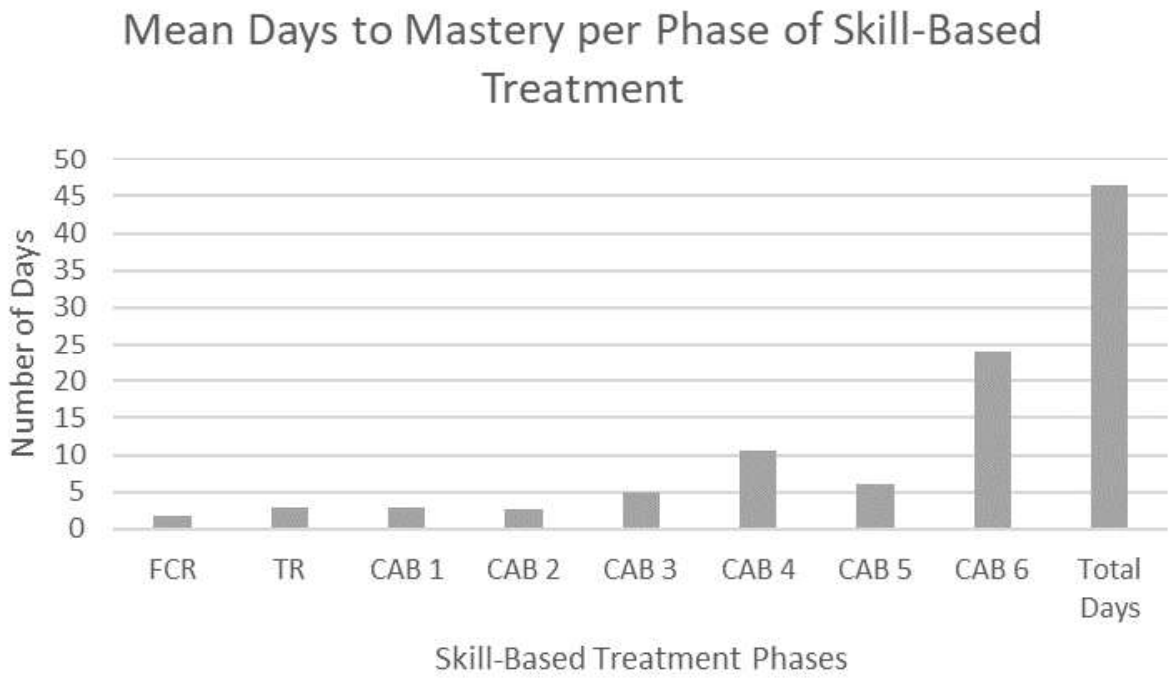
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to engaging in IT, flexible play, increasing tolerance)?

Before intervention, the rate of skill acquisition was very low due to the duration and intensity of problem behaviors. Socially significant progress was defined as mastery of each skill-based treatment phase. Following the mastery of all six phases, students re-engaged with programming that was in place before the need to minimize instruction due to the intensity of problem behavior. The rate of skill acquisition before the minimization of instruction was then compared to the rate of skill acquisition following the intervention.

All students mastered the first six phases of skill-based treatment - functional communication response (FCR), tolerance response (TR), relinquishing reinforcement (CAB 1), transitioning to the work area (CAB 2), one to three easy responses (CAB 3), and short responses to new skills (CAB 4). Learners 4, 5, 6, and 7 mastered long responses to new skills (CAB 5). Learners were engaged in treatment for 29 to 95 days, with a mean of 47.4 days. See Figure 21 for a visual representation of the data and Appendix O for the raw data table.

Figure 21

Mean Number of Days to Mastery per Phase



Note: FCR = Functional Communication Response
TR = Tolerance Response
CAB 1 = Relinquish Reinforcement
CAB 2 = Transition
CAB 3 = 1-3 known responses
CAB 4 = short sets of new skills
CAB 5 = long set of new skills
CAB 6= varied sets of new skills with a challenge

All learners mastered the functional communication response (FCR) on the first day of treatment, except for Learner 4. Learner 4 participated in sessions for six days before mastering the FCR. Mastery of a tolerance response required one to five days. Learners 2 and 6 mastered the tolerance response in the shortest amount of time, two days and one day, respectively. Learner 1 took the longest to master the tolerance response, which required five days of instruction.

Learners 3 and 5 mastered relinquishing reinforcement (CAB 1) in one day, while Learner 7 took nine days to master relinquishing. All learners mastered transitioning to the work area (CAB 2) in one day except for Learners 1 and 3, who took five and eight days, respectively. Responding to one to three easy responses (CAB 3) took Learner 3 and Learner 5 one day, while Learner 3 required fifteen days of instruction to master this skill.

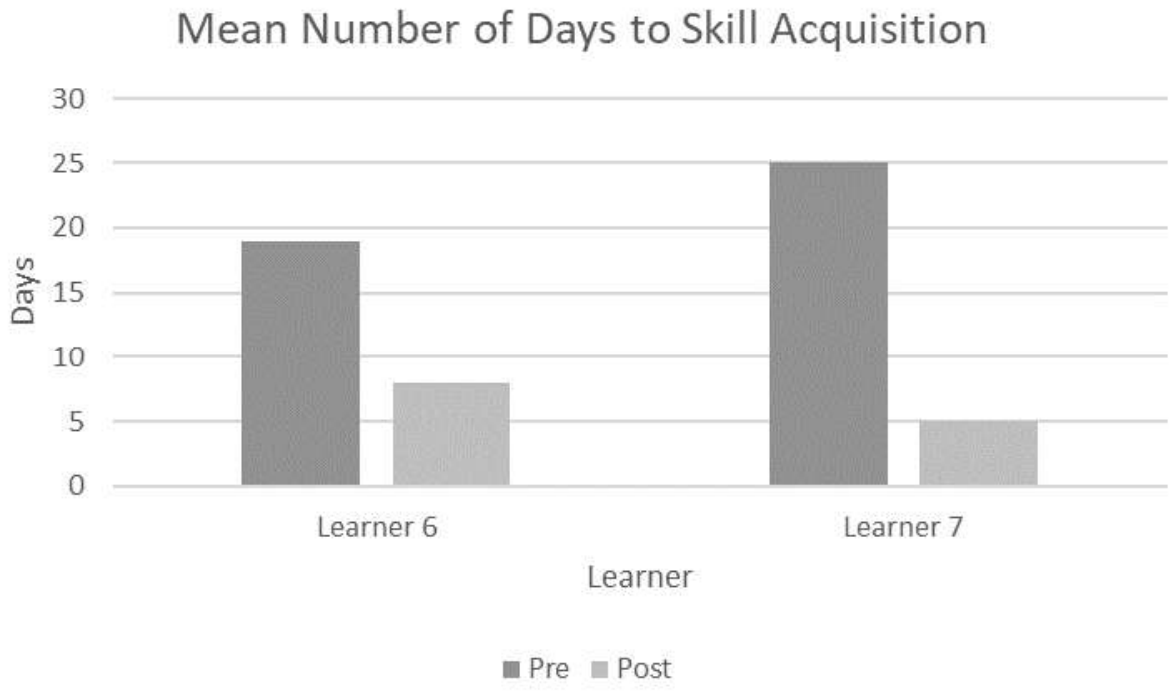
CAB 4, responding to short sets of new skills, showed the most significant variability across learners, requiring between one and nineteen days of instruction to achieve mastery. Learner 4 only needed two days to master this skill. Learners 1, 2, and 3 did not master responding to long sets of new skills (CAB 5). Learner 7 mastered this skill in one day, while Learners 4 and 5 mastered the skill in nineteen and eighteen days, respectively. Only Learners 4, 6, and 7 mastered instruction with a challenge (CAB 6). These learners mastered CAB 6 in 23, 7, and 25 days, respectively.

Following the mastery of CAB 6, Learners 6 and 7 re-entered programming in place before the intervention. The mean days to mastery before intervention were 19 and 25 days for Learner 6 and Learner 7, respectively. Following intervention, the mean number of days to mastery was eight and five, respectively. Learner 6’s average number of days to mastery

decreased by 58%. Learner 7's average number of days to mastery decreased by 80%. (See Figure 22 for a visual representation of the data and Appendix K for the raw data table.)

Figure 22.

Mean Number of Days to Skill Acquisition



Research Question 3

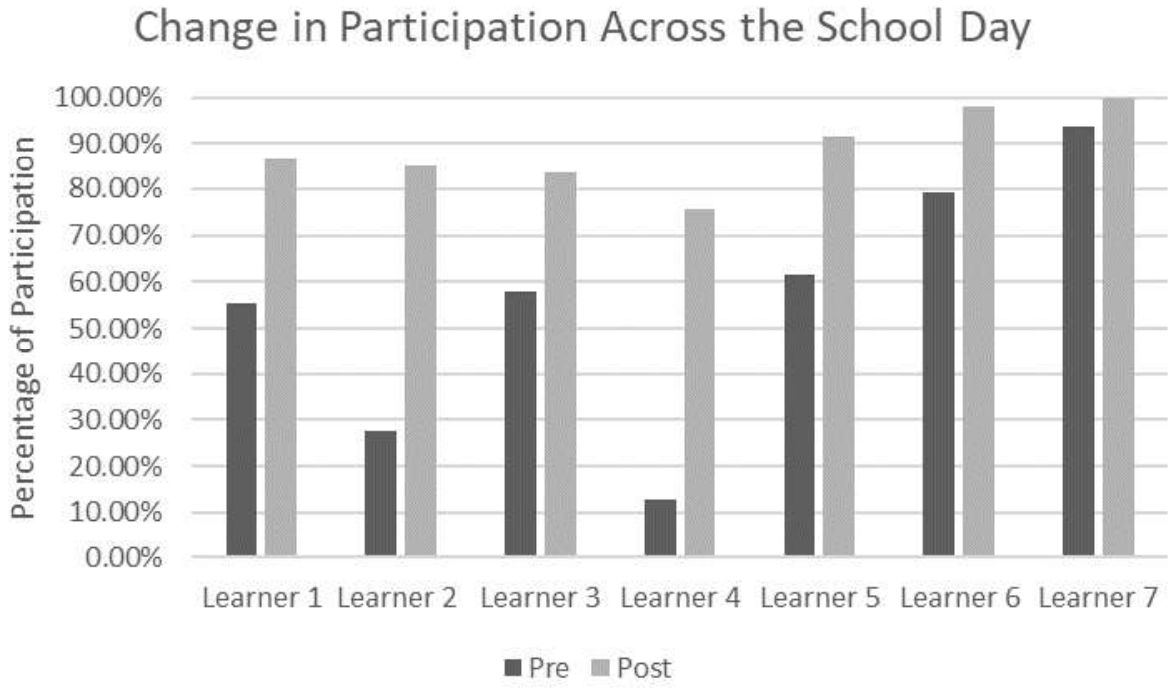
- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student's percentage of participation in instruction?

Figure 23 compares the percent of participation per day across three days prior to implementation and three days following implementation. All learners increased the percentage of their school day in which they participated. Learners 2 and 4 showed the most improvement,

with 496% and 207% increases, respectively. Learner 7 showed the least growth in participation, at 6.7%. The mean percent increase in participation across the seven learners was 124.7%.

Figure 23

Change in Participation Across the School Day



Research Question 4

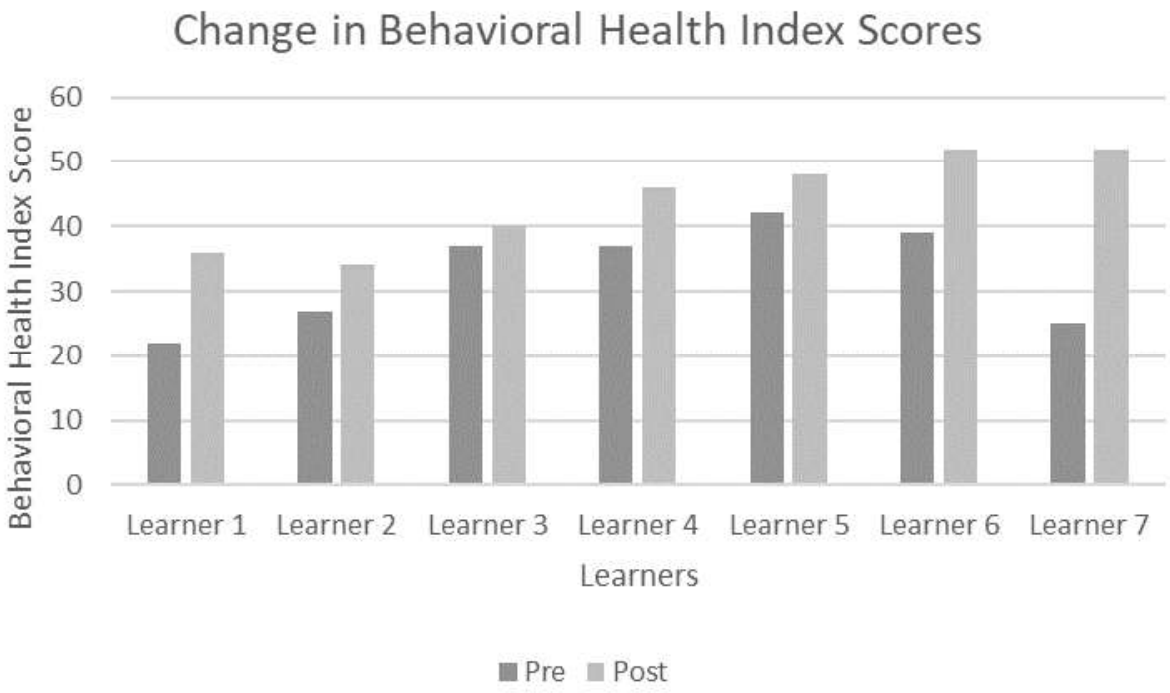
- What changes will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, lead to in a student's rating on the Behavioral Health Index (BHI), indicating a change in critical skills, behavior management, and health repertoires?

The Behavioral Health Index (Appendix F) scores increased for all learners following the implementation of skill-based treatment. The increase in ratings ranged from 8% to 108%, with a mean of 33%. Learner 7's ratings indicated the highest percent change of 108%, while Learner

3's rating increased the least with a percent change of 8%. The most change occurred in the critical skills domain of the Behavioral Health Index, with a mean increase of 55%. The least change happened in the health repertoire, with a mean change of 13%. Learner 7 demonstrated the most significant change in the critical skills and the behavior management domains, with increases of 175% and 133%, respectively. Learners 2 and 5 demonstrated the least change in the critical skills domain, with 24% and 25% increases, respectively. Learner 3 did not show any growth in the behavior management domain. Learner 1 demonstrated the most change in the health domain, with an increase of 60%, while Learners 3, 4, and 5 did not show any change in this domain. See Figure 24 for a visual representation of the data and Appendix O for raw scores.

Figure 24

Behavioral Health Index Ratings



Summary

Seven learners aged 5 to 10 who engaged in severe problem behavior participated in skill-based treatment. Six of the learners received educational services in full-time autistic support classes, and one learner received educational services in a general education kindergarten classroom. Following the intervention, the rates of problem behavior decreased for five of the seven learners and increased for two. The mean baseline reduction was between 97% and 100% for four of the seven learners, who showed excellent to complete improvement.

All learners mastered the first six phases of skill-based treatment (functional communication response, tolerance response, relinquishing reinforcement, transitioning, engaging in three known responses, and engaging in up to three novel responses). Two learners completed the intervention and resumed programming in place prior to intervention. These two learners showed a decrease in the skill acquisition rate following the intervention's completion. Learner 6's average number of days to mastery decreased by 58%, and Learner 7's average number of days to mastery decreased by 80%.

All learners increased their participation in the classroom. Participation increased from 6.7% to 496% across the school day following the intervention. The mean percent increase across all learners was 124.7%. Finally, the Behavioral Health Index ratings increased for all seven learners, indicating a positive change in critical skills, behavior management, and health repertoires. Ratings increased between 8% and 108%, with a mean of 33%. See Table 11 for a comparison of learner characteristics and outcomes. The learners ' individual findings and implications for individual outcomes are explored in Chapter V.

Table 11

Comparison of Student Characteristics and Outcomes

Learner	Age	Language Ability	Mode of Comm'n	Staff: Student Ratio	Days with Session Data	Change in Concern of Problem Behavior	Mean Baseline Reduction Problem Behavior	Percent Change in Participation	Percent Change in BHI	Skill Acquisition	Mean Number of Trials per day
1	10	2	Vocal	4:8	29	-5	98%	207%	64%	CAB 4	9
2	7	1	PS	4:8	95	-2	-16.9%	6.7%	26%	CAB 4	6.8
3	10	1	SGD	3:8	34	-4	-48%	62%	8%	CAB 4	4.4
4	6	4	Vocal	2:18	43	-2	97%	56%	24%	CAB 6+	8.8
5	5	4	Vocal	3:8	40	-2	69%	44%	10%	CAB 5	10.9
6	8	3	Vocal	4:8	38	-3	99%	496%	33%	CAB 6+	14.8
7	9	2	Vocal/ SGD	4:8	38	-5	100%	24%	108%	CAB 6+	30.9

Note. Language Ability: 1 = nonvocal; 2 = single-word utterances; 3 – short sentences; 4 = full fluency
Communication Mode: SGD = speech generating device; PS = Picture Selection
Mean Baseline Reduction Equation = $(1 - (\text{M of Final } 3_{\text{Treatment}} / \text{ M of Final } 3_{\text{Baseline}})) \times 100$

CHAPTER V

Following the implementation of skill-based treatment, five of the seven learners decreased their rate of severe problem behavior. Skill-based treatment increased all learners' participation across the school day and their ratings on the Behavioral Health Index. All learners improved their skill sets to include an omnibus mand and tolerance response, as well as cooperation when relinquishing reinforcement, transitioning to a work area, and engaging in required responses. This chapter begins by discussing the implications of the social validity ratings. It then explores each research question, how the findings of this study relate to previous studies, and the impact of these findings on the learners. Implications of the findings will be explored, followed by limitations and recommendations for future research.

Social Validity

Overall, the high social validity ratings in the current study demonstrate the intervention's social validity. The mean rating for treatment feasibility was 6.3 on a Likert scale of 7. This result aligns with the findings of Santiago et al. (2016), in which the acceptability of the procedures was rated a mean of 6.7 on a 7-point scale. Teachers of five of the seven students in the current study rated treatment feasibility a seven on a 7-point scale. The findings of Jessel et al. (2018c) and Beaulieu et al. (2018) align with this result with treatment acceptability scores of 7 on a 7-point scale.

The teacher of Learners 4 and 5 in the current study rated the feasibility of the intervention slightly lower. The feasibility of the treatment with Learner 4, who was serviced in the kindergarten classroom, was rated a five. The practicality of implementing skill-based

treatment in a general education kindergarten classroom with almost twenty other students created barriers to successful implementation. The team could only sustain happiness, relaxation, and engagement (HRE) with Learner 4 if he were included in the general education classroom. When pulled into the special education classroom, Learner 4 frequently requested to return to his peers. On occasion, Learner 4 would leave the special education classroom and return to the kindergarten classroom before the end of the session. Due to his preference to remain with his neurotypical peers, skill-based treatment was moved from the special education classroom to the kindergarten general education classroom.

Skill-based treatment began in the kindergarten classroom during whole-class read-aloud, prioritizing Learner 4 sitting up and physically remaining on the carpet designated for whole-class instruction instead of lying on the floor and rolling on the carpet. The team determined that center-time (when students rotate through classroom activities, including small group instruction with the teacher) would better suit the desired outcome for Learner 4. The kindergarten teacher changed her classroom schedule so that center time would align with the special education teacher's availability and created a building center to align with Learner 4's preferences. During centers, Learner 4 was allowed to remain at the building center while the remainder of the class rotated through the centers. The special education teacher began skill-based treatment by presenting the demand to clean up and join his assigned center. Once Learner 4 mastered CAB 2 (using the functional communication response, responding with the tolerance response, cleaning up, and transitioning to a work area), the kindergarten teacher began implementing skill-based treatment trials by directing him to transition to her work table. The feasibility of implementing skill-based treatment created barriers for Learner 4. Still, all staff

members agreed that overcoming the obstacles allowed him to remain in the general education classroom and make significant progress during the school year.

The feasibility of servicing Learner 5 was rated a four. Implementing skill-based treatment with Learner 5 posed difficulty as he required a classroom without other students to maintain happiness, relaxation, and engagement (HRE). Due to scheduling, this was almost impossible to achieve as Learner 5 needed to remain in a classroom with other children without 1:1 support for at least two and a half hours of his three-hour school day due to scheduling, lack of room, and lack of staff. These limitations led to increased problem behavior when Learner 5 was instructed in a classroom with other students and a hardship on staff in determining how best to support the other students in the classroom. These barriers were not overcome during the intervention, and Learner 5 was moved to a more restrictive placement.

The decrease across all teacher ratings in their concern for problem behavior demonstrates social validity and aligns with the findings of Santiago et al. (2016) and Jessel et al. (2018c). Jessel et al. (2018c) also asked interventionists to rate their confidence on a seven-point Likert scale in applying the strategies learned from the intervention. The mean rating in Jessel et al. (2018c) aligned with the mean rating in the current study, with mean ratings of 6.5 and 6, respectively. These findings depict the alignment with the social validity of previous research and relate to the importance of the current study.

Research Question One

- How will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, affect the rate of problem behavior for students with autism in a public school classroom?

In the current study, the problem behavior of four learners, Learners 1, 4, 6, and 7, remained at near-zero levels following the implementation of skill-based treatment. These findings align with numerous published studies (Hanley et al., 2014; Santiago et al., 2016; Strand & Eldevik, 2017; Herman et al., 2018; Beaulieu et al., 2018; Jessel et al., 2018a; Jessel et al., 2018b; Taylor et al., 2018; Rose et al., 2018; Coffey et al., 2020b; Ferguson et al., 2020, and Fiani & Jessel, 2022). The mean baseline reduction for these four learners was 98.5% (range, 97%-100%). These findings align with the findings of Fiani & Jessel (2022), who eliminated problem behavior for seven of the eleven learners in the study with a mean baseline reduction of 98.5% (range, 91%-100%).

The teacher of Learners 1, 6, and 7 collected duration data for problem behavior throughout the school year. She reported that Learner 1's behaviors targeted for reduction decreased from 750 minutes during November to 170 minutes during February. Staff shared that they were comfortable instructing Learner 1 following skill-based treatment due to the vast decrease in problem behavior and increase in functional communication, but the learner's parents insisted on a change of placement as soon as it became available.

Learner 6's teacher shared that before implementing skill-based treatment, Learner 6 engaged in problem behavior for an average of 87 minutes per day. Following skill-based treatment, her problem behavior decreased to an average of 8 minutes per day. The duration of problem behavior increased to an average of 22 minutes per day when she was paired with a new learner in the classroom. Following this increase, she was again paired with Learner 7, during which problem behavior decreased to near-zero levels.

Learner 7's teacher related that his duration data across the school year showed a 90% decrease in his problem behavior as he engaged in an average of 67 minutes of problem behavior

a day in October and an average of 7 minutes a day in April and May. During the final month of school, he engaged in three aggressions - two of which were throwing a toy when it would not do what he wanted. The topography of his problem behavior changed from aggressing and eloping to crying and saying, “No.”

Before implementing skill-based treatment, Learner 4 was allowed to keep one set of toys at his desk in the kindergarten classroom across the school day. He was asked to participate in classroom activities but rarely joined. These preventative measures were implemented to decrease the need to remove the entire class and keep the other students safe when Learner 4’s behavior escalated to unsafe levels. Following skill-based treatment, behaviors decreased to near-zero levels with a mean baseline reduction of 97%, and he no longer needed to keep a set of toys at his desk.

As the decrease in problem behavior is consistent across the literature, the researcher did not expect problem behavior to increase for Learners 2 and 3 or only moderately decrease for Learner 5. The impact of the variability in the density of instruction, the ability to achieve happiness, relaxation, and engagement despite the variables in a public school, and staff training will be discussed further in the implications section.

Research Question Two

- How will a replication of Hanley et al.’s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student’s criterion to mastery across skill sets indicative of socially significant progress towards school readiness (including, but not limited to engaging in IT, flexible play, increasing tolerance)?

To the author's knowledge, this was the first study to compare the rate of skill acquisition before intervention and following intervention. Two of the seven students completed skill-based treatment and reentered into the same programming utilized before intervention. These learners markedly decreased the days required to master skills (see Figure 22). Learner 4 also completed skill-based treatment. However, staff could not determine a baseline of skills due to intense refusals with demands at the beginning of the school year. Therefore, although his report card and progress report show progress, it is unclear which skills he gained throughout the school year due to his initial lack of cooperation. At the end of the year, the kindergarten teacher remarked that she still wasn't sure if she could collect an accurate baseline of his skills.

The number of days for each student to master each step of skill-based treatment varied greatly. Most students mastered the functional communication response (FCR) within one to two days. Learner 4 took six days to master the skill with the phrase, "Can I have more time, please?" before the teacher varied the communication response based on the context. Learner 4 continuously yelled, "Go away!" instead of emitting the communication response or just before emitting the communication response. Based on its resistance to extinction, the researcher surmises that the phrase "Go away!" was initially densely reinforced and then intermittently reinforced across environments before he entered school. Regardless of his slow start, Learner 4 was one of only four participants who mastered CAB 5 and one of three to master CAB 6.

Learner 1 had the most difficulty with the tolerance response. His original target was to give a thumbs up and say, "Okay." Once he could imitate a thumbs-up, he began saying, "Good" each time he made the motion. Staff realized that any time they had given him a thumbs up, they had said, "Good job" to him. After several sessions attempting to support him in saying, "Okay," the team decided to change the tolerance response to giving a thumbs up and saying, "Good!"

Learner 7 took the longest to master CAB 1 (relinquishing reinforcement) even though he was one of only two students to complete skills-based treatment and return to his previous programming. Giving toys to the instructor was very aversive to Learner 7, so the researcher instructed staff to use a bin for him to place his materials. After Learner 7 refused to place his toys in a bin, staff realized that he would only put them away if they were at the exact spot from which they came. Once this precise method of cleaning up was allowed, Learner 7 mastered CAB 1.

Learner 3 took 26 days to master CAB 2 (transitioning to the table of high expectations), the longest for all learners. Learner 3 engaged in low-level behaviors such as crying and refusals when asked to transition to the table. Staff did not want to move on to the next skill until he transitioned without any low-level behaviors when transitioning across preferred activities. He quickly transitioned from the play area and the trampoline but took two weeks to master transitioning from watching videos on his laptop to the work table.

Learner 2 required 15 days to master CAB 3, which was the longest time for all learners. CAB 3 involves responding to 1-3 known skills at the table. Learner 2 engaged in self-injurious behavior when seated and presented with a task. Known tasks included a variety of simple put-in task boxes with 1-3 pieces. Following mastery of CAB 3, Learner 2 required 19 days to master CAB 4, and could not master CAB 5 after 54 days of instruction. Instruction of CAB 5 began just before the number of minutes Learner 2 was awake in school decreased rapidly (See Appendix R and Appendix S). These correlations will be further discussed in the implications section.

As the learners in this study engaged in treatment for most of their school day, this study most closely aligns with Taylor et al., 2018. Studies before Taylor et al. (2018) took place in

outpatient clinics or homes with learners engaged in sessions of no more than 120 minutes (Beaulieu et al., 2018; Hanley et al., 2014; Santiago et al., 2016; Strand & Eldevik, 2017). Taylor et al. (2018) conducted skill-based treatment in a public middle school, but treatment occurred in a 1:1 room before progressing to the general education classroom and other learning areas. This treatment took place over 119 days. In the current study, learners engaged in skill-based treatment in their regular classroom (full-time autistic support or kindergarten classroom) for 29 to 95 days, with a mean of 47.4 days. In Taylor et al. (2018), skill-based treatment was initiated by a BCBA, who mastered each phase prior to including other staff members in the instruction of each phase. In the current study, classroom teachers and paraeducator staff all began skills-based treatment simultaneously and moved through the phases together. The current study supported the teams to teach to generalization instead of wondering whether or not generalization would occur.

In the current study, learners achieved mastery over an average of 46.4 days. In the seminal study by Hanley et al. (2014), learners completed skill-based treatment across eight to fourteen weeks, engaging in only 22-32 one-hour sessions. While the term “sessions” is defined differently across research, participants across studies completed skill-based treatment anywhere between 20 visits (Rajaraman et al., 2022a) and 260 sessions (Beaulieu et al., 2018). Variables, including the density of instruction, are paramount to determine the effectiveness of the treatment. The implications section will discuss these variables as they apply to the current study.

Research Question Three

- How will a replication of Hanley et al.’s 2014 study, including modifications from the subsequent literature within a public school classroom, affect a student’s percentage of participation in instruction?

This is the first study to examine the effect of skill-based treatment on the percent participation across the school day. All learners increased participation across the school day following intervention with a range of 6.7% to 496% and a mean of 124.7%. Previous research on skill-based treatment occurred in a clinical setting or a treatment room with 1:1 instruction. Thus, collecting participation data across the school day before and after intervention was not prudent. The researcher did not expect the effects of skill-based treatment to impact participation to the extent displayed in the data (see Figure 23). At the end of the school year, six of the seven learners participated in 80% of their school day without prompting or coercion. The increase in participation could be correlated with the increase in skill acquisition. Class participation has a powerful effect on achievement, whether in academics, extracurricular activities, or language development (Akpur, U., 2021; Lei et al., 2018). Thus, increasing participation across the school day is paramount to improving student achievement.

Before implementation, all learners engaged in problem behavior when directed to participate in class activities. Instruction had been decreased only to include vital routines such as toileting. Learner 4 drastically increased his participation in the general education classroom through skill-based treatment. Before implementing skill-based treatment, he threw building materials at staff, ran at staff, and eloped from the building when asked to clean up and engage with the rest of the class. At the end of his kindergarten year, Learner 4 participated most of the school day and engaged in meaningful interactions with his peers. He is now fully included in a first-grade classroom. The researcher observed him in first grade sitting on the carpet designated for classroom instruction for thirty minutes instead of sitting by himself at his desk with preferred manipulatives or rolling around on the floor. He then participated in a twenty-minute intensive writing session 1:1 with a special education teacher. Before skill-based treatment,

Learner 4 refused to print in his journal and only drew pictures of himself. During the observation, he crafted two sentences with appropriate capitalization and punctuation and drew a picture corresponding to his writing.

Before skill-based treatment, Learner 1 and Learner 6 engaged in aberrant behaviors when directed to participate. Learner 1 disrobed and climbed on furniture while aggressing against staff, and Learner 6 hid in a cubby or under tables when adults spoke to her. Following skill-based treatment, these learners rarely engaged in aberrant behavior and approached adults to engage in activities. The instructors of all learners were extremely pleased that participating in skill-based treatment led to increased participation across the school day.

Research Question Four

- What changes will a replication of Hanley et al.'s 2014 study, including modifications from the subsequent literature, lead to a student's rating on the Behavioral Health Index (BHI), indicating a change in critical skills, behavior management, and health repertoires?

Acorn Health developed the Behavioral Health Index with the head of their Clinical Advisory Board, Gregory P. Hanley, Ph.D., director of the Behavior Analysis Doctoral Program at Western New England University. The rating scale tracks progress, but its scores have not been used in published literature. In this study, Behavioral Index scores increased for all learners, ranging from an 8% increase to a 108% increase with a mean increase of 33%. The most change occurred in the critical skills domain of the BHI, with a mean increase in this area of 55%. Using this scale in further research will allow for cross-referencing studies and comparing progress between learners.

The most significant increase in Behavioral Health Index (BHI) scores was attained by Learner 7, with a mean increase of 108%. His ratings in the area of critical skills increased by 175%. These scores demonstrate a movement from isolated play to interactive play and few mands to a strong omnibus mand used across people and contexts to attain access to a desirable environment. Learner 7 also uses specific mands such as, “Where is it?” Before skill-based treatment, Learner 7 engaged in aberrant behavior, including aggression when he could not find a missing piece of a preferred toy or activity. Following skill-based treatment, Learner 7 now engages in generalized manding for the location of an item across people, environments, and activities. Learner 7 no longer engages in aggression towards people and property. When frustrated, Learner 7 will ask for the location of a missing item, cry, and ask for a hug from an instructor. The skills learned in skill-based treatment have generalized across environments in the school, people, and activities, were maintained across the summer, and are utilized in the current school year. It is unknown if the skills are generalized to the home environment. Increases in this area for all students from 24% to 175% have greatly improved classroom involvement and interactions.

Behavioral Health Index ratings in behavior management increased for all learners except Learner 3. Increases ranged from 13% (Learner 5) to 133% (Learner 7). Learner 3’s ratings in this area were elevated before treatment and did not increase as he continues to require a rich schedule of edible reinforcement to participate in instruction. Learner 7 no longer requires a dense schedule of reinforcement in the form of tokens and edible reinforcers to maintain participation. Staff can group him with peers for instruction, and do not need to avoid tasks for fear of behavioral outbursts. Before implementation, Learner 1 was isolated in the classroom

through mats and dividers. The students evacuated the classroom weekly for their safety. The only demand given to Learner 1 was to use the bathroom at prescribed times.

Learners 2-7's ratings in the Behavior Health Index's health repertoire either did not increase or increased by only 1-2 points. Learner 1's ratings in this area increased by 60%. His scores increased in sleeping, eating, and exercising. These increases can significantly impact the learner's quality of life.

Implications of Findings

Density of Instruction

Previously published literature collected data based on one-hour treatment sessions in a clinical or home setting (Hanley et al., 2014; Santiago et al., 2016; Strand & Eldevik, 2017; Herman et al., 2018; Ferguson et al., 2020). Rajaraman et al. (2022a) described sessions as five trials or thirty minutes, whichever occurred first. The current study collected daily data, but it is important to note the wide range of trials ran per day for each learner. The number of trials per day varied greatly depending upon various factors unique to the public school setting, such as alternative schedules, staffing shortages, illness of other students, and security drills.

The number of daily trials for Learners 1, 6, and 7 surpassed that of all other learners (see Appendix T). For ease of comparison, the number of trials per day is first compared across Learners 1, 6, and 7. Then, the number of trials presented each day to Learner 2 (increased problem behavior), Learner 3 (increased problem behavior), and Learner 5 (moderate decrease in problem behavior) are presented with that of Learner 7 (100% decrease in problem behavior). While the number of trials per day for Learner 7 averaged between 30 and 40, the number of trials for Learner 2 created a descending trend line from nine to two trials per day. The number of

trials for Learner 3 created a descending trend line, falling from ten to zero. The trend lines for Learners 4 and 5 are more stable, hovering around nine for Learner 4 and between ten and eleven for Learner 5.

When comparing the number of trials Learner 4 engaged in per day, it is important to note that this learner was included in the general education kindergarten classroom for half-day kindergarten. It was only possible to implement the intervention for thirty minutes per day during center time. The mean of nine trials per daily half-hour session surpasses the mean number of trials in which Learner 2 engaged throughout the entire school day. When Learner 4 was not involved in skill-based treatment, the kindergarten classroom continued its regular academic schedule. Learner 4 was offered to join each of the lessons. If he did not engage in the lessons, he engaged in building manipulatives at his desk. At times, he attended to the lesson and participated from his desk. Therefore, Learner 4 was continuously exposed to content in the kindergarten classroom regardless of his level of participation.

Problem behavior emitted by Learner 5 did not reach near-zero levels but decreased by 69% from baseline. The trendline for Learner 5 remained stable between ten and eleven trials per day. This learner was also a kindergarten student but could not remain in the kindergarten classroom. He attended an autistic support classroom instead of half-day kindergarten. Problem behavior ensued when other students entered the classroom due to his inability to tolerate shared attention. Therefore, even though the number of trials per day closely paralleled the number experienced by Learner 4, Learner 5 did not experience the same level of success in the intervention.

Of the seven participants in the study, two learners' problem behavior increased. Learner 2's problem behavior increased by 16.9%. Skill-based treatment was only implemented by his

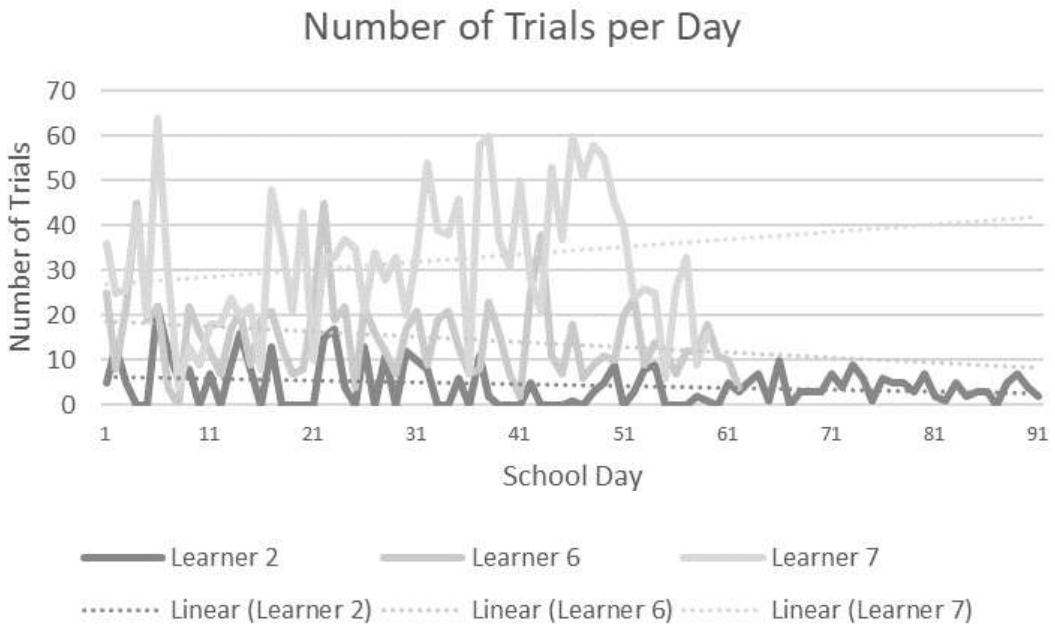
teacher, which limited the number of trials per day. The number of daily trials ranged from 0 to 22, with no trials attempted on twenty-nine days (see Appendix Q). The figure shows a decreasing trend from ten to zero for the number of trials implemented each day. Learner 2 required 15 days to master CAB 3 (the longest of all the learners) and could not master CAB 5 after 54 school days of instruction. This learner also had a seizure disorder and wore a helmet across the school day for protection. The frequency of seizures and their impact on his health increased throughout the intervention, according to data collected on the number of minutes he was present and awake during the school day. The number of minutes present decreased due to frequent appointments, which caused him to be dismissed early from school. Appendix R depicts a decreasing trend line in the number of minutes Learner 2 was present and awake across the school day. Appendix S displays a visual correlation between the date Learner 2's progress stagnated and the decreased number of minutes awake per school day. The percent of each skill-based treatment session spent outside of reinforcement decreased for Learner 2 from 40% in the initial session to 13% in the final recorded session (see Appendix P). It is unknown if the intervention's effectiveness would be more successful for Learner 2 if he received a greater density of instruction. However, the visual comparison between the number of trials in which Learner 2 engaged and the number of trials Learners 6 and 7 engaged poses a sharp contrast. (See Figure 25.)

Problem behavior also increased in frequency for Learner 3. He began the intervention with only his long term substitute running trials for 30 minutes per day. A graph of the number of trials ran per day for Learner 3 created a descending trend line, falling from ten to zero. Trials significantly decreased when his regular teacher returned from maternity leave. When she

returned to the classroom paraeducators ran a few trials a day, but the teacher did not continue the thirty-minute sessions.

Figure 25

Number of Trials per Day by Learner



Learners 1, 6, and 7 engaged in skill-based treatment throughout the school day with driven staff who ensured dense opportunities for instruction. While Learner 4 did not receive as dense instruction, he was immersed in general education kindergarten and continuously offered to participate. Learner 4 was highly motivated to engage with his peers, which increased his motivation to engage in whole-group and small-group instruction. Learner 2 encountered the same number of trials throughout the entire school day as Learner 4 encountered in half-day kindergarten. During the remainder of the day, Learner 2 engaged in manding and pairing sessions with staff not trained in skill-based treatment. Thus, it is unclear if the sessions were beneficial. It is recommended that learners be engaged in dense opportunities of skill-based

treatment across the school day to improve the probability of a decrease in problem behavior, an increase in participation, and an increase in Behavioral Health Ratings.

Training of Staff

None of the implementors in this study held degrees in behavior analysis. The teachers in the study each held master's degrees in education. The paraeducators all completed high school, with some completing college up to an associate degree. The researcher is a Board Certified Behavior Analyst who coached staff through the process. This methodology most closely resembles the study by Herman et al. (2018), in which a classroom teacher and tutor implemented skill-based treatment in a specialized school with the support of a BCBA. This study also closely aligns with Beaulieu et al. (2018), in which a behavior therapist (without an advanced degree) implemented skill-based treatment with supervision provided once per month by a BCBA.

Learners 1, 6, and 7 were all instructed in the same room by the same staff members. While none of the implementors for these learners held degrees in behavior analysis, two of the implementors attended a three-hour training presented by the researcher on the implementation of skill-based treatment. None of the other implementors attended this training. This classroom implemented skill-based treatment with Learner 1 for three weeks before beginning treatment with Learners 6 and 7. During this time, the special education teacher and the classroom paraeducator focused on the fidelity of programming and the reliability of data collection. The researcher spent seventeen sessions coaching staff in this classroom during implementation for Learner 1 and only two sessions each for Learners 6 and 7. Treatment fidelity was the highest

(100%) for Learners 6 and 7 and 91% for Learner 1, displaying the staff's skill set improvement. (See Appendix L.)

The substitute teacher in Learner 3's classroom was coached via video-conferencing, but the teacher returning from maternity leave did not receive any coaching in skill-based treatment. Baseline data was taken three days before the substitute teacher implemented skill-based treatment. The returning teacher collected three days of data when she returned to the classroom. Learner 3's problem behavior increased from the mean baseline by 48%, according to the data collected by the two teachers. Upon reviewing the data from the long-term substitute and the returning teacher, as well as the recordings, the data appears skewed due to the change in staff collecting the data. It is of note that when collecting the data upon her return, the returning teacher did not implement any of the strategies from skill-based treatment as she preferred to place demands and "push through" behavior. Thus, the data collected does not appear to be a valid representation of Learner 3's progress. This data disparity indicates the need for training for all staff involved in skill-based treatment.

Generalization

The published literature discusses the generality of skill-based treatment through extensions of treatment following the mastery of skills in a clinical or 1:1 setting. The current study is unique in that skill-based treatment was implemented in the environment and across staff members. These implementations are typically extensions following treatment. Thus, this study focused on teaching to generalization instead of programming for generalization following the success of skill-based treatment in an isolated setting with 1-2 instructors.

Due to the complexity of public school classrooms and the current lack of staff, more than one staff member is needed to implement skill-based treatment from the beginning. Learner 1 began skill-based treatment with two instructors. The two instructors increased to four instructors within the first two weeks. Skill-based treatment for Learner 6 and Learner 7 started with the four instructors working with Learner 1. Learners 3, 4, and 5 began skill-based treatment with one instructor but increased to three instructors within the first two weeks of implementation. Learner 2 was the only participant with only one instructor implementing skill-based treatment.

Data collected across the school day regarding the percent participation supports the gains in the generalization of skills. Participation data was not isolated to just the special education classroom but to related arts, recess, time with related service providers, lunch, and other special activities in the school. Learners 4, 6, and 7 maintained skills taught through skill-based treatment over summer break and generalized the skills to new classrooms and new staff members.

Ghaemmaghami et al. (2015) used skill-based treatment to teach functional communication responses across each function of behavior. The responses were taught in isolation, with one response taught to mastery before introducing another. In this study, the problem behavior of the learner persisted until a functional communication response was taught across the contingencies of escape, tangible, and attention. Building on Ghaemmaghami et al.'s 2015 study, the current research infused a variety of functional communication responses into Learner 4's skill-based treatment. After mastery of the initial functional communication response, the instructor prompted a functional communication response appropriate for the given context. Learner 4, as a fluent vocal learner, echoed the instructor's response and was observed

generalizing the phrases across people and relevant contexts without further instruction. For instance, instead of shouting, “No!” while kicking and hitting at staff, Learner 4 asked the question, “Can I have space, please?” This question quickly generalized across teachers, paraeducators, related service providers, and peers. Without direct instruction (beyond a model when appropriate), Learner 4 used appropriate questions in place of the omnibus mand, including, “Can I have more time, please?”, “Can I lay down?” and “Can I have space, please?” While modeling a variety of mands for Learner 4 was very successful, it is unknown if this method would be effective across other fluent vocal learners.

Ghaemmaghami et al. (2020) reviewed 208 studies with 744 applications of functional communication training. Most of these analyses were conducted in controlled settings with experts such as BCBAs implementing the intervention. These studies show only social relevance if the skills taught generalized across socially important contexts such as the classroom, home, and community settings. The current research attempted to capitalize on the inability to conduct skill-based treatment in a controlled setting by teaching in context to support generalization and decrease the need for treatment extension.

Following the current study it was not possible to interview parents to determine if generalization occurred across environments. However, Learner 7’s parents shared with their teacher that “he is a different child at home” following the completion of skill-based treatment and that they are very pleased with the results. Learner 4 generalized the skills learned to his first-grade classroom the following school year. Learners 2 and 6 returned to the same classrooms for the following school year. The learners maintained their skills over the summer and generalized the skills to new staff without needing explicit instruction.

Variability in the Public School Setting

The primary concern in implementing this study was the impact of an uncontrolled environment on the effectiveness of skill-based treatment. Except for Learner 5, the variability of the public school classroom did not adversely affect the findings. Learner 5 was adversely affected by the presence of peers and divided attention, which negatively impacted his success. Learner 5 required 1:1 attention in a classroom without other students to maintain happy, relaxed, and engaged. Thus, the implementation of skill-based treatment in a public school setting was less successful than the staff anticipated for Learner 5.

Learners 1, 6, and 7 were instructed in the same classroom. Learner 1 maintained his instructional area across skill-based treatment but often walked around the classroom. Other students frequently entered his area to observe what he was watching on a laptop. These visits did not alter Learner 1's demeanor. Learners 6 and 7 were paired together during the first three weeks of implementation of skill-based treatment. They shared a play area during reinforcement and often engaged in parallel play. By the end of the month, the learners were interacting by moving closer to each other and taking turns with toys. Staff rotated trials between the learners to keep both engaged throughout the school day.

Learners 2 and 3 were instructed in different schools, but both navigated busy classrooms without complaint. The variability of the kindergarten classroom may have benefitted Learner 4 as he was exposed to kindergarten content even when he was not participating. While implementing skill-based treatment during centers, the special education teacher naturally embedded social skill instruction through prompting, prompt-fading, and teaching perspective-taking in a natural setting. Teaching these skills would not have been possible in a clinical setting without the support of neurotypical peers.

Correlations Across Variables

Table 11 compares findings across learner characteristics and findings from the intervention. Learner 2's results were significant across findings. His teacher decreased the rating of her concern about his problem behavior by only 2 points, his rate of problem behavior increased, and his rate of participation increased the least amount. He could not master CAB 5 after 54 days of instruction and received the next to the least number of trials per day (mean = 6.8). Learner 3's results were also significant across the findings. His teacher also decreased the rating of her concern about his problem behavior by only two points. His rate of problem behavior increased by 48%, ratings on the Behavioral Health Index only increased by 8%, and he could not master CAB 5. Learner 3 received the least daily trials (mean = 4.4). Learners 2 and 3 each rated low in four areas noted in Table 11.

Learners 1 and 7 rated high in four of the five areas noted in Table 11. Both teachers' ratings of their concern about their problem behavior decreased most after the intervention. Their problem behavior was reduced by 98% and 100%. Their BHI ratings increased by 64% and 108%. Learner 7 completed all phases of skill-based treatment, while Learner 1 was moved to a different environment following mastery of CAB 4. Learner 7 engaged in the most daily trials (mean = 30.9). Learner 1 engaged in 9 trials per day. While Learner 7's participation only increased by 24%, Learner 1's increased by 207%.

Learners 4 and 6 each engaged in a mean range of 9 and 14.8 daily trials, respectively. They scored high in two to three of the six areas noted in Table 11. Learners 4 and 6 both

completed all phases of skill-based treatment and decreased their rate of problem behavior from 97% to 99%. Learner 6 also increased her rate of participation by 496%

The vocal learners in this study surpassed the learners using picture selection and speech-generating devices. Neither of the non-vocal students mastered skills beyond CAB 4, and their rate of problem behavior increased. These learners also engaged in the least number of trials per day (6.8 and 4.4, respectively) compared to the vocal learners (range 9 – 30.9). Learner 2, using picture selection to communicate, increased the least amount of participation across the school day. Learner 3, who used a speech-generating device, increased the least amount on the Behavior Health Inventory. It is unclear which variable most affected the learners - the learner's method of speaking or the number of daily trials. Future research should be conducted to determine the impact of these variables.

Limitations

A limitation of this study is the need for more generality and maintenance data to demonstrate the effects of the intervention across home and community. This data would also help determine the long-term effects of the intervention. Generalization data outside of the classroom was not collected in this study. It would be essential to assess the generalizability of this intervention to determine the amount of support needed for parents and guardians.

A limitation of this study was the multiple sets of instructors and paraprofessionals taking the data for the study. Notably, a long-term substitute collected the pre-intervention data and implemented skill-based treatment, but post-intervention data was collected by his typical autistic support teacher. Therefore, it is unclear if the pre- and post-data for this student was accurately collected. Another limitation of multiple implementors is the need for fidelity data to

identify when training is needed. For instance, the student teacher in Learners 1, 6, and 7 classroom needed further support to implement skill-based treatment with fidelity. This need would not have been identified without the collection of treatment fidelity.

The public school setting led to limitations due to the inability to control for all variables. For instance, Learner 6 needed to be paired with a new student in the room, which led to increased problem behavior and decreased cooperation. Other variables included staff absences that were not filled by substitutes, schedule changes for school events such as concerts, fire drills, and assemblies, the ability of staff to implement the procedures with fidelity when the researcher was absent, and the need to multi-task in a busy classroom environment.

The limit of time also created a limitation in this study. By the end of the school year, only two of the seven learners completed the intervention with enough time to enter into the programming in place before treatment. Time was needed to review data as the researcher noted that some learners could have moved on to the next phase days earlier than when staff moved them. If students had moved to the next phase as soon as they met the criteria, more learners might have completed skill-based treatment with enough time to enter their previous programming.

Training time was limited. Some staff only received brief training during thirty-minute consultation sessions throughout the intervention. It was noted that the teacher and one of the paraeducators for Learners 1, 6, and 7 attended a three-hour training with the researcher. These learners also made the most progress, with two of them completing skill-based treatment and returning to programming.

A final limitation in the study was the researcher's dual roles as consultant and researcher. The researcher provided training and consultation as a part of her job to each of the

teams in the study. She consulted via video conferencing and interacted with implementers via Bluetooth ear buds. All consultations were recorded for inter-rater reliability and fidelity checks. To alleviate any artificial effects that may have resulted from this dual role all data was collected from school administrators with redacted names and labeled with a number (e.g. Learner 1, Learner 2). The data was analyzed prior to school teams revealing the identity of each learner to the researcher. While the researcher could surmise the identities of the learners it was not confirmed until all data had been collected and analyzed. These precautions were taken to remove the researcher from drawing conclusions prior to the analysis of the data.

Recommendations for Further Research

Future research is needed regarding the environment in which skill-based treatment is effective. This research should include replications across public school districts that cannot provide 1:1 pull-out areas to implement skill-based treatment. This research is crucial to determine if skill-based treatment conducted outside a controlled environment culminates with the same findings as studies conducted within controlled environments. The current study supports the implementation of skill-based treatment within public school classrooms, but more research is required to support implementation across a variety of types of classrooms, including general education classrooms. The current study supports the use of skill-based treatment in full-time autistic support classrooms with a student teacher ratio of 1:2 and a kindergarten classroom with special education support. Future research should continue to assess the use of skill-based treatment in these classroom as well as emotional support classrooms and other elementary and secondary school grade levels.

Research should also focus on the feasibility of implementing skill-based treatment in groups or across a classroom. In the current study, skill-based treatment was conducted with

Learners 6 and 7 sharing a play area and staff rotating trials between them. Future research should extend this to other learners and larger groups. Staffing shortages and an increased number of students with behavioral needs make this research invaluable to public school districts. The researcher is currently implementing skill-based treatment across five students in an autistic support classroom to determine the feasibility of classroom implementation. She surmises that the results will be positive given learners who do not find other students aversive. Using skill-based treatment to teach tolerance of divided attention is crucial for success in a public school setting and can be addressed through this intervention. If skill-based treatment can be effectively implemented across a classroom and in small groups, the lives of many learners will be changed.

As skill-based treatment is not effective unless the skills are generalized across socially significant contexts, more research needs to be conducted to determine the effectiveness of implementing skill-based treatment across staff and family from the beginning of the intervention. This research should compare with studies extending the treatment to others once the skills have been mastered in a controlled environment. The current study displayed the viability of using skill-based treatment to teach to generalization instead of planning to teach generalization in a treatment extension. The positive results could form a guide for other researchers to use this method for gaining generalization. Many of the students in the autistic support classroom the researcher supports do not readily generalize skills across people and contexts, so skills are taught in context and across people. This method of teaching is needed to support faster generalization for this subset of students. Further research should focus on the feasibility and effectiveness of teaching to generalization from the start. Learners 2, 3, 4, 6, and 7 remain in classroom receiving consultation support from the researcher. Data will continue to be

collected regarding their use of skills learned in skill-based treatment and their rate of acquisition of skills.

Generalization is essential in teaching a variety of mands across contexts. In the current study, Learner 7 was exposed to various mands that depended on the context of the session. He generalized all of the modeled mands without the need for direct instruction. Determining how and when to teach mands beyond the omnibus mand ("My way") will be crucial for application and social validity. Future research is needed to determine which learners can begin skill-based treatment with omnibus mands and which students are appropriate to teach a variety of mands from the beginning of the intervention. This approach was successful with Learner 4 in the current study who engaged in fluent vocalizations. However, it was not successful with Learner 5, who also engaged in fluent vocalizations. Learner 5 required the use of an omnibus mand to be successful in the early stages of skill-based treatment. Determining the variables connected to the success of Learner 4 is important when planning for further implementation.

In addition, more research is needed to further the data collected in this study. It is crucial to support a possible correlation between skill-based treatment and an increase in the rate of participation across the school day, as well as an increase in the rate of skill acquisition. The decrease and often cessation of problem behavior has been well documented. However, studies have yet to continue to collect data post-intervention regarding the rate of skill acquisition or participation rate across the school day. While the elimination of problem behavior is paramount to school success, it is important to show that this decrease in problem behavior then leads to an increase in participation across the school day and an increase in the rate of skill acquisition. Based on the results from the current study, the author predicts that more studies would also find the same correlation between mastery of skill-based treatment and the increase in participation

and skill acquisition. This data is crucial for the application of skill-based treatment to gain traction in public schools.

More research is needed regarding the continuation of data on learners following the culmination of the intervention to determine the long-term effects and how to generalize these skills to the home and community environments from the school. Supporting this generalization is the need to identify how school districts can train parents and caregivers to engage in skill-based treatment at home. The current study found that Learners 2, 4, 6, and 7 maintained skills over the summer break and the effects of skill-based treatment persisted into the new school year, new classrooms, and new staff. Learner 2 is continuing to progress through skill-based treatment, Learner 4 is fully included in a first grade classroom without the need for skill-based treatment, and Learners 6 and 7 are continuing to increase the duration of instruction tolerated across staff while participating across the school day. Further research is needed to support these findings across a large number of learners.

As staff in public schools receive various levels of general autism and behavior analysis training, further research would be prudent to determine the essential training required for implementing skill-based treatment and the frequency and duration of coaching necessary for teams to be successful. In the current study, learners whose instructors attended a three-hour training conducted by the researcher observed the most significant improvements across participation, problem behavior, skill acquisition, and Behavior Health Index ratings. The correlation between training, amount of consultation, and the success of learners in skill-based treatment will be of value to schools when implementing to ensure success for teachers and students alike.

A final area of research surrounds the implications of the use of the practical functional assessment and skill-based treatment on school district policies and system-level changes. A study including the number of restraints prior to and following implementation could lead to changes in the way districts view and treat severe problem behavior. Part of the on-boarding process for districts could include training in the foundational beliefs surrounding the practical functional assessment and school-based treatment as well as implementation guidelines. Fidelity checks across all staff could lead to accountability, and policies could change to support a hands-off, rapport building focus on problem behavior.

Summary

This study was the first completed regarding the practical functional assessment and skill-based treatment within public schools in full-time autistic support classrooms and a kindergarten classroom. None of the implementors were BCBAs. Implementors included special education teachers, paraeducators in the autistic support classrooms, and a kindergarten teacher. This statement does not suggest that the practical functional assessment and skill-based treatment can be conducted in its entirety by instructors who are not trained in behavior analysis. The author is a Board Certified Behavior Analyst. She designed each practical functional assessment, coached staff during practical functional assessments, designed skill-based treatment for each learner, and provided intensive daily coaching for a half-hour each day for at least two weeks prior to fading back supports. It is suggested that instructors only engage in this process with the supervision of a BCBA due to the complex nature of the assessment and intervention.

This is the first study to compare Behavioral Health Index Scales, participation across the school day, and skill acquisition rates before and after the intervention of skill-based treatment. Programming for all students had ceased or was stagnant due to problem behavior before

implementing a practical functional assessment and skill-based treatment. Problem behavior decreased by a mean of 98.5% for five of the seven learners. The Behavioral Health Index ratings and the percentage of participation across the school day increased for all students. The two students who continued programming after completing skill-based treatment showed an increase in the rate of skill acquisition across the verbal operants. This study demonstrates the feasibility of using practical-functional assessments and skill-based treatment in a public school setting without the use of a 1:1 pull-out setting. While more research needs to be conducted, this study shows the promise of the intervention's use as well as a correlation between the intervention and an increase in participation across the school day and an increase in the rate of skill acquisition.

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Appendix A: IRB Approval Letter

Slippery Rock University of Pennsylvania

TO: Dr. Eric Bieniek
Special Education

FROM: James Preston, D.Ed., Vice-Chairperson
Institutional Review Board (IRB)

DATE: May 24, 2024

RE: Protocol Approved

Protocol #: 2024-072-88-B
Protocol Title: The Impact of Practical Functional Assessments and Skill-Based Treatment in Public School Classrooms

The Institutional Review Board (IRB) of Slippery Rock University has received and reviewed the requested modification(s) to the above-referenced protocol utilizing the expedited review process. The IRB has approved the protocol effective May 24, 2024.

Your approved protocol will expire on May 23, 2025. You will need to submit a Progress/Final Report at least 7 days prior to the expiration date.

Enclosed are copies of approved consent forms to be copied for participants to sign.

If you complete the study within the next year, please notify the IRB with a Final Report. The Final Report form and instructions can be found on the IRB website.

Please contact the IRB Office by phone at (724)738-4846 or via email at irb@sru.edu should your protocol change in any way.

Appendix B: Hanley (2014) Open-Ended Interview

Open-Ended Functional Assessment Interview Date of Interview: _____
Developed by Gregory P. Hanley, Ph.D., BCBA-D
(Developed August 2002; Revised: August 2009 and February 2022)

Child/Client: _____ Respondent: _____
Respondent's relation to child/client: _____ Interviewer: _____

RELEVANT BACKGROUND INFORMATION

1. **His/her date of birth and current age: ____-____-_____ ____yrs ____mos Male/Female**
2. **Describe his/her language abilities.**
3. **Describe his/her play skills and preferred toys or leisure activities.**
4. **What else does he/she prefer?**

QUESTIONS TO INFORM THE DESIGN OF A FUNCTIONAL ANALYSIS

To develop objective definitions of observable problem behaviors:

5. **What are the problem behaviors? What do they look like?**

To determine which problem behavior(s) will be targeted in the functional analysis:

6. **What is the single-most concerning problem behavior?**
7. **What are the top 3 most concerning problem behaviors? Are there other behaviors of concern?**

To determine the precautions required when conducting the functional analysis:

8. **Describe the range of intensities of the problem behaviors and the extent to which he/she or others may be hurt or injured from the problem behavior.**

T*o assist in identifying precursors to or behavioral indicators of dangerous problem behaviors that may be targeted in the functional analysis instead of more dangerous problem behaviors:*

9. **Do the different types of problem behavior tend to occur in bursts or clusters and/or does any type of problem behavior typically precede another type of problem behavior (e.g., yells preceding hits)? Are there behaviors that seem to indicate that severe problem behavior is about to occur?**

To determine the antecedent conditions that may be incorporated into the functional analysis test conditions:

10. **Under what conditions or situations are the problem behaviors most likely to occur?**
11. **Do the problem behaviors reliably occur during any particular activities?**
12. **What seems to trigger the problem behavior?**
13. **Does problem behavior occur when you break routines or interrupt activities? If so, describe.**
14. **Does the problem behavior occur when it appears that he/she won't get his/her way? If so, describe the things that the child often attempts to control.**

To determine the test condition(s) that should be conducted and the specific type(s) of consequences that may be incorporated into the test condition(s):

15. **How do you and others react or respond to the problem behavior?**

16. **What do you and others do to calm him/her down once he/she engaged in the problem behavior?**
17. **What do you and others do to distract him/her from engaging in the problem behavior?**

In addition to the above information, to assist in developing a hunch as to why problem behavior is occurring and to assist in determining the test condition(s) to be conducted:

18. **What do you think he/she is trying to communicate with his/her problem behavior, if anything?**
19. **Do you think this problem behavior is a form of self stimulation? If so, what gives you that impression?**
20. **Why do you think he/she is engaging in the problem behavior?**

To ensure that the analytic context is properly designed for developing the most important skill branches.

21. **Besides communication, toleration, and communication,**
    a. **What skills would make this child/client's life better/more joyful?**
    b. **What are the three most useful things the child/client could be taught to do?**

What skills, if this child/client had them, would make your life or the lives of other close caregivers better?

Appendix C: Frequency of Problem Behavior Data Sheet

BASELINE: STUDENT A

R1 (Dangerous Behaviors)	R2 (Precursor/Nondangerous Behaviors)

Student A **Date: _____**

Problem Behavior per Hour

Time	Number of Dangerous (R1) Behaviors	Number of Nondangerous (R2) Behaviors
8:40-9:40		
9:40-10:40		
10:40-11:40		
11:40-12:40		
12:40-1:40		
1:40-2:40		
2:40-3:40		

Appendix D: Duration of Participation Data Sheet

Student A Baseline Participation – Whole Interval Recording

	7:40	7:45	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40					
Participating																		
Not Participating																		

	8:45	8:50	8:55	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15
Participating																			
Not Participating																			

	10:20	10:25	10:30	10:35	10:40	10:45	10:50	10:55	11:00	11:05	11:10	11:15	11:20	11:25	11:30	11:35	11:40	11:45
Participating																		
Not Participating																		

	11:50	11:55	12:00	12:05	12:10	12:15	12:20	12:25	12:30	12:35	12:40	12:45	12:50	12:55	1:00	1:05	1:10	1:15
Participating																		
Not Participating																		

	1:20	1:25	1:30	1:35	1:40	1:45	1:50	1:55	2:00	2:05	2:10	2:15	2:20	2:25	2:30	2:35	2:40	2:45
Participating																		
Not Participating																		

	2:50	2:55	3:00	3:05	3:10	3:15	3:20	3:25	3:30	3:35	3:40							
Participating																		
Not Participating																		

Directions: Mark either participating or not participating box for each 5-minute interval. If behavior changes during interval, mark part of each box to note.

Appendix E: Cold Probe Data Sheet

Name:

Week of:

Weekly Probe Sheet

	# days active	Operant	Target Skill	Previous Y	Mon	Tue	Wed	Thur	Fri
1					Y N	Y N	Y N	Y N	Y N
2					Y N	Y N	Y N	Y N	Y N
3					Y N	Y N	Y N	Y N	Y N
4					Y N	Y N	Y N	Y N	Y N
5					Y N	Y N	Y N	Y N	Y N
6					Y N	Y N	Y N	Y N	Y N
7					Y N	Y N	Y N	Y N	Y N
8					Y N	Y N	Y N	Y N	Y N
9					Y N	Y N	Y N	Y N	Y N
10					Y N	Y N	Y N	Y N	Y N
11					Y N	Y N	Y N	Y N	Y N
12					Y N	Y N	Y N	Y N	Y N
13					Y N	Y N	Y N	Y N	Y N
14					Y N	Y N	Y N	Y N	Y N
15					Y N	Y N	Y N	Y N	Y N
16					Y N	Y N	Y N	Y N	Y N
17					Y N	Y N	Y N	Y N	Y N
18					Y N	Y N	Y N	Y N	Y N
19					Y N	Y N	Y N	Y N	Y N
20					Y N	Y N	Y N	Y N	Y N
21					Y N	Y N	Y N	Y N	Y N
22					Y N	Y N	Y N	Y N	Y N
26					Y N	Y N	Y N	Y N	Y N
27					Y N	Y N	Y N	Y N	Y N

Red: receptive ID **Green: Tact** **Yellow: Echoic** **Purple: Motor Imitation** **Blue: Intraverbal**

Criteria for mastery: _____ consecutive yes'

If program change made, indicate by drawing a phase change line on the corresponding date of the applicable target.

Notes/Reminders:

Appendix F: Behavioral Health Index

FTF Behavioral Consulting | acorn HEALTH

CHILD / CLIENT: ______
SCORER: ______
TODAY'S DATE: ______
INITIAL AST. DATE: ______

Behavioral Health Index

This document helps parents, clinicians, insurers, and other partners track a child's progress with Applied Behavior Analysis (ABA) therapy for autism

BEHAVIORAL HEALTH INDEX	1	2	3	4	INT. AST.	AST. TODAY
Critical Skills						
Play / Leisure	☐ No play skills	☐ Isolate play with objects & electronics	☐ Parallel play with others and engagement when alone	☐ Interactive and extended play with others and engagement when alone		
Stereotypic Behavior	☐ Engages in intractable stereotypy & redirection occasions SPB	☐ Engages in stereotypy that interferes with learning and socializing	☐ Engages in stereotypy that sometimes requires redirection	☐ No stigmatizing or interfering stereotypy		
Functional Communication: Omnibus Mands	☐ No independent omnibus mands	☐ Via simple response occurring in one context with only a few people	☐ Via a complex response occurring in one context & with various people	☐ Independent, omnibus mands across various people & contexts		
Functional Communication: Specific Mands	☐ No independent specific mands	☐ Via simple responses occurring in one context with only a few people	☐ Via a complex response occurring in one context with various people	☐ Multiple specific mands across various people & contexts		
Delay Tolerance	☐ SPB ocurs when delays or denials are presented	☐ Mild PB is usually occasioned by denials	☐ No PB during delays or denials across a few contexts	☐ No PB during delays or denials across people & all contexts		
Contextually Appropriate Behavior (CAB)	☐ Doesn't engage in any CAB when reinforcers are unavailable; instead SPB is occasioned by denials	☐ Reliably relinquishes, transitions, completes a few instructed responses in single activity/context	☐ Reliably completes a few instructed responses in multiple activities within single context	☐ Reliably engages in varied and extended CABs across various people & contexts		
Behavior Management						
Behavior Medication	☐ Two or more medications being used to manage SPB	☐ One medication being used to manage SPB		☐ No medications being used to manage SPB		
Behavior Modification	☐ Rich schedules of edible rewards	☐ Rich schedules of tokens exchangeable for edible & tangible rewards	☐ Lean schedule of tokens exchangeable for tangibles & activities	☐ No programmatic use of arbitrary rewards or punishers		
Behavior Mollification	☐ Strong programmatic focus on mollification / avoidance tactics	☐ Programmatic use of mollification for safety while skills are developed	☐ Infrequent use of mollification for safety while skills are developed	☐ No programmatic use of mollification / avoidance tactics		
Restraint & Seclusion	☐ Regular & noncontingent use of protective equipment, holds, or TO	☐ Regular & contingent use of protective equipment, holds, or TO	☐ Rare use of protective equipment, holds, or TO	☐ No use of protective equipment, holds, or TO		
Injuries to Self or Others	☐ More than one staff / client injury in last 3 months	☐ One staff or client injury in last 3 months		☐ No staff or client injuries in last 3 months		
Location & Social Restriction	☐ Almost always seperate from peers with staff hovering at distance	☐ Usually in separate room with staff in close proximity	☐ Usually grouped with peers but restricted to certain contexts	☐ Grouped with peers and accesses most contexts with and without staff		

Health Repertoires

Appendix G: Additional Trials Data Sheet

Additional Sessions Throughout School Day

Date	Length of Session	Number of EOs Presented
		FCR TR CAB1 CAB2 CAB3 CAB4
		FCR TR CAB1 CAB2 CAB3 CAB4
		FCR TR CAB1 CAB2 CAB3 CAB4
		FCR TR CAB1 CAB2 CAB3 CAB4
		FCR TR CAB1 CAB2 CAB3 CAB4
		FCR TR CAB1 CAB2 CAB3 CAB4

Appendix H: Treatment Fidelity

Treatment Fidelity List

Instructor Name:	
Date:	
Target:	
Learner:	

Intervention Session				
Client led	All synthesized reinforcers are present	☐ Yes	☐ No	
	Adult can define HRE (happy, relaxed, engaged) in measurable terms and ensures the learner is HRE for at least 30 seconds.	☐ Yes	☐ No	
	Adult can define reasonable requests and honors these throughout the session.	☐ Yes	☐ No	
	Adult is available to the learner (the proximity preferred by the learner, reciprocating social bids of attention, providing the attention preferred by the learner, looking towards the learner) throughout session	☐ Yes	☐ No	
Adult led	Adult does not warn learner how much work is coming.	☐ Yes	☐ No	
	Adult clearly progresses the EO (Stands up, clap, provide instruction to stop SR+ and work, approach)	☐ Yes	☐ No	
	Adult delivers clear instructions	☐ Yes	☐ No	
	If needed, adult uses 3-step prompting procedure (Sd-wait three seconds, model -wait 3 seconds, physical prompt)	☐ Yes	☐ No	
	During EO adult allows access to only EO materials	☐ Yes	☐ No	
	Adult sets high expectation and holds the learner to this	☐ Yes	☐ No	
	Adult praises each step of compliance	☐ Yes	☐ No	
	Adult defines and reinforces every R1	☐ Yes	☐ No	
	Adult reinforces compliance with the synthesized reinforcers	☐ Yes	☐ No	
	Adult offers surprise shorties (jackpot reward as immediate reward for compliance)	☐ Yes	☐ No	
End of Session (10-15 minutes) [if items are mastered, it may take up to 20 minutes]				
	The adult defines safe, dignified, and televisable ensures that the session takes place in this manner.	☐ Yes	☐ No	
	The door remained open throughout the session and learner was allowed the freedom to leave the setting	☐ Yes	☐ No	

	The learner was HRE throughout the session, including throughout the EO. (When an R1 or multiple R2's are present the answer is no)	☐ Yes	☐ No	
	R1's and/or R2's turned off after delivery of the synthesized reinforcers	☐ Yes	☐ No	
	Learner returned to HRE within 3-5 seconds contingent upon the delivery of the synthesized reinforcers	☐ Yes	☐ No	

Appendix I: Universal Protocol Fidelity Check

Universal Protocol Implementation Integrity Form

Expectation	+/-
1. Show continuous positive regard and empathy a. Appear positive, confident, and caring at all times b. Make it clear that you are available to the client (do not appear distracted) c. Provide non-judgmental listening (restate assertions and declarations to convey understanding)	
2. Enrich the environment a. Ensure multiple preferred activities are available and arranged to allow for free choice b. Rotate and vary activities, even if it's unclear if the client will prefer the new ones c. Facilitate a *shared* experience versus a supervised experience	
3. Follow the client's lead to the extent possible a. Allow clients to wander and explore within non-dangerous boundaries b. Answer all questions asked by the client, even if they are repetitive c. Honor all reasonable requests (verbal or non-verbal), even they are repetitive, and do so genuinely	
4. Invite the client to participate in scheduled activities a. Consider the schedule a guide; it's most important to follow the client's lead	
5. Limit non-essential demands a. Limit instructions in general b. Limit questions unless following client's conversational lead or if questions are preferred by the client c. Do not attempt to limit or redirect motor, object, or vocal stereotypy	
6. When presenting essential demands, make them less aversive a. Consider first whether the demand is truly essential and omit if not essential b. Provide choices prior to the provision of the demand c. Offer materials to complete the task without issuing a demand vocally (e.g., provide meal without saying "eat your lunch"), or provide non-directive prompting ("What do you do with this?") d. Provide as much support as needed for the client to be successful; consider again a shared experience	
7. Upon the first instance of problem behavior or an indication problem behavior is likely, immediately provide access to all reinforcers. a. Acknowledge the communicative intent of the behavior empathetically b. Terminate any existing demand, expectation, or non-preferred interaction c. Provide the client some space but continue to be available to them d. Provide access to any tangible or activity reinforcers that are (or were just) available e. Listen for any requests made by the client and attempt to satisfy them f. Document the interaction that preceded problem behavior, type of problem behavior (dangerous or non-dangerous), and the events that when removed/provided stopped the problem behavior *Do not work through minor PB or use planned ignoring. Listen to what the client is communicating; respond accordingl*	
Total: *Mastery criteria: 90% correct across 2 consecutive 10-min observations* *Score "+" if performed correctly and independently.* *Score "-" if performed incorrectly (or if prompted by supervisor).*	/

Appendix J: Interobserver Agreement

Observer: _____

Student: _____ Video:_____

	SR+	
Duration		
Behavior	R1	R2

	EO	
Duration		
Behavior	R1	R2
Cooperation		
Target		
Independent		

APPENDIX K: RATE OF SKILL ACQUISITION

Rate of Skill Acquisition

	Learner 6		Learner 7	
Tact Noun			Pre 33 Days	Post 7 Days
Tact Verb/Noun	Pre 8 Days	Post 11 Days		
Tact Letter/Number			Pre 19 Days	Post 5 Days
Tact Part/Feature	Pre 26 Days	Post 10 Days		
Tact Function	Pre 27 Days	Post 4 Days		
Tact Class	Pre 20 Days	Post 3 Days		
Edmark (lesson completion)			Pre 4.5 Days	Post 4.8 Days
Tact Sight Words	Pre 14 Days	Post 14 Days	Pre 44 Days	Post 3 Days
Reversal Tact Function				3 Days
Telling Time to Half Hour				6.5 Days
Mean	Pre 19 Days	Post 8 Days	Pre 25 Days	Post 5 Days

APPENDIX L: TREATMENT FIDELITY RAW DATA

Treatment Fidelity Scores

Learners	FCR	TR	CAB 1	CAB 2	CAB 3	CAB 4	CAB 5	CAB 6	MEAN
Learner 1	U=100% I=84%	U=100% I=89%	U=100% I=95%	U=100% I=100%	U=100% I=79%	U=100% I=100%			U=100% I=91%
Learner 2	U=100% I=89%	U=100% I=100%	U=100% I=100%	U=100% I=89%	U=100% I=95%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=97%
Learner 3	U=100% I=79%	U=100% I=79%	U=100% I=89%	U=100% I=84%	U=100% I=100%	U=100% I=84%			U=100% I=86%
Learner 4	U=100% I=95%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=99%
Learner 5	U=100% I=100%	U=100% I=79%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=79%	U=100% I=79%		U=100% I=91%
Learner 6	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%
Learner 7	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%	U=100% I=100%

Note: U = Universal Protocol; I = Intervention

APPENDIX M: INTER-RATER RELIABILITY RAW DATA

	Number of Sessions Recorded	Number of Sessions with IOA	Sessions for IOA	Raw Inter-rater Agreement	Mean Inter-rater Agreement per Session	Mean Inter-rater Agreement
Learner 1	17	4	Day 2	Behavior 100% Duration 94% Independence 100%	98%	97%
			Day 6	Behavior 94% Duration 100% Independence 100%	98%	
			Day 10	Behavior 100% Duration 89% Independence 100%	96%	
			Day 15	Behavior 100% Duration 100% Independence 100%	100%	
Learner 2	21	5	Day 4.2	Behavior 100% Duration 100% Independence 100%	100%	95%
			Day 6	Behavior 84% Duration 83% Independence 100%	89%	
			Day 10	Behavior 95% Duration 100% Independence 100%	98%	
			Day 14.1	Behavior 88% Duration 100% Independence 88%	92%	

(Appendix M continued)

	Number of Sessions Recorded	Number of Sessions with IOA	Sessions for IOA	Raw Inter-rater Agreement	Mean Inter-rater Agreement per Session	Mean Inter-rater Agreement
Learner 3	12	3	Day 2	Behavior 100% Duration 100% Independence 100%	100%	97%
			Day 5	Behavior 87.5% Duration 100% Independence 100%	96%	
			Day 10	Behavior 84% Duration 100% Independence 100%	95%	
Learner 4	17	4	Day 3	Behavior 94% Duration 100% Independence 100%	98%	98%
			Day 7	Behavior 88% Duration 100% Independence 100%	96%	
			Day 11	Behavior 94% Duration 100% Independence 100%	98%	
			Day 15	Behavior 100% Duration 100% Independence 100%	100%	
Learner 6	2	1	Day 2	Behavior 100% Duration 80% Prompt Level 100%	93%	93%

APPENDIX N: NUMBER OF SCHOOL DAYS TO MASTERY RAW DATA TABLE

Learner	FCR	TR	CAB 1	CAB 2	CAB 3	CAB 4	CAB 5	CAB 6	Total
1	1	5	2	5	2	6			21
2	1	1	4	1	15	19	54+		95+
3	1	4	1	8	1	10	1+		26+
4	6	4	2	1	5	2	18	23	61
5	1	3	1	1	1	18	15		40
6	1	1	2	1	5	14	9	7	40
7	1	2	9	1	5	5	1	25	49
Mean	1.7	2.9	3	2.6	4.9	10.6	6.1	18.3	47.4

Note: FCR = functional communication response
TR = tolerance response
CAB 1 = relinquishing reinforcement
CAB 2 = transition
CAB 3 = 3 easy responses
CAB 4 = short sets of new skills dependent on IEP team decision
CAB 5 = long sets of new skills
CAB 6 = sets of new skills with a challenge

APPENDIX O: RAW DATA PRE AND POST BEHAVIORAL HEALTH INDEX RATINGS

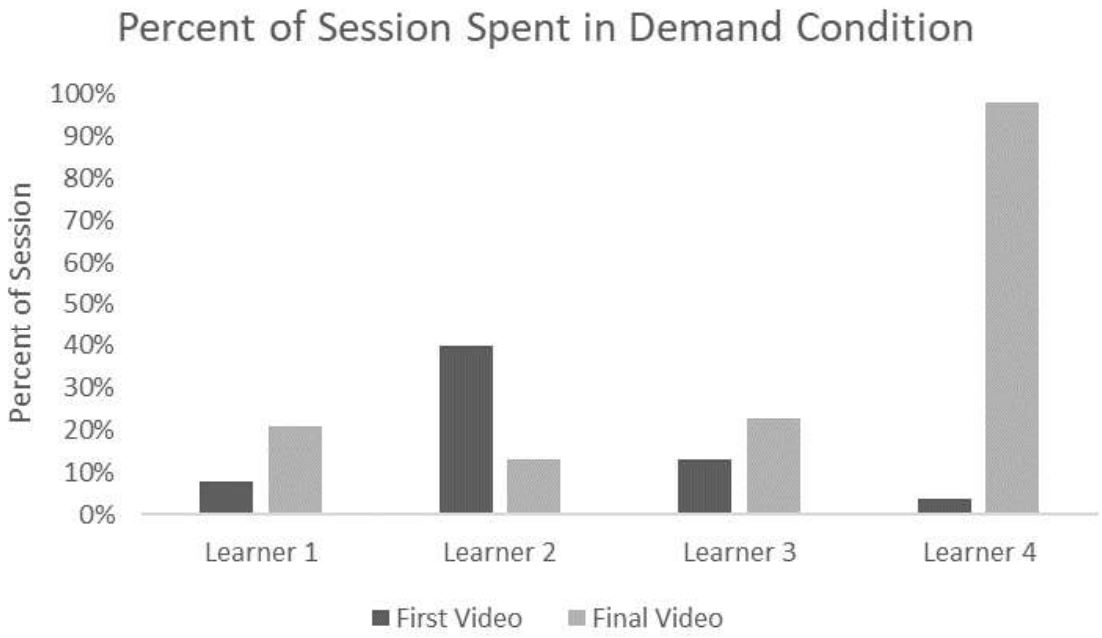
Behavioral Health Index Scores

	Learner 1			Learner 2			Learner 3			Learner 4		
	Pre	Post	Percent Change	Pre	Post	Percent Change	Pre	Post	Percent Change	Pre	Post	Percent Change
Critical Skills (24 possible)	7	12	71%	12	15	25%	10	13	30%	13	17	31%
Behavior Manage-ment (24 possible)	10	16	60%	8	11	38%	20	20	0%	15	20	33%
Health Repertoire (12 possible)	5	8	60%	7	8	14%	7	7	0%	9	9	0%
Total (60 possible)	22	36	64%	27	34	26%	37	40	8%	37	46	24%

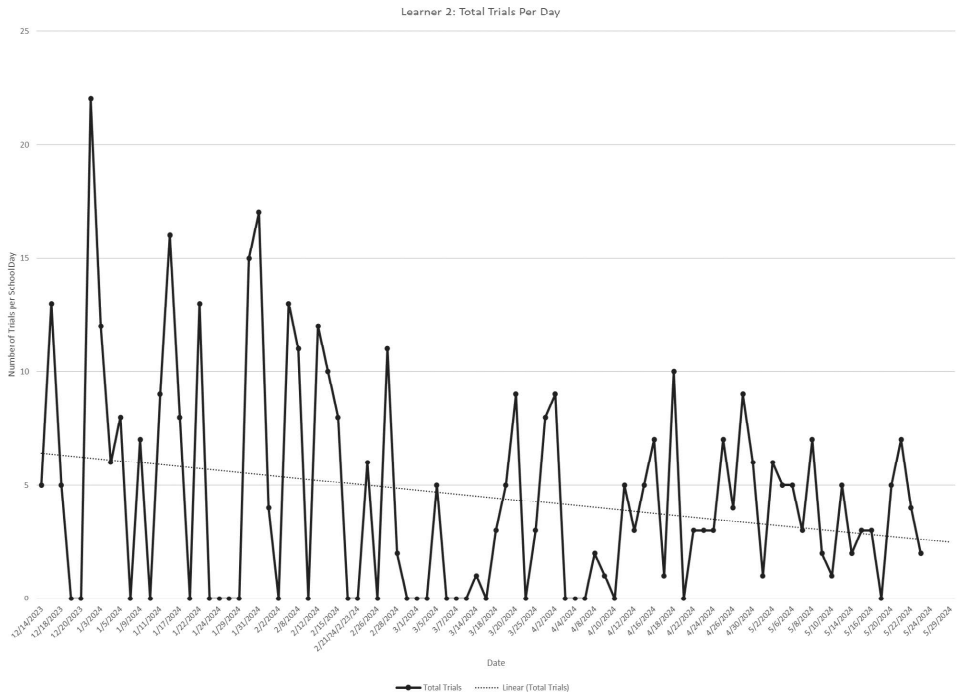
Appendix O (con'd)

	Learner 5			Learner 6			Learner 7			Mean		
	Pre	Post	Percent Change	Pre	Post	Percent Change	Pre	Post	Percent Change	Pre	Post	Percent Change
Critical Skills (24 possible)	17	21	24%	12	21	75%	8	22	175%	11	17	55%
Behavior Manage-ment (24 possible)	15	17	13%	17	21	24%	9	21	133%	13	18	38%
Health Repertoire (12 possible)	10	10	0%	10	10	0%	8	9	13%	8	9	13%
Total (60 possible)	42	48	10%	39	52	33%	25	52	108%	33	44	33%

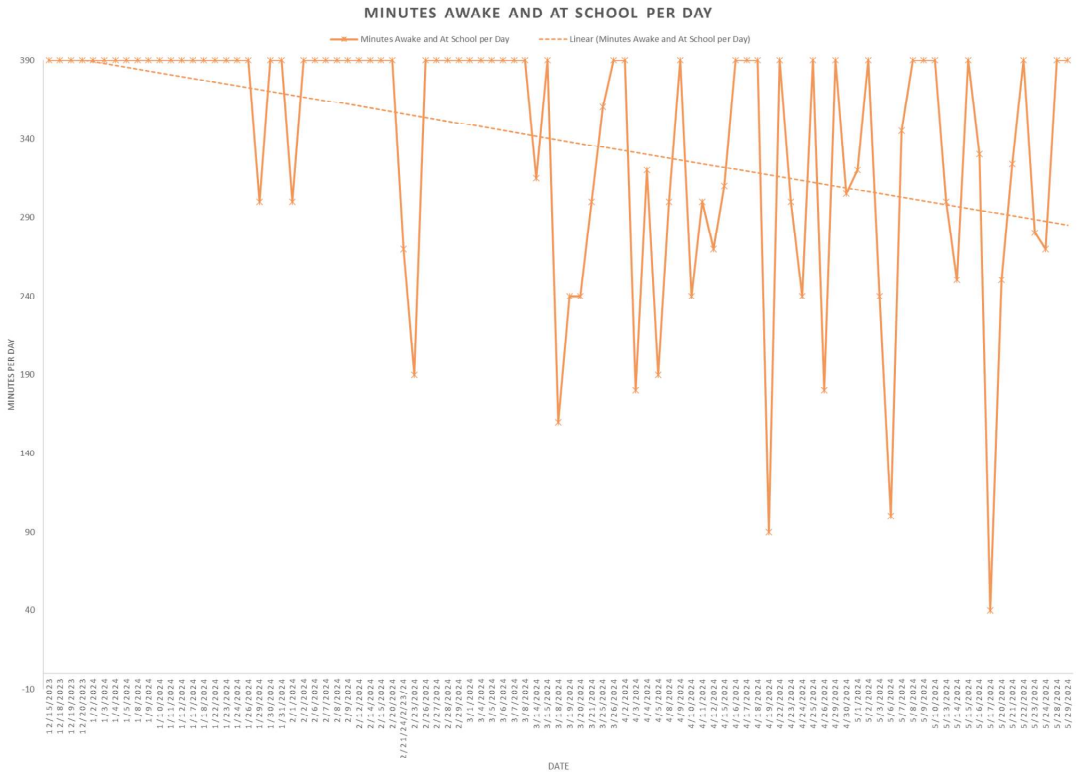
APPENDIX P: PERCENT OF SESSION SPENT IN DEMAND CONDITION



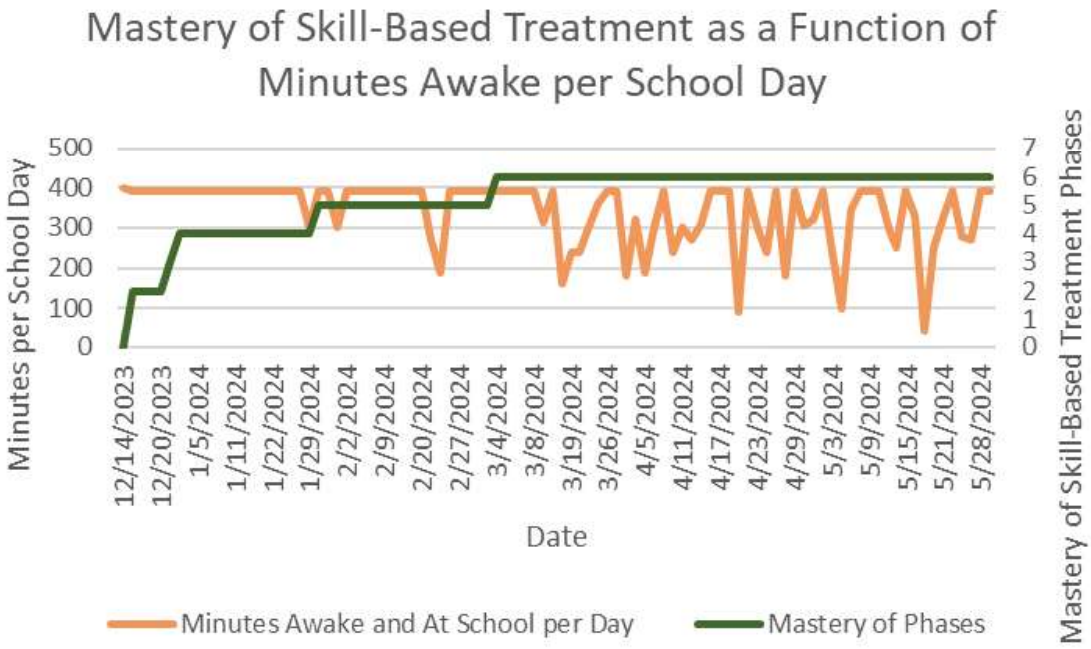
APPENDIX Q: LEARNER 2: NUMBER OF TRIALS PER DAY



APPENDIX R: LEARNER 2: MINUTES AWAKE AND AT SCHOOL PER DAY

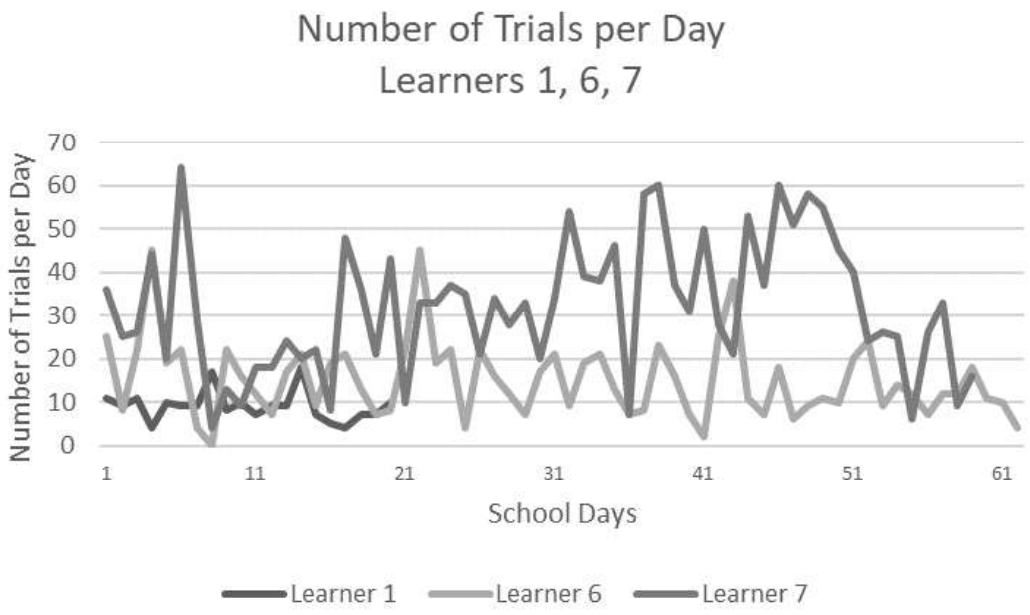


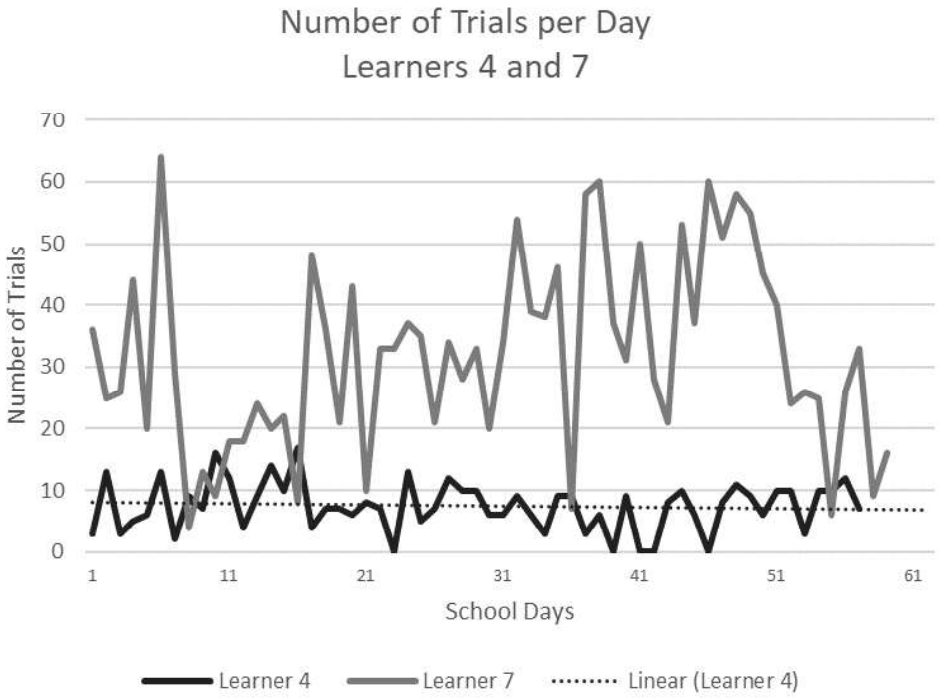
APPENDIX S: LEARNER 2: MASTERY OF SKILL-BASED TREATMENT AS A FUNCTION OF MINUTES AWAKE PER SCHOOL DAY

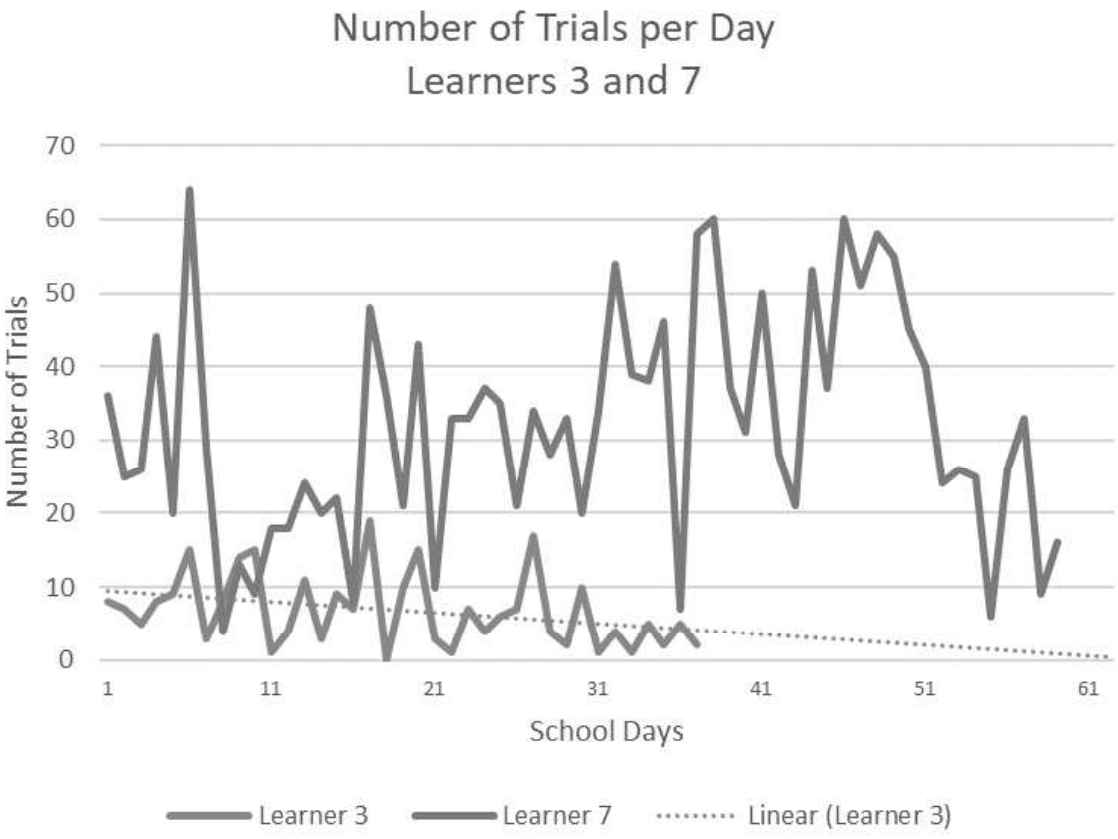


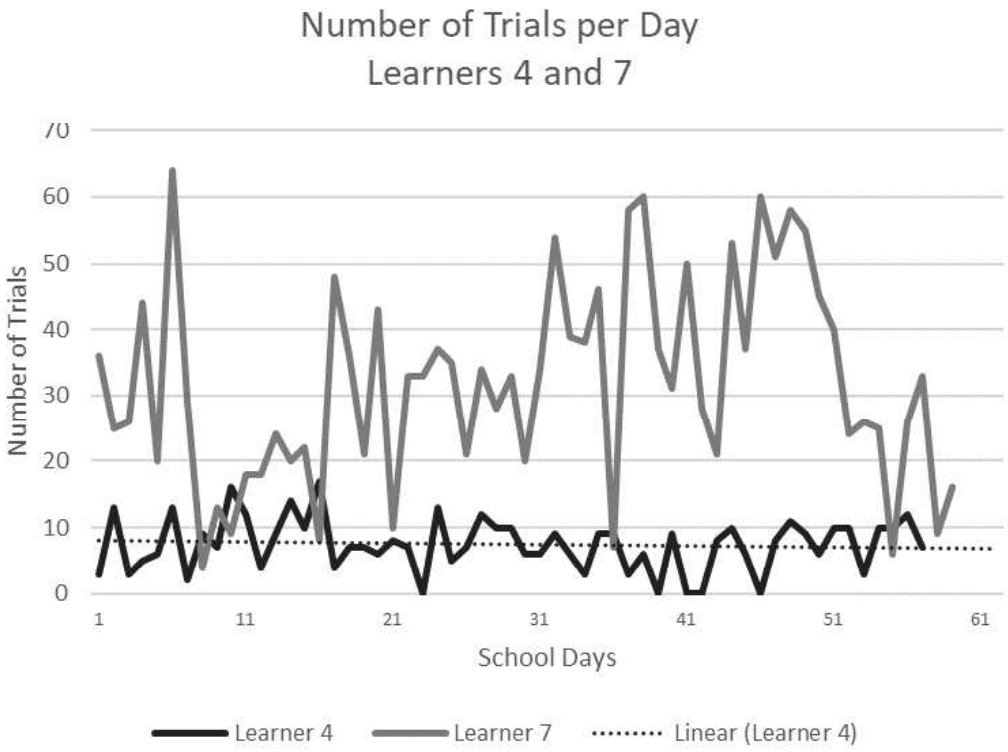
APPENDIX T: NUMBER OF TRIALS PER DAY WITH TRENDLINES

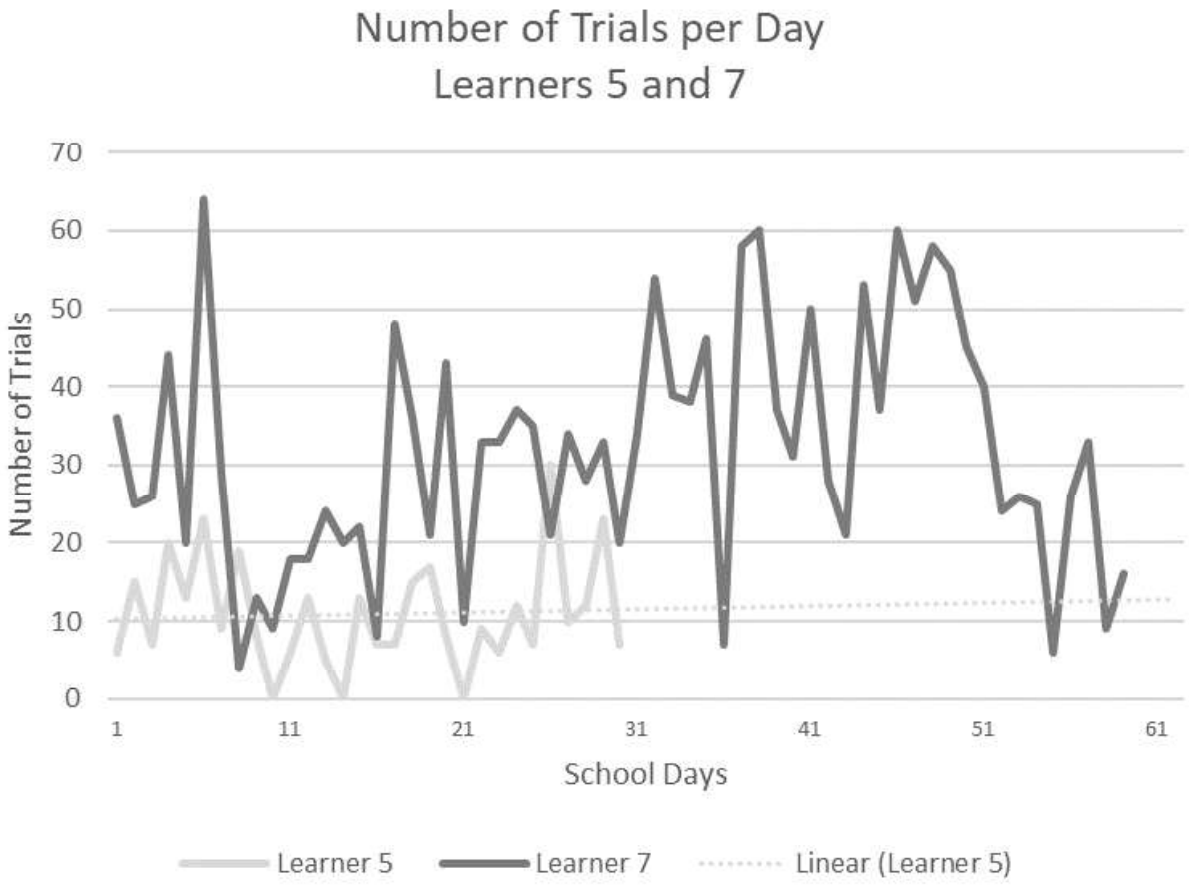
Number of Trials per Day: Learners 1, 6, 7




Number of Trials per Day
Learners 4 and 7
70
60
50
40
30
20
10
0
Number of Trials
1
11
21
31
41
51
61
School Days
Learner 4
Learner 7
Linear (Learner 4)


Number of Trials per Day
Learners 3 and 7
70
60
50
40
30
20
10
0
Number of Trials
1
11
21
31
41
51
61
School Days
Learner 3
Learner 7
Linear (Learner 3)


Number of Trials per Day
Learners 4 and 7
70
60
50
40
30
20
10
0
Number of Trials
1
11
21
31
41
51
61
School Days
Learner 4
Learner 7
Linear (Learner 4)


Number of Trials per Day
Learners 5 and 7
70
60
50
40
30
20
10
0
Number of Trials
1
11
21
31
41
51
61
School Days
Learner 5
Learner 7
Linear (Learner 5)