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Applied Behavior Analysis Therapy for Children with Autism Spectrum Disorder and the Impact of Environment on Treatment Outcomes

James Adkins
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

James J. Adkins

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Anthony Perry, Committee Chairperson, Psychology Faculty
Dr. Steven Little, Committee Member, Psychology Faculty
Dr. Virginia Salzer, University Reviewer, Psychology Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

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Abstract

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James J. Adkins

MPhil, Walden University, 2020

MA, Marshall University 2000

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Autism spectrum disorder (ASD) effects growing numbers of children and effective treatment is essential for families to overcome the challenges associated with ASD. Applied behavior analysis treatment has been tailored to address the unique learning needs of children with ASD. The purpose of this study was to examine the extent to which treatment environment impacted language milestones and barriers among children with ASD. Behaviorism and applied behavior analysis served as the framework for the study. A nonexperimental quantitative mixed design with two independent variables was used. The between-subjects independent variable was type of treatment environment (home vs. clinic). The within-subjects independent variable was time of assessment; the dependent variable was Verbal Behavior Milestones Assessment. A 2 X 2 mixed ANOVA for language milestone scores indicated a significant main effect of time of assessment. This showed a significant increase in language milestones scores between the baseline assessment and the second assessment. A 2 X 2 mixed ANOVA for language barrier scores indicated a significant main effect of time of assessment. There was a significant decrease in language barrier scores between the baseline assessment and the second assessment. There was no significant main effect for type of environment or interaction between type of environment and time of assessment. The consideration by families and clinicians of whether to utilize a clinic-based model or in-home based model of treatment may have more significant ramifications other than location, most importantly the effectiveness of treatment that increases skills and decreases behavioral barriers resulting in positive social change.

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Dedication

I dedicate this to my wife Stefanie, who has relentlessly supported me through my program and many life endeavors. I am forever grateful for your love. I love you.

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First and foremost, I want to extend my gratitude to Dr. Perry. You have encouraged me in my Ph.D. pursuits and exceeded my expectations as a chair. Thank you, Dr., Little for all your support and guidance. Thank you, Dr. Sickle for sticking with me through this journey. I want to also thank my student success advisor Cat Heck, who helped me turn the corner with her dedication to student success!

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Chapter 1: Introduction to the Study

Applied behavior analysis (ABA) is a methodology that focuses on the role of the environment and the process of learning to improve problem behaviors in disorders, such as autism spectrum disorder (ASD, Mohammadzaheri et al. 2014). Most treatment approaches for ASD are conducted within clinical or in-home settings. The use of ABA, which entails various behavioral intervention approaches, is grounded in the principle's behaviorism to improve behaviors in the treatment of ASD. Although ABA has shown effectiveness in behavioral interventions in ASD, various researchers have identified the need for further research on the efficacy of ABA on ASD behavioral change in multiple environmental settings, such as home, community, school, and clinical settings (Mohammadzaheri et al. 2014; Schreibman et al., 2015; Strand & Eldevik, 2018). Therefore, investigating the role of environmental setting on the effectiveness of ABA intervention is needed to inform strategies that can be generalized across settings and those specific to a particular environmental setting.

This study will contribute to positive social change by increasing insights into the potential impact environment may play in treatment outcomes. The consideration by families and clinicians of whether to utilize a clinic-based model of treatment or in-home based treatment may have more significant ramifications other than location, most importantly the effectiveness of treatment. This chapter will provide an overview of research examining ABA interventions with children diagnosed with ASD. In addition, I will summarize the literature on the importance of treatment setting and ABA treatment outcomes. In the purpose section I will describe the non-experimental research study, the

research questions, and hypotheses. The theoretical foundation for this study is behaviorism and ABA and will be briefly discussed as to how the theory is related to the current study. The nature of the study section will provide a rationale for the design, describe the variables of interests, and summarize the methodology. Finally, this chapter will offer descriptions and definitions of key concepts associated within the field of ABA and ASD treatment followed by a discussion of the assumptions and scope and delimitations. The chapter ends with the significance and limitations of the study.

Background

Smith and Eikeseth (2010) discussed the renowned works of Lovaas (1987) in ABA interventions, who in the 1960s demonstrated the effectiveness of behavioral analysis approaches in reducing symptoms among children with behavioral challenges, and specially children with ASD. The authors acknowledged the claim made by Lovaas that ABA interventions need to be applied at the early stages of development in order to be successful. Lovaas's (1987) findings reported significant reduction in ASD symptoms among nine out of the 19 participants such that it was not easy to distinguish them from children with normal development. While the study focused on only one environment (in-clinic setting), it revealed that ABA-based interventions are highly effective in a clinic setting.

However, Smith and Eikeseth (2010) noted studies similar to Lovass (1987) lacked clear criteria for determining areas of specific improvement other than a reduction in ASD symptoms. In contrast, studies such as Green (1996), Nuzzolo-Gomez et al. (2002) and Lerman et. al., (2004) acknowledged the importance of establishing

operational definitions of improvement in specific domains (e.g., language development, intelligence, etc.) before evaluating the efficacy of ABA-based treatment for children with ASD. Some researchers have described improvement as the complete restoration of social, communication, and cognitive skills while others construe improvement in terms of reduction in the severity of ASD symptoms. Both Green (1996) and Lerman et al. (2004) provided evidence of the development of cognitive, social, and communication skills as well as a trivial reduction of symptoms among children treated with ABA-based therapies.

Unlike Lovass' (1987) study that was completed in a clinical setting, Fava et al. (2011) and Schreibman et al. (2015) focused on the natural setting for children with ASD. Schreibman et al. (2015) discussed implementation of naturalistic developmental behavioral interventions in a natural setting, which included mutual control of reinforcement access between the ABA therapist and the focus child. This is consistent with Fava et al. (2011) who showed a decline in autism diagnostic observation schedule total scores (i.e., reduction in ASD symptoms) for autistic children who could master learning outcomes in a natural home setting. Schreibman et al. (2015), Fava et al. (2011) who compared the progress of children in the natural home setting and clinical settings and found children with ASD progressed in both naturalistic and other treatment environments, the children in more natural environment, where parents could be included achieved more generalization of skills and effective treatment outcomes.

Whereas Fava et al. (2011) and Schreibman et al. (2015) focused on common treatment approaches and naturalistic home settings in their studies involving children

with ASD, Mohammadzaheri et al. (2014) contrasted the differences between pivotal response training commonly used in ‘in-home’ treatment programs and the conventional early intensive behavioral intervention for children with ASD. The authors found that pivotal response training was highly effective in improving formal targeted and non-targeted areas of behaviors within 90 days following the implementation of ABA-intervention. This is similar to Green (1996), Nuzzolo-Gomez et al. (2002), and Lerman et. al., (2004), who emphasize the significance of establishing the meaning of improvement through the reduction of problem behaviors associated with the symptoms of ASD and the acquisition of communication and social skills.

There is a gap in the literature as to whether different treatment environments have an impact on ABA treatment outcomes for children with ASD beyond reducing severity of ASD symptoms. There are many studies comparing and contrasting various components of ABA treatment and assessment of various behavioral domains, however limited research exists examining the role of the environment in which treatment is implemented.

Problem Statement

Schreibman et al. (2015) described applied behavior analysis as understanding how the environment impacts and can change behavior. Some of the methods more commonly associated with science as it relates to interventions for autism spectrum disorder are early intensive behavior interventions, pivotal response training, discrete trial teaching, natural environmental teaching, and verbal behavior intervention. These treatment modalities of ABA have specific teaching methodologies that all fall under the

broader science of ABA (CDC, 2020). While many sub-definitions exist on how to apply the principles of ABA, these basic treatment modalities can occur in different treatment settings (e.g., home, school, clinic, etc.). This is the focus of the current study. Specifically, I will examine the possible differences in language acquisition milestones and barriers among children with ASD who received treatment in the home versus those who received treatment in a clinic setting.

ASD is a developmental condition that affects social and emotional understanding and reciprocity, communication, restricted behavioral patterns, and interests (American Psychiatric Association [APA], 2013). While previous research has been done that included behavioral symptom outcomes while using ABA as the intervention with ASD (e.g., Fava et al., 2011), researchers have called for additional investigations addressing how future ABA treatment could be improved. For example, Schreibman et al. (2015) contended that there is a need to test the long-term effectiveness of ABA treatment in a naturalistic environment. Strand and Eldevik (2018) also recently called for future studies to more systematically replicate ABA interventions across settings such as home, community, and the school environments. The authors suggested such approaches will help identify the best ways to improve problem behaviors at a reduced cost by reducing the overhead cost associated with brick-and-mortar locations, while increasing parent involvement in treatment by allowing more direct involvement in treatment that could not be obtained in an in-clinic model with other children in treatment.

Strand and Eldevik's (2018) case study of a child with an ASD diagnosis was a replication of a previous case study conducted by Slaton et al. (2014). Strand and Eldevik

extended the previous results by conducting the study in a home setting rather than in a clinic setting, which required minor procedural adjustments to accommodate the environment. The study replicated previous results to the original clinic-based study and found a reduction in ASD problem behaviors and an increase in appropriate verbal behaviors in the child with ASD. The authors suggested that future research with ABA should increase parent involvement in home settings. Parental training and parent participation are common during "in-home" services, and participation of parent training is usually accounted for by attendance. Such approaches are expected to help identify the best ways of decreasing problem behaviors at a reduced cost and increased parent involvement (Strand & Eldevik, 2018). Furthermore, results from the case study provided evidence that in-home models can be more cost-effective, shorter in duration, and more convenient for families who cannot visit a clinic for treatment. Evidence also indicated that ABA behavioral therapies within ASD can be generalized from clinic to home settings, but limited research is found beyond this one case study regarding developmental outcomes.

In assessing problem behaviors in children with ASD, Lindgren et al. (2016) compared behavioral outcomes and costs of evidence-based ABA treatments in three different delivery methods including clinic-based telehealth (conducted by parents at clinics), home-based telehealth (conducted remotely by coaching consultants), and in-home therapy (conducted by parents at home) for children with ASD. Each treatment model included some form of remote assistance from professionals. The results indicated that all three delivery methods decreased problem behaviors that are associated with ASD

(e.g., aggression, etc.). Although there were no significant differences in outcomes based on method of treatment delivery, the two models that included home delivery showed slightly better outcomes than the clinic-based method. In response, the authors suggested that statistical differences may have been achieved with larger samples and greater power to detect outcome differences. The authors further argued that their results highlighted the importance of continuing to uncover factors that might influence the sustainability of delivery methods, including those done in real-world settings.

Similar to Lindgren et al. (2016), the proposed study will assess outcome differences between home and clinic treatment. However, there will be no remote assistance included in the proposed research. As such, this study will examine the possibility that differences between home and clinic treatment setting. The proposed study will assess potential differences in language acquisition milestones and barriers among children with ASD who received ABA treatment in a clinical setting and those who receive the treatment in an in-home setting.

Considering the calls for additional research in ABA effectiveness across treatment delivery settings, the proposed study will assess the outcome data of participants after one year of treatment that is delivered by trained ABA facilitators either in a clinical setting or a home-based environment. In doing so, this study will address a gap in the existing literature regarding the long-term outcomes of ABA across multiple treatment settings. There is a gap in the literature as to whether different treatment environments have an impact on ABA treatment outcomes for children with ASD beyond reducing severity of ASD symptoms. There are many studies comparing and contrasting

various components of ABA treatment and assessment of various behavioral domains, however limited research exists examining the role of the environment in which treatment is implemented.

Purpose of the Study

The intent of the proposed research is to determine the extent to which type of ABA treatment setting (home vs. clinic) relates to language acquisition milestones and barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months after treatment, 12 months after treatment). The independent variables include type of environment (between-subjects IV) and time of VB-MAPP assessment (within-subjects IV). The dependent variables include language acquisition milestones and language acquisition barriers.

Research Questions and Hypotheses

RQ1: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language milestones, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

$H_0$1: There is no significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.

H_a1: There is a significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.

RQ2: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language acquisition barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

$H_0$2: There is no significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.

H_a2: There is a significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.

Theoretical Framework

The specific application of ABA as an intervention for children with ASD is based upon the work of Skinner (1957). The theoretical approach most appropriate for this research is based upon behaviorism. Behaviorism is the study of behavior through several core assumptions of behavior. The first is determinism, which asserts that all events, including human behavior, are impacted by external factors that are not controlled by the free will. The second assumption is parsimony, which concludes that the simplest explanation is usually the most likely. The third assumption indicates that evidence must be empirically measurable (Cooper et al., 2020).

Shyman (2016) discusses the field of ABA and the tradition of the medical model being used as related to concepts of disability and ability and focuses on the treatment of a disability through a client and clinician relationship. Behaviorism is the theoretical approach for the current study. Since the theory asserts the measurement behavior

change, associated with the symptoms of ASD, in both clinic and in-home settings of treatment, the social model will be pursued. ASD is not currently rendered as a diagnosis from medical testing, but one of the behavioral observations. This model of behaviorism applies principles of function-based behavior to verbal behavior and the verbal operants as defined by Skinner (1957). The approach is also known as early intensive behavior intervention which supports the development of these verbal responses to be closer to those of children who do not have an ASD (Mohammadzaheri et al., 2014). This will be synonymous with what is referred to as ABA therapy. The framework of behaviorism and applied behavior analysis are directly aligned with current studies design and approach. The archival data set will provide ABA treatment outcome data for two group of children with ASD receiving treating either in the home setting or the clinic setting. The research questions and the hypothesis will evaluate whether language acquisition milestones and barriers differ between those group over a 12-month period of treatment.

Nature of the Study

The research design is a nonexperimental quantitative mixed design using data from an archival data set. The between-subjects independent variable is the type of environment in which treatment was provided (home vs. clinic). The within-subjects independent variable is time of assessment (baseline, 6-months into treatment, and 12 months into treatment). A 2 X 3 mixed ANOVA will be utilized. One ANOVA will be used to assess possible differences in language acquisition milestone scores. A second AVOVA will be used to assess possible differences in language acquisition barrier

scores. The participants include children (3 to 12 years of age) who had a diagnosis of ASD and received ABA treatment in a clinic setting or an in-home setting.

Definitions

Autism spectrum disorder: ASD is a developmental condition that affects social and emotional understanding and reciprocity, communication, restricted behavioral patterns, and interests (Hodges et. al, 2020).

Applied behavior analysis: ABA is a broad term used to refer to the application of the scientific principles of behavior that help build socially useful routines while minimizing unwanted behavior. ABA is particularly meant to treat socially significant behaviors that may bring desired change (Cooper et. al 2020). However, the term ABA is in most cases used interchangeably with a treatment approach such as discrete trial training (DTT), typically used with a level 3 severity of ASD. However, there is a significant difference between ABA and DTT. While ABA is more of a theory, DTT is defined as a behavioral therapy technique that is made up of a series of lessons taught repeatedly to create required behavior in an individual (Lovaas, 1987).

Registered behavior technician (RBT): The RBT is a paraprofessional certification in applied behavior analysis. RBTs assist in delivering behavior analysis services and practice under the direction and close supervision of an RBT Supervisor and/or an RBT Requirements Coordinator, who are responsible for all work RBTs perform. as noted by the Behavior Analyst Certification Board (2021). Retrieved 5 July 2021, from https://www.bacb.com/.

Board certified behavior analysist (BCBA): BCBA is a graduate-level certification in applied behavior analysis. People certified as a BCBA may supervise the work of board-certified assistant behavior analysts (BCaBA) and/or Registered Behavior Technicians (RBT) as noted by the Behavior Analyst Certification Board (2021). Retrieved 5 July 2021, from https://www.bacb.com/.

Board-certified assistant behavior analysts: BCaBA is an undergraduate-level certification in applied behavior analysis. BCaBAs may supervise the work of RBTs but may not provide serviced without supervision of a BCBA. as noted by the Behavior Analyst Certification Board (2021). Retrieved 5 July 2021, from https://www.bacb.com/.

Licensed behavior analyst (LBA): LBA is a graduate-level certification in applied behavior analysis. People certified as a BCBA may supervise the work of BCaBAs and/or RBTs.and are licensed under authorities of some states directly. Not all state offer licensing in behavior analytic services. All LBA's are BCBA's but not all BCBA's are licensed, as noted by the Behavior Analyst Certification Board. (2021). Retrieved 5 July 2021, from https://www.bacb.com/.

Early intensive behavior intervention (EIBI): EIBI is defined as an evidence-based therapy that relies on procedures and principles derived from applied behavior analysis (ABA) to treat behavioral challenges among young children with autism spectrum disorder (Klintwall & Eikeseth, 2014). EIBI is the only known behavioral or psychological treatment that can lead to consistent changes in a severe case of autism spectrum disorder in young children (Lovaas, 1987).

Assumptions

This quantitative non-experimental study is intended to determine whether the environment or location for administering ABA therapies to children with autism has an impact on treatment outcomes. The environment, in this case, involves a comparison between in-home and in-clinic. One of the assumptions is that children with ASD are capable of learning skills associated with interventions from ABA therapy, provided they are placed in an enabling learning environment. It is assumed that ABA treatment is effective with children with ASD and may result in reduction in ASD symptoms and improvements in various behavioral domains (e.g., language behavior). Variables such as family size, maturation, nutrition, other ancillary therapies and family previous knowledge and experience in the practices of ABA are assumed to be negligible on these outcomes.

It is also assumed that the registered behavioral technicians who provided ABA treatment had the minimum qualifications and experience to provide effective treatment. Similarly, it is assumed that the licensed behavior analysts had the minimum qualifications and experience to conduct valid VB-MAPP assessments.

Scope and Delimitations

The study will examine the impact of type of ABA treatment setting (home vs. clinic) on language acquisition milestones and language acquisition barriers among children with ASD. The study will compare two environmental settings: in-home and in-clinic. In particular, the study will explore possible differences in the language acquisition milestones and language acquisition barriers among children with ASD who

received ABA therapy in a clinical setting and those who received treatment in-home settings. Participants included children aged between 3 to 12 years. Since the study focuses on children, it will only include children up to the age of 12 at the most recent assessment. Past evidence reveals that early diagnosis coupled with early commencement of suitable intervention among children with ASD results in the optimal outcome and avoids progressive development of symptoms (Manohar et al., 2019). Moreover, the study targets only in-home and in-clinic environmental settings and excludes in-community and in-school settings. Thus, their inclusion may not help identify locational differences and their impact on the effectiveness of ABA therapy precisely; although, they may be considered in a future study.

Limitations

One of the limitations of this study is that the design is correlational and not experimental. That is the behavioral health organization did not randomly assign families/children to either the home or to the in-clinic treatment setting. This will limit my ability to determine casual explanations. In addition, the archival data set relied on convenient sampling and the participants were not randomly selected. This will limit the ability to generalize the results to other populations.

Another limitation in this study that could impact the validity of the results are that there are a variety of other variable that could influence scores on the VB-MAPP assessment. For example, the treatment quality may vary from one child to another due to the training and experience of the registered behavioral technicians (who provided ABA treatment) and the licensed behavioral analysts (who conducted the VB-MAPP

assessments). Similarly, other factors that could influence language milestones and/or language acquisition barriers include other interventions children may have received simultaneously with ABA treatment, developmental changes in the children as a result of maturation, as well as the family's social economic status and educational level, etc. These variables were not measured or included in the archival data set.

Significance

Verbal behavior, as noted by Frost and Bondy (2009), includes echoics, mands, tact, intraverbals, imitation, and listener response skills. Echoics are verbal imitations, while imitation is physical modeling of gestures etc. Manding is short for commands or ways someone expresses that they do or do not want something. Intraverbal skills are short conversational skills. Tacts are basically labeling is identifying items through sight and sounds. Imitation is physical imitations of movement steps, essential for sign language and, listener response skills, which means following basic verbal instructions. It is essential to note the word communication is not synonymous with speech in this context, but it also includes gestures and other non-verbal interactions.

Frost and Bondy (2009) discuss how communication has been defined by differing communities of intervention, specifically ABA and speech and language pathology. Frost and Bondy (2009), Barnes et al. (2014), and Sundberg's (2008) research on the usefulness of VB-MAPP and measuring verbal operants to measure treatment outcomes has contributed to a growing body of research on the reliability and validity of the effectiveness of the VB-MAPP regarding the assessment and measurement of verbal, behavioral operants for children with ASD. The VB-MAPP will serve as a useful tool to

compare outcome data between treatment environments for children with ASD in determining if there is a relationship between these outcomes and the environment in which they are rendered. The VB-MAPPs is one of the most common and useful tools in the field of ASD treatment to measure developmental milestones and changes in scores associated with intervention over time as noted by Barnes et al. (2014). The current study will contribute to the literature on the effectiveness of ABA treatment for children with ASD regarding of verbal behavior. Thus, this study will provide additional evidence of the usefulness of the VB-MAPP in assessing verbal behavior in different treatment environments.

This study may advance current ABA practice regarding the importance of the treatment environment for children with ASD. ABA treatment has been shown to be effective in behavioral interventions for children with ASD. However, in recent years there has been a call for further research on the efficacy of ABA on ASD behavioral change in multiple environmental settings (e.g., Strand & Eldevik, 2018). The results of this study will determine the impact of environmental setting (home vs. clinic) on the effectiveness of ABA treatment and inform practitioners on treatment strategies that can be generalized across settings and those specific to a particular environmental setting.

This study has the potential for positive social change by increasing insights into the potential impact environment may play in treatment outcomes. The consideration by families and clinicians of whether to utilize a clinic-based model of treatment or in-home based treatment may have more significant ramifications other than location, most

importantly the effectiveness of treatment and ultimately more effective ABA treatment will improve the quality of life for children with ASD and their families.

Summary

In summary, the use of ABA to address problem behaviors in ASD is an effective strategy that is well-grounded in the principles of psychology. The use of operant conditioning to address the behavior is based on the behaviorism framework that asserts the role of environmental factors in influencing human behaviors. Since the clinical and in-home settings are different environments with unique behavior-influencing factors, it is assumed that there is a significant difference between the ABA interventions in these two setting. The following will outline a review of the literature involving ASD and ABA interventions in the environments of concern.

Chapter 2: Literature Review

Introduction

ASD is a developmental condition that affects social and emotional understanding and reciprocity, communication, restricted behavioral patterns, and interests (American Psychiatric Association [APA], 2013). While previous research has been conducted that included outcomes data that involve language acquisition and decreases in problem behaviors using ABA treatment for children with ASD (e.g., Fava et al. 2011), researchers have called for additional investigation in addressing how future ABA studies could be expanded. For example, Schreibman et al. (2015) contended that there is a need to improve upon ABA treatment procedures to better test the long-term effectiveness of treatment delivered in a naturalistic environment.

Considering these calls for additional research in ABA effectiveness across treatment delivery settings, the proposed study will assess the language acquisition milestones and barrier outcome data for children with ASD at three time periods during a year of treatment delivered by a trained ABA practitioners in either in a clinical setting or a home-based environment. While some programs combine environments or have a mixed model of treatment, this will not be a condition in this study. In doing so, it will address a gap in the existing literature regarding the long-term outcomes of ABA treatment across multiple treatment settings.

The original research published by Lovaas (1987) determined that the children with ASD who received 40 hours of Early Intensive Behavior Interventions (EIBI) in a clinic setting achieved significant progress with decreasing aggression to self and others

and increasing skills associated with verbal behavior. The experimental group improved significantly, as defined as being “indistinguishable” from peers, as compared to the control group. Later, McEachin et al. (1993) conducted a long-term study of the same participants by assessing adaptive skills and IQ scores. They found that EIBI resulted in significant improvements in increasing IQ scores and decreasing problem behaviors (e.g., aggression to self and others) in the experimental group, as compared to the control group who did not get EIBI. McEachin et al. (1993) were able to replicate Lovaas’s (1987) original result, but without the use of punishment procedures, which was a criticism of the original study.

Schreibman et al. (2015) described how applied behavior analysis (ABA) practitioners recognize the importance of environmental variables that can impact behavior and skills. Some of the methods more commonly associated with the science of ABA, as it relates to treatment for autism spectrum disorder (ASD) are early intensive behavior interventions, pivotal response training, discrete trial teaching natural environmental teaching and verbal behavior analysis. These are terms that have specific teaching methodologies that all fall under the broader science of ABA.

Strand and Eldevik (2018) recently called for future studies, including systematic replication of ABA treatments across settings such as home, community, and the school environments. Strand and Eldevik (2018) suggested how these approaches are expected to help identify the best treatments of helping to improve problem behaviors at a reduced cost, such as reducing the overhead cost associated with brick-and-mortar locations,

while increasing direct parental involvement that could not be obtained in an in-clinic model with other children in treatment.

Strand and Eldevik (2018) expanded on a case study originally completed by Slaton et al. (2017) by conducting a case study in a home setting rather than in a clinic setting, which required minor procedural adjustments to accommodate the environment. The replicated study provided similar results to the original clinic-based study by reporting on a reduction in problem behaviors such as aggression to self and others and increased appropriate requests through functional communication and increases in language skills. The authors suggested that future research involving the benefits of parent involvement in ABA treatment in the in-home setting is needed. Parental training and parent participation are common during in-home services, and participation of parent training is usually accounted for by attendance in ABA sessions. While the condition of active parent participation is a variable to be considered, it is beyond the focus of this research proposal. Such approaches are expected to help identify the best ways of decreasing problem behaviors at a reduced cost and increased parent involvement (Strand & Eldevik, 2018). Furthermore, results from the case study provided evidence that in-home models can be more cost-effective, shorter in duration, and more convenient for families who cannot visit a clinic for treatment. Evidence was also provided that behavioral therapies for ASD can be generalized from clinic to home settings, but there is limited research on the potential benefits or limitations the environment may have on treatment outcomes over a period of time.

McConachie et al. (2015) identified several challenges for families when choosing treatment associated with the many variations of treatments and assessment that fall under the broad term of ABA and ASD. The review identified 131 instruments that measured severity of ASD, symptoms and behavioral issues, but only a few were useful in measuring progress of children with ASD regarding the priorities identified by parents such as happiness, anxiety, self-esteem, non-verbal ability, peer relationships, parent stress, etc. The only overlap of assessment goals that both professional and families agreed upon were problem behaviors that included aggression to self and others. The study recommended further research in addressing the needs identified by families and persons with ASD regarding broader outcomes in everyday environments.

Lindgren et al. (2016) compared behavioral outcomes and costs of evidence-based ABA treatments in three different delivery methods including clinic-based telehealth (conducted at clinics), home-based telehealth (conducted remotely by coaching consultants at home), and in-home therapy (conducted by parents at home). Each treatment model included some form of remote assistance from professionals. The results indicated that all three delivery methods decreased problem behaviors by training families to conduct assessment of the function of the behaviors and increase communication skills based upon the function of the problem behaviors. The authors found the cost-of-service delivery in-home based telehealth services than in-home therapy. In response, the authors suggested that statistical differences may have been achieved with larger samples and greater power to detect outcome differences. The authors further argued that their results indicated the importance of continuing to examine

factors that might influence the sustainability of delivery methods, including those done in real-world settings.

Literature Search Strategy

The search terms and phrases used to conduct research of the literature and databases included *ASD, ASD, VB-MAPP, home, clinic, treatment, ABA, applied behavior analysis, ASD spectrum disorder, ASD therapy,* and *ASD treatment*. Databases used included: Google Scholar, APA PsycInfo, and SAGE Journals, as well as in a Thoreau multi-database. The scope of the literature review focused on the last 5 to 15 years, though several seminal were reviewed in reference to Skinner, Lovass, Baer, and Wolf.

Theoretical Foundation

The specific application of ABA as a treatment for children with ASD is based upon the work of Skinner (1957). As such, the theoretical approach most appropriate for this research is behaviorism. Behaviorism is the philosophy of the science of behavior. ABA is the application of this science as it relates to the systematic approach of examining the relationships between behavior and the environment. The science of behaviorism, and thus ABA is rooted in the work of Thorndike, Watson, Pavlov, and Skinner. The principles of respondent and operant learning using scientific observation and a focus on improvements in behavior that are socially significant is the key focus of ABA (Cooper et al., 2020).

The theoretical approach most appropriate for this research is based upon behaviorism. Behaviorism is the study of behavior through several core assumptions of

behavioral science, as with other scientific study. The core assumptions include determinism, empiricism, experimentations, replication, parsimony, and philosophical doubt (Cooper et al., 2020). These core assumptions are the basic principles of behavior analysis that include three areas; behaviorism, experimental analysis of behavior (research and design), and applied behavioral analysis (the application of these principles in real world circumstances).

ABA specifically grew from the work of Watson and his work with stimulus and response (antecedent-behavior) connections that was later expanded on by Skinner with the term operant conditioning (Cooper et al., 2020). Operant conditioning is the learned relationship between behavior and the outcomes of that behaviors, or was it rewarded or punished. In contrast, respondent conditioning is unlearned response behaviors (pupils dilating in bright light, inborn or reflexive). Skinner expanded the field beyond previous approaches that included “mentalism”, or the assertion that internal mental constructs were the cause of behavior. Skinner argued that behavior should be explained with observable and measurable events (Cooper et al., 2020).

Skinner used the term “radical behaviorism” that included the application of behavioral principles to private internal events and the recognition of consequences to explain behavioral responses. Behavior is learned by examining what happens after the behavior, its consequences, or outcomes, and what occurred before the behavior. This is the basis for the three-term contingency in ABA (Antecedent-Behavior-Consequence (Johnson et al., 2016). Baer et al. (1968) provided contributions to the field that is now the founding principles of ABA that included application in real world circumstances and

contribute to socially significant outcomes based on observable and measurable that can be generalized across social contexts.

Verbal behavior is the key contribution of Skinner in recognizing and developing operationalized terms to describe these private events that are unobservable except through behavioral outcomes. Skinner (1957) published “Verbal Behavior” that outlined several new categories of language he called “verbal operants”. These verbal operants included mands, tacts, echoics, intraverbals, and autoclitics that included the three-term contingency model. The mand is a demand that can is expressed with word or behaviors, a tact is a label of an item, an echoic is a verbal imitation, an intraverbal is a response to verbal stimuli, and autoclitics are expansion of mands or tacts that include adverbs or adjectives (Johnson et al., 2016).

Sundberg and Michael (2001) discussed the principles of Skinner’s theory of verbal behavior and noted the term verbal behavior used by Skinner that differs from the traditional concept of language, by breaking down communication into what Skinner called verbal operants. Sundberg (2008) utilized the original verbal operants as defined by Skinner (1957) in the development of the VB-MAPP assessment tool and expanded the operants to include additional observable verbal behaviors. These verbal operants, language acquisition milestones, and language acquisition barriers that make up the VB-MAPP tool is the standard measurement for assessing verbal behavior for children with ASD (Sundberg & Michael, 2001). These expanded operants are defined by the function they serve and are described in Appendix A and B.

The operants Skinner was concerned with the most was the verbal behavior of the speaker/communicator. He avoided other more common terms as expressive or receptive language as Skinner defined these as differing processes of verbal operants. The basic behavioral principles of are positive and negative reinforcement, motivating situations, discriminative stimuli, and response types. Both positive and negative reinforcement is intended to increase behavioral responses, motivations can be thought of as setting events, such as hunger may increase the likelihood of a request to eat. Hunger is an unlearned motivating/establishing operation, while the use a mand to let someone know you are hungry is a learned verbal operant. This learned (through reinforcement history) mand may be in the form of words “I am hungry”, a sign for “eat” or hitting the dining table repeatedly with the silverware, to communicate I am hungry. The verbal behavior that accesses reinforcement more consistently will most likely be the one used most often.

Shyman (2016) discussed the field of ABA and the tradition of the medical model being used as it related to concepts of disability and ability and focuses on the treatment of a disability through a client and clinician relationship. Behaviorism is the theoretical approach for the current study. This theory best suits the proposed research study since it entails the measurement of successful outcomes in the change of behaviors associated with the symptoms of ASD in-clinic and in-home settings of treatment. ASD is not currently rendered as a diagnosis from medical testing, but one based on behavioral observations. The approach is also known as early intensive behavior intervention (EIBI), which supports the development of verbal skills to be closer to those of children who do

not have an ASD (Mohammadzaheri et al., 2014). This is synonymous with what is referred to as ABA therapy.

Literature Review

Historical Review of Applied Behavior Analysis

The use of applied behavioral analysis (ABA) as a therapy for treating autism in children dates to the 1950s and 1960s. Schopler and Mesibov (1989) noted that Lovaas (1987) is generally described as one of the pioneers, along with Bijou and Baer (1961) of ABA development and its application among children with autism. Matson et al. (2011) completed a review of trends in ABA regarding early intervention, parental training, assessment, social skills training, and independent living for persons with ASD and found ABA treatment is the most promising research and evidenced based treatment for ASD.

Bijou and Baer (1961) presented an overview, as well as a compilation of experimental research regarding child development with the use of behavior analytic principles for children. While this work was not specifically related to the treatment of autism, it served as the basis for the ensuing ABA approaches for treating children with autism. For example, Wolf et al. (1964) demonstrated the effectiveness of ABA treatment when applied to children with ASD and behavioral challenges. The authors were able to eliminate self-destructive behavior displayed in a three-and-a-half-year-old boy by using punishment, extinction, and differential reinforcement of the absence of the self-destructive behavior or the display of an alternative desired behavior. While these studies did not provide therapeutic effect evidence, they supported the principles of behavior in

affecting behavioral change among children with autism regarding decreasing self-destructive behaviors.

Lovaas (1987) used EIBI in an experiment with 19 preschool age children (experimental group) diagnosed with ASD and a control group of 19 children of similar ages. The children in the experimental group received 40 hours per week of EIBI for at least 2 years. These children with ASD were able to participate in less restrictive school settings as well. The results indicated a significant increase in IQ scores by more than 30 points on average and some children no longer meeting the criteria for ASD based upon the IQ scores and participation in less restrictive school settings as the criteria.

Smith and Eikeseth (2010) noted while in most cases Lovaas stressed the significance of positive reinforcement, in the 1960s he sometimes used contingent aversive conditions counter aggression and/or life-threatening behaviors demonstrated by children with autism in institutional settings. The above study indicated that reducing problem and dangerous behavior among children with ASD was achieved by using aversive techniques. Smith and Eikeseth (2010) noted that Lovass was disappointed to learn many of the children in the original study had significant setbacks and returned to using problem behaviors when treatment was concluded.

Carr (1977) noted that teaching replacement behaviors and reinforcing these behaviors with children with ASD was beginning to gain momentum. Carr (1977) agreed with Lovaas and other researchers that the behavioral problems displayed by children with ASD was a result of operant behavior and, thus, could be treated with behavior analytic approaches. Carr (1977) hypothesized that social reinforcement and escape from

demands were the key motivating factors for several self-injurious behaviors in children with children with ASD.

Iwata et al. (1994) showed that operant functions (get or escape from) of disruptive behavior and the application of ABA treatment can decrease problem behavior based on the function by teaching alternative behaviors that serve the same function. The study included 9 children with ASD who were provided contingent reinforcement of access to play materials and demands. Iwata et al. (1994) used operant methodologies to assess functional relationships between the problem behaviors (self-injury) and the environmental events. The study revealed high levels of self-injury in both the between and within subjects however, 6 of the 9 children displayed higher levels of self-injury dependent upon the physical and/or social environmental conditions. This finding suggested the within-subjects variability can be attributed to a function of social and/or physical environmental conditions. The study revealed implications that reinforcement-based treatment methods for replacing problem behavior was highly beneficial for children with ASD as the physical and social environmental situations that can be manipulated.

DeMeyer et al. (1981) built on the idea of intensive ABA by concluding that substantial improvements in the behavioral repertoire of children with autism could be attained through systematic behavioral education programs that entail the highest possible hours of child contact and different therapists, such as parents who have been supported with behavioral techniques through training.

Matson et al. (1996) revealed in a review of behavioral treatments since 1980 and a total of 251 published studies of treatment methods for ASD, that most use of ABA for children with ASD target problem behaviors, languages, social, and academic, and basic living skills. The treatment was organized by either positive practices, aversive practices, extinction (no reinforcement delivered) or a combination of these. Many treatments attempted to address stereotypy first, followed by aggression, and then self-injury behavior. Matson et al. (1996) and his colleagues hypothesized that the use of functional assessment and ABA treatment was more beneficial than attributing behavior to diagnosis alone.

Historical Reference of In-Home and In-Clinic Services

Prior to Lovaas et al. (1973), ABA treatments for children with autism were typically administered in state hospitals or laboratory settings. Lovaas was concerned with the high number of patients who regressed to their initial status of behavioral problems, including loss of functioning, language, social skills, play, and social interaction upon returning to the hospitals. Lovaas et al. (1973) recommended several approaches that could help improve the functioning of children and replace disruptive behavior including parent/guardian involvement and commencing ABA treatment as early as possible. In addition, Lovaas (1973) recommended implementing treatment in the children's homes as opposed to a hospital/institutionalized setting. Lovaas (1987) extended the 1973 research study by comparing the effectiveness of comprehensive ABA behavioral treatment, which included typically 40 hours of treatment per week, with less comprehensive ABA treatment of only few hours. Results showed that a comprehensive

ABA treatment plan including parent involvement and in-home ABA treatment resulted in significant improvements in children's behavioral, language, and social skills compared to another group which received non-intensive ABA intervention. Lovaas (1987) has since been referenced as the pioneer study showing the importance of home-based delivery of ABA intervention.

A retrospective study conducted by Luiselli et al. (2000) demonstrated that the impact of in-home ABA services was related not only to service intensity (hours of service) but also to the age of children, concluding that children who were treated using an in-home ABA program before the age of three achieved many improvements. Similarly, Elder et al. (2003) showed the significance of cultural diversity and its effect on the efficacy of in-home training to children with autism. The cultural differences and expectations of what is valued will certainly affect the outcomes of ABA interventions.

Fenske et al. (1985) compared the treatment outcome differences for 9 children with ASD in the method of EIBI before they were 5 years of age and for 9 children with ASD who received the same treatment after 5 years of age in specialized treatment day school called the Princeton Child Development Institute. Result showed that the earlier the intervention was more beneficial in terms of treatment outcomes regarding decreasing problem behaviors and increasing language and developmental skills. Nevertheless, many of the studies on the in-clinic service delivery model of ABA did not consider the model or setting. Studies such as Fenske et al. (1985) focused on the age of participants and did not evaluate the impact of setting on the effectiveness of intervention programs.

Comparison of the In-Home and In-Clinic Models

The results of Lovaas et al. (1973), Lovaas (1987) and Lovaas and Smith (2003) demonstrated that in-home service delivery based on ABA principles was highly effective. However, none of these studies allowed for a comparison of the features and efficacies of in-home and in-clinic service delivery models. This claim is reiterated by Leaf et al. (2017), who acknowledged that while the principles of ABA can be used in different settings, there is no clarity on the differences between in-home and in-clinic ABA service delivery models.

Leaf et al. (2017) described the differences between the two models of ABA service delivery. The first was the in-home service delivery model, which they term as "home-based model," as an intervention that takes place in a home setting. Generally, treatment can be administered in a specific room/area or several rooms/areas in the home. Leaf et al. (2017) described the second as the in-clinic service delivery model (clinic-based model) as a situation where individuals with autism receive ABA treatment services at a particular center, such a hospital or an office building of a given agency. Although authors such as Taubman et al. (2001) regarded behavioral treatment services provided in school-setting as being a clinical-based model intervention, Leaf et al. (2017) classified behavioral intervention services provided in a school setting as a different category. As Grindle et al. (2008) stated, the early intensive behavioral intervention (EIBI) can be effectively implemented through the involvement of trained staff (therapists). Thus, both home-based and clinic-based ABA service delivery models entail the use of trained staff and supervision by a Board-Certified Behavior Analyst (BCBA).

Nevertheless, key differences between in-home and in-clinic service delivery models manifest in how the direct line staff (therapists) and supervision services are obtained and the amount supervision. In-clinic treatment delivery generally lends to more supervision as the BCBA would be present in the clinic on a frequent and routine basis. Leaf et al. (2017) explained that with a home-based model, the parent of an autistic child can directly hire a line staff or be recruited and employed by an agency. If a direct line staff is hired, the parent may contract with an independent supervisor, or a service agency provides supervision services after an arrangement between the parent and agency. The supervisor is responsible for training both direct life staff and parents, continuous supervision, and designing curriculum, However, the service agency under the clinic-based model is responsible for hiring, training, supervision, and providing required support, including training the parent (Leaf et al. 2017).

Benefits and Challenges of In-Home Service Model

In line with Lovaas' (1987) results, parent involvement is instrumental in ensuring the success of ABA treatments. Leaf et al. (2017) asserted that parent involvement in a home-based ABA service delivery model provides parents with opportunities for hands-on involvement in both treatment observation. Furthermore, Stokes and Baer (1977) indicated that providing ABA-based treatment services at home is suitable for advancing generalization since the autistic child receives treatment in an environment where they spend most of their time. While generalization is still possible even with the clinic-based intervention model, Leaf et al. (2017) emphasized that the in-home service delivery model is highly suited for implementation of generalization strategies such as

programming general motivations/stimuli. Moreover, the home-based model is highly suitable for teaching children daily life skills since it provides a suitable environment.

However, home-based service delivery may be rendered less useful and effective due to family dynamics. Since the caregiver/parent must be with the patient most frequently, a situation whereby the parents/caregiver is engaged in other economic activities would make home-based ABA services quite impossible. Leaf et al. (2017) suggested that the absence of the key caregiver could create an unfavorable environment for both the child with ASD and the therapist, who must work in a coordinated way to ensure successful treatment outcomes. Other challenges of home-based ABA treatment models that have been highlighted by Leaf et al. (2017) included dual relationships, making it difficult for the professional to maintain objectivity and this may compromise service delivery by therapists and supervisors.

Benefits and Challenges of In-Clinic Service Model

As Leaf et al. (2017) noted, the clinic-based model has unique benefits that ensure service delivery integrity. Direct therapist and supervisors are together, and the staff feels connected with others daily in the treatment process, unlike the case of the home-based model where there is typically less daily supervision and access to clinical leadership routinely. Moreover, the clinic-based model provides a suitable environment whereby ABA approaches, such as group instructions, can be offered effectively. Based on the intervention outcomes, the results of a study conducted by Dixon et al. (2014) showed that the intervention outcomes were significantly higher when treatment services were offered under a center-based setting than when similar services were provided in a home-

based setting. However, the clinic-based model suffers significant drawbacks, including the absence of or limited parent involvement and limited capability for achieving generalization beyond the clinical environment. While both clinic-based and home-based treatment delivery models require services of trained staff, therapists, and supervisors, Leaf et al. (2017) asserted that the costs of an in-clinic treatment delivery model could beat those incurred during in-home intervention.

The Verbal Behavior Milestones Assessment and Placement Program

The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) is an assessment of verbal operants and developmental milestones as well as a curriculum guide and skills tracking mechanism developed for children with autism (Vietze & Lax, 2018). The criterion-referenced program is also applicable to individuals who have language problems and delays (Vietze & Lax, 2018). The VB-MAPP is developmental-based and is used for assessing the children with language difficulties. Integrating the principles of Skinner's verbal behavior, VB-MAPP provides a language assessment for all children with developmental language problems to compare with children who are developing typically (Montallana et al., 2019).

The VB-MAPP is a criterion-referenced mechanism for tracking the impact of ABA treatment for children with ASD. The VB-MAPP is a useful tool for assessing most language development milestones for children with ASD. In a study by Dixon et al. (2014), the goal of the research was to assess the efficacy of the Promoting the Emergence of Advanced Knowledge (PEAK) relational training system and how it compared with the VB-MAPP scores for persons with ASD. Using three participants, the

researchers implemented the PEAK-Direct Training module for the three participants during a 45-to-69-day period. Throughout this period, the VB-MAPP test scores indicated an upward trend. In this context, the effectiveness of the PEAK-Direct module was obtained through the VB-MAPP scores. The participants even mastered specific untargeted verbal skills. Dixon et al. (2014) conclude that that both PEAK and VB-MAPP assessment tool can be used to measure the effectiveness of most developmental treatments and fits in most research designs.

Edwards et al. (2018) used the VB-MAPP in the analysis of developmental milestones, barriers, and the functional leisure engagement that included the appropriate use of toys and play for children with autism using backward chaining (an ABA teaching procedure). The study involved 3 school aged children with ASD. The children received one on one therapy in a special classroom for 5 days per week and 2 hours each day. Social and independent play are part of the developmental milestones measured with the VB-MAPP. Edwards et al. (2018) reported that all three participants indicated a rise in functional play skills and decreases in stereotypy after treatment had ended.

Summary and Conclusions

In Chapter 2, I reviewed current literature that relates to ABA treatment and the environments in which the treatment is rendered. I discussed the theory of behaviorism and the various models of ABA, as this relates to the premise of this study. I discussed and how ABA treatment is defined and used as treatment methodologies in the differing environments. I also discussed the VB-MAPP assessment tool as it relates to assessing the language and developmental needs of children with ASD. Previous research has

demonstrated the treatment effectiveness of ABA for children with ASD, and as well as the benefits and limitations of the differing environments in which treatments is delivered. However, there is a gap in the literature the effectiveness of ABA as a function of treatment setting. To address this gap, this study on milestones and barriers (using VB-MAPP scores) for children with ASD based upon where the treatment was delivered (in-home vs. in-clinic). In Chapter 3, I discuss the research design, population, sample and sampling procedures, data collection procedures, instrumentation and operationalization of constructs, data analysis plan, threats to validity, and ethical procedures. and statistical analysis for this quantitative study.

Chapter 3: Research Method

Introduction

In recent years, several researchers have noted the importance of the environmental setting in ABA treatment for children with ASD (Mohammadzaheri et al. 2014; Schreibman et al., 2015; Strand & Eldevik, 2018). These researchers suggested the advantages of a natural home environment allows for the skills acquired in therapy to be used in a more natural and immediate context. In contrast, children receiving treatment in a clinic setting may acquire skills more quickly, but these will still need generalization training in the real-world environments. A second advantage in the natural home is that the family has a greater opportunity to engage in the daily treatment, thus decreasing the need for extensive generalization training. Previous research focusing on the type of environment in which ABA treatment was provided has been limited and typically involved case studies and/or qualitative analysis. The current quantitative study will fill a gap in the literature by examining the impact of the type of environment in which treatment was provided (home versus clinic setting) on language acquisition skills and barriers among children with ASD. Thus, the intent of the proposed research is to determine if there are significant differences in language milestone scores and language acquisition barrier scores between children who received ABA treatment in the home versus in a clinic setting.

In Chapter 3 I discuss the research design and rationale, the population, sampling and sampling procedures, procedures for recruitment and participation, data collection

and data analysis plan, instrumentation and operationalization of constructs, threats to validity, and ethical considerations.

Research Design and Rationale

The research design is a nonexperimental quantitative mixed design. There are two independent variables. The between-subjects independent variable is the type of environment in which treatment was provided. There are two levels of this independent variable that include children who received ABA treatment in the home and children who received ABA treatment in a clinic setting. It is possible, but unlikely, that some children started their treatment either in-home or in-clinic and may have changed treatment environments. If any children in the database did change treatment environments, they will not be included in the analysis. The within-subjects independent variable is the time of assessment for language milestones and language acquisition barriers. All of the children had a baseline assessment completed prior to ABA treatment. A second assessment was completed at 6 months into treatment, and then a final assessment at 12 months into treatment. At each time of assessment, the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) was used to assess language milestones and language acquisition barriers. Thus, there are two dependent variables that include language milestone scores and language acquisition barrier scores. Thus, A 2 X 3 mixed ANOVA will be utilized. One ANOVA will be used to assess possible differences in language acquisition milestone scores. A second AVOVA will be used to assess possible differences in language acquisition barrier scores.

Using this type of research design, I will be able to determine whether different treatment environment have an impact on the specific treatment outcomes. In this case, the treatment outcomes consistent with ABA interventions focus on verbal behavior skills and barriers to the acquisition of verbal behavior skills among children with ASD. I will be using an archival data set from a medical and behavioral health organization that provide ABA treatment for children with ASD. This research design is consistent with other limited studies in the literature that have compared the type of environment and treatment outcomes (e.g., Dixon, 2014; Leaf et al., 2017).

Methodology

Population

The target population is intended to be recipients who have a diagnosis of ASD, as described in earlier chapters. Recent estimates for the numbers of children diagnosed with an ASD is 1 in 59 (16.8 per 1000) at the age of 8 years according to the Centers for Disease Control (CDC, 2018). This data from the CDC involved more than 300,000 children. This is from in the surveillance program of the Autism and Developmental Disabilities Monitoring Network in 11 states within the United States. The data indicated that the prevalence of ASD diagnosis for males was approximately 1 in 42. The prevalence for females was approximately 1 in 189. Of those children diagnosed with ASD, approximately 31% also had a diagnosis of an intellectual developmental disability in 9 of the 11states (CDC, 2018).

Sampling and Sampling Procedures

The sampling procedures used for this study included non-probabilistic sampling using a convenience sample as opposed to random sampling. A strength of using non-probability sampling is the access to data can be expedited for analysis, however a weakness includes limits in attributing the results to large groups beyond the sample used. That is, a convenience sample may limit the ability to generalize the results to other populations (Frankfort-Nachmias & Nachmias, 2008).

The sample was obtained from a medical and behavioral health organization located in the southeastern United States. The organization supports ASD treatments as a portion of many services rendered in the region. The sample of children in the clinic-based treatment was determined by the fact that the clinics are only available in some areas. Thus, those children/families who resided near the clinic typically chose the clinic as the location of treatment. The sample of children who received in home treatment was due to the inability to travel to the clinic for treatment. In this case, a registered behavioral technicians traveled to the child's residence where treatment was provided. The registered behavioral technicians (RBT) provided the ABA treatment in both settings. The medical and behavioral health organization collected the data from VB-MAPP assessments on children with ASD receiving ABA treatments from 2008 to present (2021). There were disruptions to treatment during the Covid-19 pandemic and this data will be excluded.

The inclusion criteria for the sample of data that I will access from the archival data set includes the following: 1) children ranged in age from 3 to 12 years of age; 2) the

children had to have at least a provisional diagnosis of ASD by a licensed clinical psychologist or physician; and 3) all of the children were assessed using the VB-MAPP completed by a licensed clinician. While not a specific inclusion or exclusion criterion, it is likely some of the children may have comorbid conditions or dual diagnoses (CDC, 2018).

A power analysis was performed using G*Power 3.1software to calculate a minimum required sample size for a two-way mixed ANOVA (Faul, Erdfelder, Lang, & Buchner, 2007). Parameters for the power analysis included power of .80, an alpha value of .05, an effect size of .25, two groups, and three measurements. Previous studies have reported medium effect sizes when looking at similar quantitative research regarding environmental variables (Fava et al. 2011; Lindgren et al. 2016; Schriebman et al., 2015; Sheinkopf & Siegel, 1998). The power analysis resulted in a recommended sample size of 28.

Procedures for Recruitment, Participation, and Data Collection

A formal data request was made to the medical and behavioral health organization following their internal data request process. I received conditional approval to access the archival data set once I obtain Walden University's Institutional Review Board approval. Once I receive Walden IRB approval the medical behavioral health organization will provide the archival data set that includes the VB-MAPP assessment scores for the children and along with basic demographic information. The data set will also be de-identified to maintain anonymity and confidentiality of the families who participated in treatment. The treatment data was collected between 2008 and present (2021). Any data

collected during the Covid-19 pandemic will not be included in the analysis. I will not know the exact number of children in the database until I receive IRB approval and gain access to the database. The details regarding the procedures in the treatment and data collection process are discussed below.

The sample of children in the clinic-based treatment was determined by the fact that the clinics are only available in some areas. Thus, those children/families who resided near the clinic typically chose the clinic as the location of treatment. The sample of children who received in home treatment was due to the inability to travel to the clinic for treatment. In this case, a registered behavioral technician traveled to the child's residence where treatment was provided. The registered behavioral technicians (RBT) provided the ABA treatment in both settings. For this specific medical and behavioral health organization, children with ASD generally received between 10 to 30 hours of ABA treatment per week. This will be verified once access to the archival data set granted.

The VB-MAPP assessments were completed by licensed behavior analysts (LBA) at baseline prior to receiving ABA treatment. A second assessment was completed at 6 months into treatment, and then a final assessment at 12 months into treatment. Generally, the LBA completes all assessments for a specific child. During the VB-MAPP assessment process the LBA interacts with the child and assessing specific learning and language milestones as well as learning and language acquisition barriers. In both settings, the LBA may also request input from the parent or guardian of the child

regarding the VB-MAPP milestones and barriers. This assessment process completed by the LBA typically between 3-5 hours.

Instrumentation and Operationalization of Constructs

The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) was used to measure: 1) learning and language milestones, 2) learning and language acquisition barriers among the children with ASD who received ABA treatment (Sundberg, 2008). The VB-MAPP contains an assessment of the verbal behavior through assessment. The milestone assessment has 16 domains and is divided across three developmental levels (0-18, 18-30, and 30-48 months). The language and verbal behavior milestones described at each developmental level are based on the typical verbal behaviors/milestones seen in neurotypical children. The early language and verbal behavior milestones that correspond with the 0–18-month level include: early mands, tacts, listener skills, social skills, visual perception, and matching skills, play skills, motor imitation skills, and vocal behaviors. The second level (18-30 months) expands on these skills but also includes listener responding by feature, function, and class. The third level (30-48 months) expands on these skills and includes also pre-academic levels of reading, math, and writing skills. The score for each milestone domain can be scored as 0, .5, or 1. The scores for each language milestone domain are added together for a total score ranging from 0 to 170 (Sundberg, 2008). The definitions/descriptions of the language acquisition milestones are provided in Appendix A.

The VB-MAPP also contains an assessment of the language acquisition barriers This section of the assessment contains 24 learning and language barriers typically

associated with learners diagnosed with ASD. Many of these barriers are identified in the Diagnostic Statistical Manual (American Psychiatric Association, 2013) being associated with the behavioral criteria for an ASD diagnosis. The barriers section is completed using a rating scale from 0 to 4, with higher scores indicating a more significant barrier. The scores for each barrier are added together for a total possible score ranging from 0 to 96 (Sundberg, 2008). The definitions/descriptions of the language acquisition barriers are provided in Appendix B.

The VB-MAPP assessment tool has been evaluated in terms of interobserver agreement (IOA) among licensed clinicians, licensed behavior analysts and/or board-certified behavior analysts. For example, Sundberg and Sundberg (2011) assessed reliability using inter-observer agreement (IOA) in a study using the VB-MAPP with 39 typically developing children between 23 and 61 months old. The VB-MAPP assessments were also completed with 71 children with ASD between 35 months and 15 years of age. Each person completed the VB-MAPP assessments independently and followed the same set of standardized assessment tool instructions. The authors reported that across observers there was a 93.4% mean agreement, with a range of 84% to100%. These data suggested the VB-MAPP instrument is reliable for intraverbal assessment and intervention. Sundberg and Sundberg (2011), also reported construct validity by comparing the VB-MAPP assessments of the typically developing children and children with ASD. The results showed that the verbal performance of typically developing children was seen in the gradual increase in the difficulty of the intraverbal items, and their chronological age. The verbal performance of children with ASD followed a similar

patter, however age was not the best predictor of performance. Instead, the presence of prerequisite verbal skills was a better predictor of intraverbal performance. The authors again concluded that the VB-MAPP provides a valid intraverbal assessment and can be used in interventions for individuals with language delays.

In a more recent study, Dixon et al. (2015) assessed the validity of the VB-MAPP in assessing language and verbal behavior skills in individuals with ASD (aged 5 to 22 years). In this study, verbal behavior and language skills were assessed with eh VB-MAPP and the assessment program called Promoting the Emergence of Advanced Knowledge Relational Training System (PEAK). The PEAK assesses generalized verbal skills, into basic subcategories related to foundational learning skills, perceptual learning skills, verbal comprehension skills and verbal reasoning, memory, and mathematical skills. The researchers examined the correlation between the VB-MAPP language acquisition scores and the PEAK scores and reported a significant positive relationship between the two assessment tools (r=.82, p<.0001*).* In addition, the VB-MAPP scores were also a significant predictor of the scores on the PEAK. The authors also noted in a previous study (Dixon et al., 2014) there was a significant positive relationship the PEAK and the Peabody Picture vocabulary Test, providing additional indirect providing validity support for the VB-MAPP. Thus, the VB-MAPP has demonstrated satisfactory levels of reliability and validity in assessing language and verbal behavior skills in neurotypical children and children with ASD. The VB-MAPP is a copyrighted assessment form that the organization purchased for its use with clients in treatment.

Data Analysis Plan

The data will be analyzed using the Statistical Package for Social Sciences (SPSS) software package version 25. As noted previously, A 2 X 3 mixed ANOVA will be utilized. The assumptions associated with analysis of variance will be assessed prior to the analysis. The assumptions include independent observations within each sample, normality, and homogeneity of variance. In addition to examining the distributions for the dependent variables, normality will be assessed using a boxplot and Shaprio-Wilk tests for normality (including skewness and kurtosis values). Visual inspection of the boxplots for values greater than 1.5 box-lengths from the edge of the box will indicate outliers. A p-value that is not significant (p>.05) will indicate a normal distribution. Homogeneity of variance will be tested using Levine's test of equality of error variances. A p-value that is not significant (p>.05) will indicate that the assumption of homogeneity of variance has been adequately met. The following research questions and hypotheses will be tested:

Research Question 1: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language milestones, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

$H_0$1: There is no significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.

H_a1: There is a significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.

RQ2: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language acquisition barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

$H_0$2: There is no significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.

H_a2: There is a significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.

A 2 X 3 mixed ANOVA will be used to analyze the data. Type of environment in which treatment is provided (in the home versus in a clinic setting) will serve as the between-subjects independent variable. Time of VB-MAPP assessment (baseline, 6 months, 12 months) will serve as the within-subjects independent variable. One ANOVA will be used to assess possible differences in language acquisition milestone scores. A second ANOVA will be used to assess possible difference in language acquisition barrier scores. The results of the ANOVAs will be evaluated using an alpha level of .05 and the amount of variance explained will be assessed using eta squared (η^2).

Threats to Validity

This study recognizes multiple threats to internal and external validity associated with the use of archival that has been previously collected. While a quantitative research design is described as a more valid design than qualitative or mixed methods, there are still threats to validity that can arise (Creswell, 2009). A threat to external validity could

be related to the method of sampling. In this study, convenience sampling was used as the participants were not randomly selected. Nonrandom sampling can provide weaker external validity and is likely to be more biased than a random sample (Frankfort-Nachmias & Nachmias, 2008). In addition, while ANOVA may reveal difference between groups as a function of the independent variables, I will have difficulty drawing casual explanations due to the non-experimental nature of the design of this study.

Another threat to validity is related to the possibility that other interventions may have been implemented simultaneously with the children who received the ABA treatment. The fact that all the children in the study had a diagnosis of ASD increases the likelihood they may have also been receiving speech, occupational, physical therapies and/or medication interventions that may contribute verbal behavior and language development during the period of ABA therapy. In addition, there is no data regarding the level of ASD severity or functionality other than the VB-MAPP scores. Level of severity and functionality could certainly impact the effectiveness of ABA treatment on language acquisition (Nah et al., 2014).

Another threat to validity is the maturation of the children. There will be developmental changes in the children over the course of ABA treatment that may influence language acquisition milestones and/or language acquisition barriers. Although the VB-MAPP is a reliable and valid instrument, developmental changes in emotional, social, and intellectual functioning may contribute to language acquisition (Berk & Meyers 2016).

Another factor that could impact the validity of the results are differences in the level of training and experience of the registered behavioral technicians (RBT) who provided ABA treatment and the licensed behavior analysts (LBA) who conducted the VB-MAPP assessments. While, the behavioral health and medical organization verified the certification and licensure of these individuals, they may have had differing types of education, training, and experience.

Ethical Procedures

Permission to access the archival data set for this study was obtained with the agreement the data will remain anonymous and confidential. The ethical considerations in this study include maintaining the anonymity of the client's protected information. I will maintain the confidentiality of any identifying information of the participants. Only anonymous information and data will be used for the purposes of this study. The only information used in in the study will basic demographic data, location of treatment, and VB-MAPP scores. Participants names or other identifying information will be used for this excluded from the data file. The data set will be maintained in a password protected personal computer.

Summary

The purpose of this study is to is to determine if there are significant differences in language milestone scores and language acquisition barrier scores between children who received ABA treatment in the home versus in a clinic setting. A nonexperimental quantitative mixed design will be used. The between subjects variable is type of environment (home vs clinic) and the within subjects variable is time of the VB-MAPP

assessments. A 2 X 3 mixed ANOVA will be utilized. One ANOVA will be used to assess possible differences in language acquisition milestone scores. A second AVOVA will be used to assess possible differences in language acquisition barrier scores from the VB-MAPP assessment. The participants include children who have a diagnosis of ASD and have received ABA treatment in a clinic setting or an in-home setting. The data will be obtained from an archival data set and will be de-identified to maintain anonymity and confidentiality of the families who participated in treatment. In Chapter 4 I will present the descriptive and inferential statistics to evaluate the research questions and hypotheses.

Chapter 4: Results

Introduction

The intent of the proposed research was to determine the extent to which type of ABA treatment setting (home vs. clinic) relates to language acquisition milestones and barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months after treatment, 12 months after treatment). The independent variables included type of environment (between-subjects IV) and time of VB-MAPP assessment (within-subjects IV). The dependent variables included language acquisition milestones and language acquisition Two research questions and hypotheses were evaluated:

RQ1: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language milestones, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

> $H_0$1: There is no significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.
>
> H_a1: There is a significant difference in language milestone between children receiving ABA treatment at home versus in a clinic setting.

RQ2: To what extent do children receiving ABA treatment at home and children receiving ABA treatment in a clinic setting differ on language acquisition barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-

MAPP), over a 12-month period (baseline, 6 months into treatment, 12 months into treatment)?

> $H_0$2.: There is no significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.
>
> H_a2: There is a significant difference in language acquisition barriers between children receiving ABA treatment at home versus in a clinic setting.

In this chapter, the data collection procedure is discussed in detail, including data collection time frames, necessary procedural changes, and other relevant information related to the data collection process. Basic demographic data of the clients are also present. An evaluation of the statistical assumptions and the results from the two-way mixed ANOVAs are presented.

Data Collection

The data used for this study was archival data that was entered into a database for record keeping between the dates of September 10, 2015, and April 13, 2021. The original data analysis plan outlined in Chapter 3 indicated there would be a 2x3 design with assessment intervals of 6 months (baseline, second, and third assessment). However, after gaining access to the archival data set it was determined that there were only two assessment periods available for a majority of the clients. The mean time between the initial baseline assessment and second assessment for children in-home was 332.42 (*SD*=166.749) and the mean time between the baseline assessment and the second

assessment for children receiving treatment in the clinic was 428.25 (*SD* = 187.931). I conducted an independent samples *t*-test that demonstrated that the time between the baseline and second assessment was not significantly different between the two treatment environments, $t(34) = -1.559$, $p > .05$.

There were a total of 36 clients included in the data set. There were 12 clients who received in-clinic ABA services, and 24 clients who received in-home ABA services. There were 16 males and 8 females who received in-home ABA services. There were 10 males and 2 females who received in-clinic ABA services. There were 24 (66.7%) males and 12 females (33.3%). The ages of clients ranged between 3 and 11 years of age. There were five 3-year-old clients (13.9%), nine 4-year-old clients (25%), five 5-year-old clients 13.9%), seven 6-year-old clients (19.4%), three 7-year-old clients (8.3%), three 8-year-old clients 8.3%), two 9-year-old clients 5.6%), one 10- year-old client (2.8%) and one 11-year-old client (2.8%). The demographic data for age, gender, and type of environment are shown in Table 1.

Table 1

Demographic Data for Age, Gender, and Type of Environment

Variable	n	%
Age of participant		
3	5	13.90
4	9	25.00
5	5	13.90
6	7	19.40
7	3	8.30
8	3	8.30
9	2	5.60
10	1	2.80
11	1	2.80
Gender of participant		
male	26	72.20
female	10	27.80
Type of environment		
in-home	24	66.70
in-clinic	12	33.30

The mean age for the children receiving treatment in-home was 6.170 years (*SD* = 1.993) and the mean age for children receiving treatment in the clinic was 4.50 years (*SD* = 1.931). I conducted an independent samples *t* test that indicated that the children receiving treatment in-home were significantly older on average than the children receiving treatment in-clinic, $t(34) = 2.389$, $p < .05$.

Results

A 2 X 2 mixed ANOVA was conducted for each dependent variable. The independent variables in each analysis included type of treatment environment as the between-subjects IV (in-home and in-clinic) and the time of the VB-MAPP assessment as

the within-subjects IV (baseline and the second assessment). The dependent variables included the VB-MAPP language acquisition milestone scores and language acquisition barrier scores.

Evaluation of Statistical Assumptions

Screening for outliers was completed and for the baseline language acquisition milestone scores two outlier were detected (one in the in-home group and one in the in-clinic group). There was one outlier detected for the second assessment language acquisition milestone scores for the in-home group only. No outliers were detected for the barrier scores at baseline and at second assessment for either group. A decision was made not to remove these few outliers because there was no justification for removal. That is, professional clinicians completed the VB-MAPP assessments, and it is unlikely that those few scores had errors in measurement. It should be noted that those few outliers were higher scores than most of the children in each group, which may simply indicate that these children had higher skill development (language acquisition milestones) prior to ABA treatment. The one outlier for the second assessment may simply indicate this child responded more favorable to treatment relative to the other children.

Normality was assessed for the dependent variables at baseline and second assessment according to the type of environment. The tests of normality for the language acquisition milestone scores demonstrated that for the in-home children the distributions of milestone scores were normally distributed at baseline and the second assessment (Kolmogorov-Smirnov, $p = .07$ and $p = .20$). The tests of normality for the language acquisition milestone scores demonstrated that for the in-clinic children the distributions

of milestone scores were not normally distributed at baseline and the second assessment (Kolmogorov-Smirnov, $p = .001$ and $p = .03$). The tests of normality for the language acquisition barrier scores demonstrated that for the in-home children the distribution of barrier scores was not normally distributed at baseline (Kolmogorov-Smirnov, $p = .02$) but were normally distributed at the second assessment (Kolmogorov-Smirnov, $p = .08$). The tests of normality for the language acquisition barrier scores demonstrated that for the in-clinic children the distributions of barrier scores were normally distributed at baseline and the second assessment (Kolmogorov-Smirnov, *ps* = .2). While some of the data were not normally distributed, ANOVA is a robust test even when the assumption of normality is not met (Tabachnick & Fidell, 2013).

Homogeneity of variances was assessed using Levene's test of equality of error variances for the between-subjects variable (type of environment). Homogeneity of variance was met for baseline assessment milestone scores, $F(1,34) = .003$, $p = .959$, and for second assessment milestone scores, $F(1,34) = .742$, $p = .395$. Homogeneity of variance was also met for baseline assessment barrier scores, $F(1,34) = 1.164$, $p = .288$, and for second assessment barrier scores, $F(1,34) = .008$, $p = .927$.

Since a mixed design has repeated measures, one should be concerned with issues of sphericity. However, Mauchly's test of sphericity was not an issue since there were only two occasions of the repeated measure for each dependent variable thus the sphericity test was null (met).

2 X 2 Mixed ANOVA for Milestone Scores

Research question 1 was assessed using a 2 (type of environment: in-home and in-clinic) 2 X 2 (time of assessment: baseline and second assessment) mixed ANOVA with the dependent variable of VB-MAPP language acquisition milestone scores. It was hypothesized that there is a significant difference in milestone scores in children receiving ABA treatment in-clinic versus in-home.

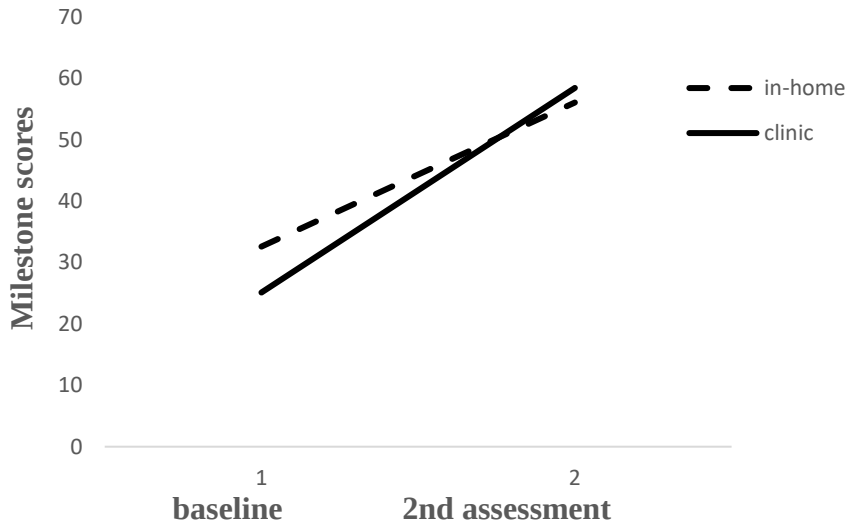
The results of the 2 X 2 mixed ANOVA indicated that there was no significant main effect for the type of environment, $F(1,34) = .048$, $p = .827$. This demonstrated that there was no significant difference in VB-MAPP milestone scores between in-home (M = 44.34) and in-clinic (M = 41.79).

The results of the 2 X 2 mixed ANOVA indicated that there was a significant main effect for the time of assessment, $F(1,34) = 55{,}207$, $p < .001$, $\eta^2 = .619$. This demonstrated that there was a significant increase in VB-MAPP milestone scores from baseline assessment (M=30.11) to the second assessment (M= 56.875).

The results of the 2 X 2 mixed ANOVA indicated that there was no significant interaction between the type of environment and time of assessment, $F(1,34) = 1.661$, p = .206. This demonstrated that the effect of time of assessment did not change as a function of the type of environment. The results of this analysis are depicted in Figure 1.

Figure 1

Mean Language Acquisition Milestones Scores at Baseline Assessment (Before Treatment) and at the Second Assessment (After Treatment) as a Function of Type of Environment



2 X 2 Mixed ANOVA for Barrier Scores

Research question was assessed using a 2 (type of environment: in-home and in-clinic) X 2 (time of assessment: baseline and second assessment) mixed ANOVA with the dependent variable of VB-MAPP language acquisition barrier scores It was hypothesized that there is a significant difference in barrier scores in children receiving ABA treatment in-clinic versus in-home.

The results of the 2 X 2 mixed ANOVA indicated that there was no significant main effect for the type of environment, $F(1, 34) = 1.781$, p=.191. This demonstrated that

there was no significant difference in VB-MAPP barrier scores between in-home (*M*= 42.48) and in-clinic (*M*=30.71).

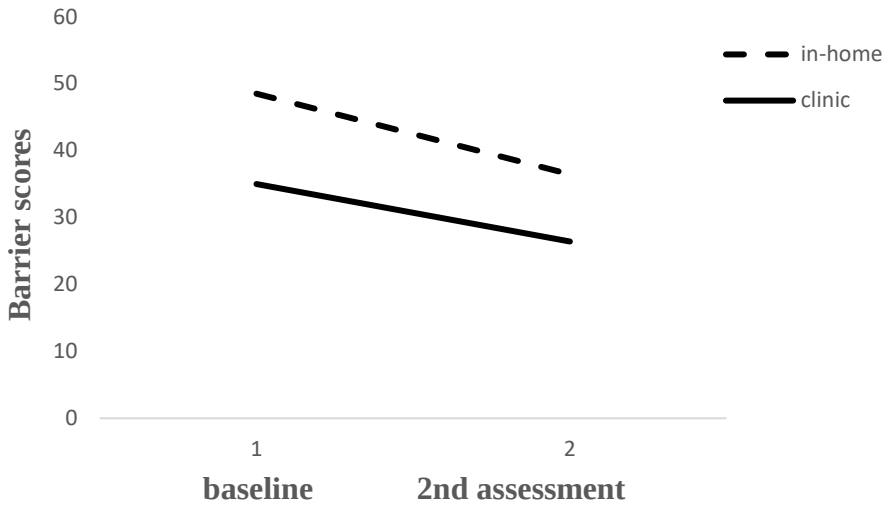
The results of the 2 X 2 mixed ANOVA indicated that there was a significant main effect for time of assessment, $F(1, 34) = 7.01$, $p<.01$. This demonstrated that there was a significant decrease in barrier scores from baseline assessment (*M*= 44.0) to the second assessment (*M*= 33.11).

The results of the 2 X 2 mixed ANOVA indicated that there was no significant interaction between the type of environment and time of assessment, $F(1, 34) = .197$, $p=.66$.

This demonstrated that the effect of time of assessment (for barrier scores) did not change as a function of the type of environment. The results of this analysis are depicted in Figure 2.

Figure 2

Mean Language Acquisition Barrier Scores at Baseline Assessment (Before Treatment) and at the Second Assessment (After Treatment) as a Function of Type of Environment



Summary

The 2 X 2 mixed ANOVA for milestone scores resulted a significant main effect of time of assessment. That is, milestone scores significantly increased from baseline to second assessment. There was no significant main effect for type of environment or the interaction between type of environment and time of assessment. The 2 X 2 mixed ANOVA for barrier scores resulted a significant main effect of time of assessment. That is, barrier scores significantly decreased from baseline to second assessment. There was no significant main effect for type of environment or the interaction between type of environment and time of assessment. In Chapter 5 I will discuss the interpretations of these findings, and how these findings may contribute to the decisions clinicians, parents, and payors determine the environmental effects on treatment. I will discuss the

limitations of the study, recommendations for further study, and the implications of these findings.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative nonexperimental study was to determine the extent to which the type of ABA treatment environment (in-home vs. in-clinic) relates to language acquisition milestones and barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), over a 12-month period (at baseline and approximately 12 months after treatment). The research design was a nonexperimental quantitative mixed design using data from an archival data set. The between-subjects independent variable was the type of environment in which treatment was provided (home vs. clinic). The within-subjects independent variable was time of assessment (at baseline before treatment and then at the second assessment during treatment). A 2 X 2 mixed ANOVA was utilized. One ANOVA was used to assess possible differences in language acquisition milestone scores. A second AVOVA was used to assess possible differences in language acquisition barrier scores. The participants included children (3 to 12 years of age) who had a diagnosis of ASD and received ABA treatment in in-home setting or a clinic setting.

The results of the 2 X 2 mixed ANOVA indicated that there was a significant main effect for time of assessment which demonstrated that language acquisition milestone scores significantly increased from baseline to second assessment. There was no significant main effect of type of environment or interaction between time of assessment and type of environment for language acquisition milestone scores. The results of the second 2 X 2 mixed ANOVA also indicated that there was a significant

main effect for time of assessment for language acquisition barrier scores. This result demonstrated that language acquisition barrier scores significantly decreased from baseline to second assessment. Again, there was no significant main effect for type of environment or interaction between type of environment and time of assessment for language acquisition barrier scores.

Interpretation of the Findings

The findings extend the knowledge in the discipline of ABA treatment for children with ASD as called for by Strand and Eldevik (2018) for future studies of ABA treatments across different treatment environments. McConachie et al. (2015) identified several challenges for families when choosing a treatment that included broad definitions of ABA and multiple variations of treatment protocols. My findings help narrow these broad definitions of ABA to focus on EIBI as a model and the use of VB-MAPP as an assessment tool. A gap in the research was identified regarding the role of the environment on ABA treatment outcomes related to language skills. This study extends the knowledge families and practitioners may use when determining questions related to where treatment should take place and treatment efficacy.

Schreibman et al. (2015) suggested that ABA practitioners often acknowledge the importance of environmental variables that can impact behavior and skills for children with ASD even though there is limited research on the differences between common treatment environments. This study expands on current knowledge and found that ABA treatment was just as effective when provided in-home compared to in-clinic. There were no significant differences in language acquisition milestone scores or language

acquisition barrier scores as a function of type of environment. Rather, ABA treatment was shown to be effective in both environments as demonstrated by the significant increase in language acquisition milestone scores and the significant decrease language acquisition barrier scores from baseline to second assessment. One possible explanation for these results is that treatment is effective when parents are allowed to choose their preferred treatment environment. The parents in this study did have a choice of their preferred treatment environment. It could be that when parents are given the choice of where treatment occurs this simply leads to lower parental stress. Parental stress has been shown to negatively impact ABA treatment outcomes (e.g., Strauss et al., 2012). Previous research has also shown that parental involvement in their child's treatment improves treatment outcomes (Sneed, 2022). Thus, the results of the current study may not have been the same if families had been forced into receiving services in one environment versus the other.

Lovass' (1987) provided a solid foundation for the effectiveness of ABA treatment in a clinic setting, based upon the principles of ABA though this body of research is limited to data from in-clinic settings. This study expands upon the current research and extends findings to the in-home model as well.

The theoretical model of behaviorism applies principles of function-based behavior to verbal behavior and the verbal operants as defined by Skinner (1957). The approach is also known as early intensive behavior intervention which supports the development of these verbal responses to be closer to those of children who do not have an ASD diagnosis (Mohammadzaheri et al., 2014). My study was based on the

application of ABA as a treatment for children with ASD based upon the work of Skinner (1957) regarding verbal behavior. The theoretical approach most appropriate for this research was based upon behaviorism and specifically, the verbal behavior model as discussed earlier. Skinner's (1957) original work was used to develop the VB-MAPP used for assessment and treatment guidance and was the tool used from archival sources in this study, as well being one of the most common ways to determine treatment protocols for children with ASD.

The results from the current study indicated there were no significant differences in language acquisition milestone scores or language acquisition barrier scores, when comparing the in-home to the in-clinic groups. While the work of Lovaas and Smith (2003), among others, demonstrated efficacy in ABA treatment in clinic settings, it led to an assumption that the clinic environment contributed to the efficacy of ABA treatment. The scores for language acquisition milestones significantly increased and the scores for the language acquisition barriers scores significantly decreased for both groups. Thus, ABA treatment was just as effective in either environment when comparing the in-home to the in-clinic groups. This supports the proposition of behavioral theory as Skinner (1957) indicated that verbal behavior is a learned behavior and like other learned behaviors it can be increased through reinforcement. Sundberg and Michael (2001) recognized importance these verbal operants. Sundberg (2008) organized these into the VB-MAPP assessment that allows researchers to measure verbal skills and barriers in a way that assesses developmental progress through ABA treatment.

Limitations of the Study

One limitation of this study was that the design was correlational and not experimental. The behavioral health organization did not randomly assign families/children to either the home or to the in-clinic treatment setting. This limited my ability to determine causal explanations. In addition, the archival data set relied on convenient sampling and the participants were not randomly selected. This limits my ability to generalize the results to other populations.

Another limitation which may have impacted the validity of the results is that there are other variables that could have influenced scores on the VB-MAPP assessment. For example, the treatment quality may have varied from one child to another due to the training and experience of the registered behavioral technicians (who provided ABA treatment) and the licensed behavioral analysts (who conducted the VB-MAPP assessments). Similarly, other factors that may have influenced changes in the VB-MAPP scores included other interventions children may have received simultaneously with ABA treatment, developmental changes in the children due to maturation, as well as the family's social economic status and educational level, etc. These variables were not measured or included in the archival data set. Lastly, the COVID-19 pandemic may have also impacted the study in ways that are unclear and may have contributed to and impacted treatment for some of the children receiving services in either and/or both environments.

Recommendations

Further studies focusing on the differences between treatment environments for children receiving ABA treatment are warranted. Specifically, future research could include the use of experimental designs with type of environment and time of assessment, but where the amount of time between assessments is standardized and treatment is extended over the course of at least 3-4 assessment periods. Another recommendation includes the comparison of multiple treatment approaches using ABA methodologies, environments, and assessment measures based upon the broad definitions of treatment and assessment. This would further contribute to and expand on the knowledge of ABA treatment outcomes based upon environment and assessment methods beyond those in this study.

Additionally, future research may include evaluation of progress or language skill development, language barriers, and problem behaviors using additional measurement tools beyond the VB-MAPP. Other assessment tools commonly utilized may include the Vineland II (Sparrow et al., 2005), which is a standardized assessment for general developmental skills and commonly used in assessment for children with ASD. The PEAK is also a developmental assessment that includes the developmental language milestones through 48 months but continues the assessment into adolescents (Dixon et al., 2014). In addition, another factor to consider in future research on ABA treatment outcomes related to these skills are the effect of education and experience of the ABA professionals providing treatment.

Another area for future research may include assessment of treatment outcomes with specific focus on age, severity of diagnosis, that is now associated with mild, moderate, or severe ASD categories that accompany the ASD diagnosis and are associated with level (amount) of treatment rendered or recommended. Furthermore, future research may examine the level of parental/family participation in treatment and the impact this has upon treatment outcomes.

Lastly, additional research examining alternative models of ABA treatment that utilize alternative curricula and assessment, such as PEAK, may be useful in comparison to this traditional model of EIBI. Assessments like PEAK include a prescribed curriculum based upon assessment outcomes that guide treatment. There may also be benefit in examining the use of discrete trial teaching methods (therapist led) to more naturalistic (child led) models of treatment, where the child chooses reinforcement, and the therapist uses whatever the child has selected to use in treatment protocols. This is different than discrete trial teaching where the therapist controls access to the reinforcement and the child's access to it based upon treatment protocols. There are multiple treatment modalities of ABA that have specific teaching methodologies that all fall under the broader science of ABA (CDC, 2020). These differences are not commonly understood by parents or professionals who are not directly working within the field of ABA. Research that examines these models and teaching methods for efficacy will increase a family's knowledge and allow for educated analysis of the model that is best suited for their child and their unique needs.

Implications

This study may lead to positive social change by increasing insights into the potential impact environment may play in ABA treatment outcomes. The consideration by families and clinicians of whether to utilize a clinic-based model of treatment or in-home based treatment model may have more significant ramifications other than location, most importantly the effectiveness of treatment that increases skills and decreases behavioral barriers.

The results indicated for the children in the study that the environmental setting variable did not have a significant impact on language acquisition milestone or barrier scores. There was an increase in language and developmental milestone scores and a decrease in language acquisition barrier scores in both environments, indicating ABA was effective in both environments. This may contribute to positive social change on the individual child specific level, as it appears ABA treatment, in either environment, is beneficial with similar (successful) outcomes. This contributes to benefit for families in areas where access to a clinic may be limited and in-home options are the only option. This also serves as positive social change for practitioners who may have concerns related to ABA treatment environment regarding the effectiveness of outcomes in one environment over another. The clinician may have concerns over the ability to develop and maintain instructional control in the home due to not being able to control many aspects of this environment, or concerns with the limited ability to generalize skills outside of an artificial clinic setting for treatment.

Another potential implication for positive social change on a larger societal scale is related to decisions made by insurance companies that have varied coverage or reimbursement rates dependent upon arbitrary environmental variables. These may include policies of where treatment can be rendered, or reimbursement limits based upon the environment in which services are rendered. This may limit or deny access to ABA treatment for children with ASD because some providers may only be able to serve children in a clinic setting based upon funding source limits. This may also limit the ability of providers of ABA treatment to render services in one environment or the other based upon these policies that may dictate services be rendered only in a clinic or an in-home setting. The decision to provide treatment in one environment or another should be based upon the unique clinical needs of the client and the family's current situation.

Conclusion

The diagnosis of ASD is one of the most common diagnoses for children in the United States at 1 in 59 according to estimates by Centers for Disease Control. Families of children with ASD are left to the funding sources for interventions to steer them in the right direction for what is effective treatment, or if treatment is needed or how treatment is defined. This study was conducted to determine the extent to which type of ABA treatment setting (home vs. clinic) related to language acquisition milestones and language acquisition barriers, as measured by the Verbal Behavior Milestones Assessment and Placement Program. The results indicated ABA treatment was an effective treatment for children with ASD in both the in-home and the in-clinic environment for the children with ASD. That is, language acquisition milestones

significantly increased, and language acquisition barriers scores significantly decreased from baseline to second assessment. While this study used a non-experimental design with only one assessment tool, it does provide insight into ABA treatment outcomes related to language skills for children receiving ABA treatment in both the in-home and in-clinic environments.

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental disorders* (5th ed.). American Psychiatric Association.

Axelrod, S., McElrath, K. K., & Wine, B. (2012). Applied Behavior Ananysis: Autism and Beyond. *Behavioral Interventions*, *27*(1), 1–15. https://doi.org/10.1002/bin.1335

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., Kurzius-Spencer, M., Zahorodny, W., Robinson Rosenberg, C., White, T., Durkin, M. S., Imm, P., Nikolaou, L., Yeargin-Allsopp, M., Lee, L. C., Harrington, R., Lopez, M., Fitzgerald, R. T., Hewitt, A., … Dowling, N. F. (2018). Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years - Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. *Morbidity and Mortality weekly Report Surveillance Summaries*, *67*(6), 1–23. https://doi.org/10.15585/mmwr.ss6706a 1

Barnes, C. S., Mellor, J. R., & Rehfeldt, R. A. (2014a). Implementing the verbal behavior milestones assessment and placement program (VB-MAPP): Teaching Assessment Techniques. *The Analysis of Verbal Behavior*, *30*(1), 36–47. https://doi.org/10.1007/s40616-013-0004-5

Barnes, C. S., Mellor, J. R., & Rehfeldt, R. A. (2014b). Implementing the verbal behavior milestones assessment and placement program (VB-MAPP): Teaching assessment techniques. *The Analysis of Verbal Behavior*, *30*(1), 36–47. https://doi.org/10.1007/s40616-013-0004-5

Barnes, C. S., Mellor, J. R., & Rehfeldt, R. A. (2014). Implementing the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP): Teaching assessment techniques. The Analysis of Verbal Behavior, 30, 36-47.

Behavior Analyst Certification Board (2021). Retrieved 2 May 2021, from https://www.bacb.com/

Bijou, S.W. & Baer, D.M. (1961). *Child development I: A systematic and empirical theory*. Prentice-Hall.

Bondy, A., Esch, B. & Sundberg, M. (2016). Questions on Verbal Behavior and its Application to Individuals with Autism: An Interview with the Experts. *The Behavior Analysis Today, 11*(3): 186-205. https://files.eric.ed.gov/fulltext/EJ937628.pdf

Buchner, A., Erdfelder, E., Faul, F., & Lang, A.-G. (2021).*: G*Power*.. Universität Düsseldorf. https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower

Carr, E.G. (1977). The motivation of self-injurious behavior: a review of some hypothesis. *Psychological Bulletin, 84*(4), 800-816. https://doi.org/10.1037/0033-2909.84.4.800

Christensen, D. L., Maenner, M. J., Bilder, D., Constantino, J. N., Daniels, J., Durkin, M. S., Fitzgerald, R. T., Kurzius-Spencer, M., Pettygrove, S. D., Robinson, C., Shenouda, J., White, T., Zahorodny, W., Pazol, K., & Dietz, P. (2019). Prevalence and characteristics of autism spectrum disorder among children aged 4 years—Early autism and developmental disabilities monitoring network, seven sites,

United States, 2010, 2012, and 2014. *Morbidity and Mortality Weekend Report Surveillance Summaries, 68*(2), 1–19. https://doi.org/10.15585/mmwr.ss6802a1

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis (2nd ed.). Merrill Prentice Hall.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). Applied behavior analysis (3rd ed.). Merrill Prentice Hall.

DeMeyer, M.K., & Ferster. C.B. (1962). Teaching new social behavior to schizophrenic children. *Journal of the American Academy of Child Psychology, 1*(3), 443-461.

Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal Investigators; Centers for Disease Control and Prevention. (2010). Prevalence of autism spectrum disorder among children aged 8 years—Autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *Morbidity and Mortality Weekly Rreport Surveillience Summaries, 63*(2):1-21.

Dixon, M. R., Belisle, J., Whiting, S. W., & Rowsey, K. E. (2014). Normative sample of the PEAK relational training system: Direct training module and subsequent comparisons to individuals with autism. *Research in Autism Spectrum Disorders*, *8*(11), 1597-1606. https://doi.org/10.1016/j.rasd.2014.07.020

Dixon, M. R., Belisle, J., Stanley, C., Rowsey, K., Daar, J. H., & Szekely, S. (2014). Toward a behavior analysis of complex language for children with autism: Evaluating the relationship between PEAK and the VB-MAPP. *Journal of Developmental and Physical Disabilities*, *27*(2), 223–233. https://doi.org/10.1007/s10882-014-9410-4

Edwards, K.S., Landa, R.K., Frampton, S.E. & Shillingsburg, M.A. (2018). Increasing functional leisure engagement for children with autism using backward chaining. *Behavior Modification. 42*(1): 9-33. https://doi.org/10.1177/0145445517699929

Fenske, E. C., Zalenski, S., Krantz, P. J., & McClannahan, L. E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities*, *5*(1-2), 49–58. https://doi.org/10.1016/s0270-4684(85)80005-7

Ferster, C.B. (1961). Positive reinforcement and behavioral deficits of autistic children. *Child Development, 32*, 437-456. https://doi.org/10.1111/j.1467-8624.1961.tb05042.x

Ferster, C. B., & Simons, J. (1966). Behavior therapy with children. *The Psychological Record*, *16*(1), 65–71. https://doi.org/10.1007/bf03393644

Frost, L., & Bondy, A. (2009). A common language: Using B. F. Skinner's verbal behavior for assessment and treatment of communication disabilities in SLP-ABA. *The Journal of Speech and Language Pathology–Applied Behavior Analysis*, *4*(1), 2–9. https://doi.org/10.1037/h0100250

Fryling, M. J., Wallace, M. D., & Yassine, J. N. (2012a). Impact of Treatment Integrity on Intervention Effectiveness. *Journal of Applied Behavior Analysis*, *45*(2), 449–453. https://doi.org/10.1901/jaba.2012.45-449

Green, G. (1996). *Evaluating claims about treatments for autism.* In C. Maurice, G. Green, & S. C. Luce (Eds.), *Behavioral intervention for young children with autism: A manual for parents and professionals* (p. 15–28). PRO-ED.

Grindle, C. F., Kovshoff, H., Hastings, R. P., & Remington, B. (2008). Parents' Experiences of Home-Based Applied Behavior Analysis Programs for Young Children with Autism. *Journal of Autism and Developmental Disorders*, *39*(1), 42–56. https://doi.org/10.1007/s10803-008-0597-z

Hodges, H., Fealko, C., & Soares, N. (2020). Autism spectrum disorder: definition, epidemiology, causes, and clinical evaluation. *Translational Pediatrics*, *9*(Suppl 1), S55–S65. https://doi.org/10.21037/tp.2019.09.09

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*(2), 197–209. https://doi.org/10.1901/jaba.1994.27-197

Johnson, G., Kohler, K., & Ross, D. (2016). Contributions of Skinner's theory of verbal behaviour to language interventions for children with autism spectrum disorders. *Early Child Development and Care*, *187*(3-4), 436–446. https://doi.org/10.1080/03004430.2016.1236255

Klintwall, L., & Eikeseth, S. (2014). Early and Intensive Behavioral Intervention (EIBI) in Autism. In V. Patel, V. Preedy, & C. Martin (eds). *Comprehensive Guide to Autism*. Springer, New York, NY (pp. 117-137).

Knopf, A. (2020). Autism prevalence increases from 1 in 60 to 1 in 54: CDC. *The Brown University Child and Adolescent Behavior Letter*, *36*(6), 4–4. https://doi.org/10.1002/cbl.30470

Koegel, L. K., Harrower, J. K., & Koegel, R. L. (1999). Support for Children with Developmental Disabilities in Full Inclusion Classrooms Through Self-

Management. *Journal of Positive Behavior Interventions*, *1*(1), 26–34. https://doi.org/10.1177/109830079900100104

Koegel, R. L., Schreibman, L., Loos, L. M., Dirlich-Wilhelm, H., Dunlap, G., Robbins, F. R., & Plienis, A. J. (1992). Consistent stress profiles in mothers of children with autism. *Journal of Autism and Developmental Disorders*, *22*(2), 205–216. https://doi.org/10.1007/bf01058151

Leaf, J. B., Cihon, J. H., Ferguson, J. L., & Weinkauf, S. M. (2017). An Introduction to Applied Behavior Analysis. In J. Matson (eds). *Handbook of Childhood Psychopathology and Developmental Disabilities Treatment. Autism and Child Psychopathology Series*. Springer, Cham (pp. 25-42).

Leaf, J. B., Leaf, R., McEachin, J., Cihon, J. H., & Ferguson, J. L. (2017). Advantages and challenges of a home- and clinic-based model of behavioral intervention for individuals diagnosed with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 48*(6), 2258-2266.

Leaf, J. B., Sheldon, J. B., & Sherman, J. A. (2010). COMPARISON OF SIMULTANEOUS PROMPTING AND NO-NO PROMPTING IN TWO-CHOICE DISCRIMINATION LEARNING WITH CHILDREN WITH AUTISM. *Journal of Applied Behavior Analysis*, *43*(2), 215–228. https://doi.org/10.1901/jaba.2010.43-215

Leaf, R. B., McEachin, J. J., & Taubman, M. (2008). *Sense and nonsense in the behavioral treatment of autism: It has to be said.* New York, NY: Different Roads to Learning.

Lerman, D. C., Vorndran, C., Addison, L., & Kuhn, S. A. (2004). A rapid assessment of skills in young children with autism. *Journal of Applied Behavior Analysis*, *37*(1), 11–26. https://doi.org/10.1901/jaba.2004.37-11

Lerner, M. D., McPartland, J. C., & Morris, J. P. (2013). Multimodal emotion processing in autism spectrum disorders: An event-related potential study. *Developmental Cognitive Neuroscience*, *3*(6), 11–21. https://doi.org/10.1016/j.dcn.2012.08.005

Lindgren, S., Wacker, D., Suess, A., Schieltz, K., Pelzel, K., Kopelman, T., Lee, J., Romani, P., & Waldron, D. (2016). Telehealth and Autism: Treating Challenging Behavior at Lower Cost. *PEDIATRICS*, *137*(Supplement), S167–S175. https://doi.org/10.1542/peds.2015-2851o

Lotfizadeh, A. D., Kazemi, E., Pompa-Craven, P., & Eldevik, S. (2018). Moderate Effects of Low-Intensity Behavioral Intervention. *Behavior Modification*, *44*(1), 92–113. https://doi.org/10.1177/0145445518796204

Lotfizadeh, A. D., Kazemi, E., Pompa-Craven, P., & Eldevik, S. (2020). Moderate Effects of Low-Intensity Behavioral Intervention. *Behavior Modification*, 44(1), 92–113.

Lovaas, O. I. (1981). *Teaching developmentally disabled children: The ME book.* Baltimore: University Park Press.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology*, *55*(1), 3–9. https://doi.org/10.1037//0022-006x.55.1.3

Lovaas, O. I., & Smith, T. (2003). *Early and intensive behavioral intervention in autism.* In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (p. 325–340). The Guilford Press.

Lovaas, O. I., Koegel, R., Simmons, J. Q., & Long, J. S. (1973). Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis, 6*(1), 131-166.

Lovaas, O. I., Schaeffer, B., & Simmons, J. Q. (1965). Building social behavior in autistic children by use of electric shock. *Journal of Experimental Research in Personality, 1*(2), 99–109.

Luiselli, J.K., Cannon, B. O., Ellis, J. T., Sisson, R. W., (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder. A preliminary evaluation of outcome in relation to child age and intensity of service delivery. Autism: *The International Journal of Research and Practice, 4*(4), 426-438.

Maenner MJ, Shaw KA, Baio J, et al. Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2016. MMWR Surveill Summ 2020;69(No. SS-4):1–12. DOI: http://dx.doi.org/10.15585/mmwr.ss6904a1

Manohar, H., Kandasamy, P., Chandrasekaran, V., & Rajkumar, R. P. (2019). Early Diagnosis and Intervention for Autism Spectrum Disorder: Need for Pediatrician-Child Psychiatrist Liaison. *Indian Journal of Psychological Medicine, 41*(1), 87–90.

Mason, L.L., Anastasia, S., Stephanie, S.C., Alonzo, A., Alexandria, A. & Humbert, P. (2018). A Comparison of Outcomes from Criterion-referenced and Experimental Evaluations of Verbal Behavior. *Behavioral Development, 23*(2): 118-129.

Matson, J. L., Benavidez, D. A., Compton, L. S., Paclawskyj, T., & Baglio, C. (1996). Behavioral treatment of autistic persons: A review of research from 1980 to the present. *Research in Developmental Disabilities, 17*(6), 433-465.

Matson, J. L., Turygin, N. C., Beighley, J., Rieske, R., Tureck, K., Matson, M. L. (2012). Applied behavior analysis in autism spectrum disorders: Recent developments, strengths, and pitfalls. *Research in Autism Spectrum Disorders, 6*(1), 144-150.

McConachie H, Parr JR, Glod M, Hanratty J, Livingstone N, Oono IP, *et al.* Systematic review of tools to measure outcomes for young children with autism spectrum disorder. *Health Technol Assess* 2015;19(41)

McEachin, J.J., Smith, T., and Lovaas, O. I. (1993) Long-Term Outcome for Children with Autism Who Received Early Intensive Behavioral Treatment. American Journal on Mental Retardation, 97, 359-372

Mohammadzaheri, F., Koegel, L. K., Rezaee, M., & Rafiee, S. M. (2014). A Randomized Clinical Trial Comparison Between Pivotal Response Treatment (PRT) and Structured Applied Behavior Analysis (ABA) Intervention for Children with Autism. *Journal of Autism and Developmental Disorders*, *44*(11), 2769–2777. https://doi.org/10.1007/s10803-014-2137-3

Montallana, K. L., Gard, B. M., Lotfizadeh, A. D., & Poling, A. (2019). Inter-Rater Agreement for the Milestones and Barriers Assessments of the Verbal Behavior

Milestones Assessment and Placement Program (VB-MAPP). *Journal of Autism and Developmental Disorders*, *49*(5), 2015–2023. https://doi.org/10.1007/s10803-019-03879-4

Morris, E. K., Altus, D. E., & Smith, N. G. (2013). A study in the founding of applied behavior analysis through its publications. *The Behavior Analyst*, *36*(1), 73–107. https://doi.org/10.1007/bf03392293

Morris, E. K., Todd, J. T., Midgley, B. D., Schneider, S. M., & Johnson, L. M. (1990). The history of behavior analysis: Some historiography and a bibliography. *The Behavior Analyst*, *13*(2), 131–158. https://doi.org/10.1007/bf03392530

Nah, Y.-H., Young, R. L., & Brewer, N. (2014). Using the Autism Detection in Early Childhood (ADEC) and Childhood Autism Rating Scales (CARS) to Predict Long Term Outcomes in Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, *44*(9), 2301–2310. https://doi.org/10.1007/s10803-014-2102-1

Nuzzolo-Gomez, R., Leonard, M. A., Ortiz, E., Rivera, C. M., & Greer, R. D. (2002). Teaching Children with Autism to Prefer Books or Toys Over Stereotypy or Passivity. *Journal of Positive Behavior Interventions*, *4*(2), 80–87. https://doi.org/10.1177/109830070200400203

PR, N. (2014, March 27). CDC estimates that 1 in 68 children has been identified with an autism spectrum disorder. PR Newswire US.

Schopler, E., Short, A., & Mesibov, G. (1989). Relation of behavioral treatment to "normal functioning": Comment on Lovaas. *Journal of Consulting and Clinical Psychology*, *57*(1), 162–164. https://doi.org/10.1037/0022-006x.57.1.162

Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., McGee, G. G., Kasari, C., Ingersoll, B., Kaiser, A. P., Bruinsma, Y., McNerney, E., Wetherby, A., & Halladay, A. (2015). Naturalistic Developmental Behavioral Interventions: Empirically Validated Treatments for Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, *45*(8), 2411–2428. https://doi.org/10.1007/s10803-015-2407-8

Sheinkopf, S. J., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders*, *28*(1), 15–23.

Shyman, E. (2016). The Reinforcement of Ableism: Normality, the Medical Model of Disability, and Humanism in Applied Behavior Analysis and ASD. *Intellectual and Developmental Disabilities*, *54*(5), 366–376. https://doi.org/10.1352/1934-9556-54.5.366

Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.

Slaton, J. D., Hanley, G. P., & Raftery, K. J. (2017). Interview-informed functional analyses: A comparison of synthesized and isolated components. *Journal of Applied Behavior Analysis*, *50*(2), 252–277. https://doi.org/10.1002/jaba.384

Smith, T., & Eikeseth, S. (2010). O. Ivar Lovaas: Pioneer of Applied Behavior Analysis and Intervention for Children with Autism. *Journal of Autism and Developmental Disorders*, *41*(3), 375–378. https://doi.org/10.1007/s10803-010-1162-0

Smith, T., Eikeseth, S., Sallows, G. O., & Graupner, T. D. (2009). Efficacy of applied behavior analysis in autism. *The Journal of Pediatrics*, *155*(1), 151–152. https://doi.org/10.1016/j.jpeds.2009.01.065

Sneed, L. (2022). *Treatment Efficacy of Parent-Led ABA for Children With Autism and Their Parents* (Doctoral dissertation, Walden University).

Soluaga, D., Leaf, J. B., Taubman, M., McEachin, J., & Leaf, R. (2008). A comparison of flexible prompt fading and constant time delay for five children with autism. *Research in Autism Spectrum Disorders*, *2*(4), 753–765.

Sparrow, S. S., Balla, D. A., Cicchetti, D. V., & Doll, E. A. (2005).

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization1. *Journal of Applied Behavior Analysis*, *10*(2), 349–367. https://doi.org/10.1901/jaba.1977.10-349

Strand, R. C. W., & Eldevik, S. (2017). Improvements in problem behavior in a child with autism spectrum diagnosis through synthesized analysis and treatment: A replication in an EIBI home program. *Behavioral Interventions*, *33*(1), 102–111. https://doi.org/10.1002/bin.1505

Strauss, K., Mancini, F., & Fava, L. (2013). Parent inclusion in early intensive behavior interventions for young children with ASD: A synthesis of meta-analyses from

2009 to 2011. *Research in Developmental Disabilities*, *34*(9), 2967–2985. https://doi.org/10.1016/j.ridd.2013.06.007

Strauss, K., Vicari, S., Valeri, G., D'Elia, L., Arima, S., & Fava, L. (2012). Parent inclusion in early intensive behavioral intervention: The influence of parental stress, parent treatment fidelity and parent-mediated generalization of behavior targets on child outcomes. *Research in Developmental Disabilities*, *33*(2), 688-703.

Sundberg, Mark L. (2008) VB-MAPP Verbal Behavior Milestones Assessment and Placement Program: a language and social skills assessment program for children with autism or other developmental disabilities: guide Concord, CA: AVB Press,

Sundberg, M. L., & Michael, J. (2001). The Benefits of Skinner's Analysis of Verbal Behavior for Children with Autism. *Behavior Modification*, *25*(5), 698–724. https://doi.org/10.1177/0145445501255003

Sundberg, M. L., & Sundberg, C. A. (2011). Intraverbal Behavior and Verbal Conditional Discriminations in Typically Developing Children and Children With Autism. *The Analysis of Verbal Behavior*, *27*(1), 23–44. https://doi.org/10.1007/bf03393090

Taubman, M., Brierley, S., Wishner, J., Baker, D., McEachin, J., & Leaf, R. B. (2001). The effectiveness of a group discrete trial instructional approach for preschoolers with developmental disabilities. *Research in Developmental Disabilities*, *22*(3), 205–219.

Tabachnick, B., & Fidell, L. (2013). *Using multivariate statistics*. Boston: Pearson Education.

Vietze, P., & Lax, L. E. (2018). Early Intervention ABA for Toddlers with ASD: Effect of Age and Amount. *Current Psychology*, *28*(2). https://doi.org/10.1007/s12144-018-9812-z

Welcome to the Behavior Analyst Certification Board. (2017). Behavior Analyst Certification Board. https://www.bacb.com

Wolf, M., Risley, T. R., & Mees, H. L. (1964). Applications of operant conditioning and procedures to the behavior problems of an autistic child. *Behavior Research and Therapy, 1*(2-4), 305–312.

Appendix A: 16 Domains for Developmental Milestones

The following is a list of definitions and examples of the developmental milestones contained within the VB-MAPP assessment.

16 Domains

1. **Mand:** The child may ask for, point toward or gesture, etc. to communicates that he/she wants or does not want something. For example, a child may point to or say cookie when presented with access to a cookie.

2. **Tact**: The child may label something by saying the item name but may not want the cookie. The child may say "dog" when the dog is present, but this may not indicate the child want the dog.

3. **Listener responding:** The child reacts and follows the request from the others such stand up or sit down, or clap hands, followed by the action being displayed by the child without a model.

4. **Visual perceptual skills and matching-to-sample**: (VP-MTS) The child may match pictures to the same, such as picture of a truck to another picture of the same truck.

5. **Independent play:** Playing alone without direct instruction for a certain amount of time in ways that other children the same age may play. For example, the child may drag a toy car across the floor and make a "vroom" sound.

6. **Social behavior and social play:** Playing with others in a manner that is typically displayed by other child around the same age, such as sitting for a story for a certain amount of time or following a peer to preferred toys when asked by the peer.

7. **Motor imitation:** The child may imitate motor actions of others, such as touching his/her head, followed by shoulders etc. in a manner typical for other children the same age.

8. **Echoic**: The child repeats what he/she hears regardless of the context of being told to do so or not. This may include sounds, word approximations, or whole words.

9. **Spontaneous vocal behavior:** The child makes noises that are typical for other children of the same age. For examples, babbling and noise making.

10. **Listener responding by function, feature, and class**: (LRFFC) The child can identify what something is and/or does for example answering, "You sleep in __."

11. **Intraverbal:** The child responds to other for information or seeks out information for themselves. For example, mom asked how was school, and the child may respond with, "It was good, let me tell you about lunch".

12. **Classroom routine and group skills:** The child is able to imitate peers and following group instructions that is typical for a child the same age spontaneously. For example, other children take a seat on the circle carpet, so this child follows the action and sits on the circle carpet.

13. **Linguistic structure:** The child may use words and phrases, the structure of sentences that is typical for a child of the same age. "Hey, what's up" …. Or "push me harder" on the swing etc.

14. **Grammatic**: The child is able sentences, punctuation in correct ways to write or speak as with typical children about the same age. For example, say I want brown candy!

15. **Syntax**: The child is able to use the rules for using words, phrases, clauses, and punctuation, to form sentences. For example, I ate breakfast, as opposed to I eat breakfast regarding past tense.

16. **Math**: The child is able to complete simple activities involving numbers such as recognizing the number with the correspond word, based on others at the same age. A 2 is two, etc.

Appendix B: Twenty-Four Domains for Barriers

The following is a list of definitions and examples of the potential barriers contained within the VB-MAPP assessment.

24 possible barriers

1. **Negative behaviors**: (whining, crying, aggression)
2. **Poor instructional control:** (escaping or avoiding demands)
3. **Absent, weak, or impaired mand repertoire:** (cannot tell what he wants)
4. **Absent, weak, or impaired tact repertoire:** (leads to syntax errors)
5. **Absent, weak, or impaired motor imitation:** (imitation only after prompting, or imitating inappropriate behaviors)
6. **Absent, weak, or impaired echoic repertoire:** (cannot repeat, excessively repeats, scripting)
7. **Absent, weak, or impaired visual perceptual skills and matching-to-sample:** (cannot visually differentiate items)
8. **Absent, weak, or impaired listener repertoire:** (paying attention to the speaker, reinforcing the speaker, or showing that she understands the speaker)
9. **Absent, weak, or impaired intraverbal repertoire:** (not answering questions or answering them incorrectly)
10. **Absent, weak, or impaired social skills:** (behaving in a non-age-appropriate manner)
11. **Prompt dependent:** (will only produce behavior with exact prompt)
12. **Scrolling responses:** (listing known responses until she gets the correct answer)
13. **Impaired scanning skills:** (making choices without fully scanning the choices)

14. **Failure to make conditional discriminations:** (cannot discriminate when given multiple stimulus for an item, i.e., shown pictures of different sizes and colors of balls, and asked to find the red ball)
15. **Failure to generalize**:(cannot demonstrate skills in other places or with other people)
16. **Weak or Atypical motivating operations:** (not recognizing hunger or self-stimming)
17. **Response requirement weakens the motivating operations:** (reward is not worth the effort)
18. **Reinforcement dependent:** (only responding for reward)
19. **Self-stimulation:** (flapping, rocking)
20. **Articulation problems:** (cannot be understood when speaking)
21. **Obsessive-compulsive behavior:** (child has to wear certain clothing, or drive a certain route to school)
22. **Hyperactivity**: (child is always moving, has difficulty finishing tasks)
23. **Failure to make eye contact or attend to people** (lack of eye contact can hinder early communication)
24. **Sensory defensiveness:** (child maybe be sensitive to sounds, textures)