EXAMINING THE EFFECTS OF AN EARLY MAND TRAINING INTERVENTION ON MAND ACQUISITION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)

Maram Alnahari

Follow this and additional works at: https://dsc.duq.edu/etd

Part of the Early Childhood Education Commons, and the Special Education and Teaching Commons

Recommended Citation

This Immediate Access is brought to you for free and open access by Duquesne Scholarship Collection. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of Duquesne Scholarship Collection.
EXAMINING THE EFFECTS OF AN EARLY MAND TRAINING INTERVENTION ON MAND ACQUISITION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)

A Dissertation
Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for the degree of Doctor of Philosophy

By
Maram Mohammed Alnahari

December 2022
EXAMINING THE EFFECTS OF AN EARLY MAND TRAINING INTERVENTION ON MAND ACQUISITION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)

By

Maram Mohammed Alnahari

Approved July 29, 2022

Ann X. Huang, Ph.D.
Associate Professor of Special Education
Department of Educational Foundations and Leadership
(Committee Chair)

Elizabeth McCallum, Ph.D.
Associate Professor, Department Chair
Department of Counseling Education and School Psychology
(Committee Member)

Bridget Green, Ed.D.
Assistant Professor of Special Education
Department of Educational Foundations and Leadership
(Committee Member)

Gibbs Kanyongo, Ph.D.
Department Chair
Professor of Educational Statistics
Department of Educational Foundations and Leadership
School of Education

Gretchen Generett, Ph.D.
Dean, School of Education
Duquesne University
ABSTRACT

EXAMINING THE EFFECTS OF AN EARLY MAND TRAINING INTERVENTION ON MAND ACQUISITION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)

By
Maram Mohammed Alnahari

December 2022

Dissertation supervised by Ann X. Huang, Ph.D.

Children with autism spectrum disorder (ASD) often show language delays. Their limited communication skill may lead them to engage in the same disruptive behavior that previously got them what they wanted. Verbal behavior (VB), specifically mand training (MT), is one of the early language intervention strategies used to target language development and facilitate functional communication with young children with autism. This study aimed to examine the effectiveness of an early mand training intervention on mand acquisition in children with ASD. This study specifically targeted the application, the implementation, and their effects. A multiple baseline across participants research design was used to collect and analyze data in this study. The study involved three children with ASD aged four or younger. These children were chosen due to their limited language skills, specifically unprompted mands. This study used preferred items to
increase the value of unprompted mands. The study was conducted three days a week, three sessions a day, or until the demonstrated mastery of unprompted manding at least 80% correct in a section. The results of the study showed that the early mand training intervention significantly increased the percentage of correct response of unprompted mands in children with ASD. This finding was consistent with that of previous studies and confirmed the effectiveness of this intervention for children with ASD. Limitations and recommendations were presented and discussed at the end of the dissertation.

*Keywords:* autism and behavior disorders, mand training, intensive intervention, behavioral intervention, EIBI, young children, preschooler, ASD, Verbal behavior (VB)
DEDICATION

I dedicate my dissertation work to my beloved father Mohammed and mother Eman, for their encouragement and prayers throughout my life.

To my beloved husband Dr. Kamal for his unfailing love and support through this journey.

To my wonderful and supportive siblings: Dr. Lama, Manal, Ahmed, Dr. Mona, Dr. Abdallah, Abdalrahman, Najwa and Abdalaziz.

To my sweetest children, Miral and Motaz.
ACKNOWLEDGEMENT

I would like to thank God Allah for giving me strength and patience throughout my life. Also, there are many people that I would like to thank for completing this dissertation. First, I would like to express my gratitude to my committee chair, Dr. Ann Huang, who mentored me from the first day of this program. Thank you so much for your time, support, and patience through my dissertation.

I would also like to express my thank to my committee members, Dr. Elizabeth McCallum and Dr. Bridget Green, for all the time and support for reviewing my dissertation and for providing me with their feedback. Also, I would like to thank all other faculty members in the School of Education at Duquesne University for their support and education. My sincere thanks also go to my former professor Dr. Vicki McGinley from West Chester University for her support and encouragement even after I completed my master’s degree.

I would like to thank my country Saudi Arabia for giving me the opportunity and the scholarship to complete my graduate degrees. My thanks also go to Taif University in Saudi Arabia for their belief in me and support me through finishing my Ph.D., in particular, my former director of the Special Education Program, Dr. Saeed Alzahrani.

I would like to thank my great parents for their support, encouragement, prayers and more. I love you! I would like to thank my husband, Dr. Kamal, who was beside me completing his Ph.D. and encouraging me to overcome all the challenges through this journey. My sincere thanks also go to my supportive siblings, who were always with me;
thank you so much. Finally, my thanks go to my beautiful daughter Miral and my cute son Motaz; I love you so much!
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>IV</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>VI</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>VII</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>XIII</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>XIV</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>XV</td>
</tr>
<tr>
<td>CHAPTER I</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>General Description</td>
<td>1</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>3</td>
</tr>
<tr>
<td>THEORETICAL BASIS FOR THE STUDY</td>
<td>6</td>
</tr>
<tr>
<td>Applied Behavior Analysis</td>
<td>6</td>
</tr>
<tr>
<td>REVIEW OF RELEVANT LITERATURE</td>
<td>7</td>
</tr>
<tr>
<td>Early Interventions for Children with ASD</td>
<td>7</td>
</tr>
<tr>
<td>Success Factors to Implement the EIBI</td>
<td>8</td>
</tr>
<tr>
<td>Verbal Behavior (VB)</td>
<td>11</td>
</tr>
<tr>
<td>Mand Training</td>
<td>12</td>
</tr>
<tr>
<td>Success Factors for Implementing Mand Training Intervention</td>
<td>13</td>
</tr>
<tr>
<td>PROBLEM STATEMENT</td>
<td>13</td>
</tr>
<tr>
<td>CHAPTER II</td>
<td>16</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>16</td>
</tr>
<tr>
<td>HISTORICAL BACKGROUND</td>
<td>17</td>
</tr>
<tr>
<td>The History of Autism Spectrum Disorder (ASD)</td>
<td>17</td>
</tr>
<tr>
<td>Definition and Prevalence of Children with ASD</td>
<td>18</td>
</tr>
</tbody>
</table>

*Definition and Prevalence of Children with ASD*
<table>
<thead>
<tr>
<th>Chapter Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EARLY INTERVENTION</td>
<td>19</td>
</tr>
<tr>
<td>History of Early Intervention</td>
<td>19</td>
</tr>
<tr>
<td>Early Intervention Statistics</td>
<td>20</td>
</tr>
<tr>
<td>Definition of Early Intervention</td>
<td>20</td>
</tr>
<tr>
<td>THE HISTORY OF EIBI</td>
<td>21</td>
</tr>
<tr>
<td>Approaches/Models to Deliver EIBI</td>
<td>22</td>
</tr>
<tr>
<td>Target Areas of EIBI</td>
<td>24</td>
</tr>
<tr>
<td>REVIEW OF RELEVANT LITERATURE ON EIBI</td>
<td>26</td>
</tr>
<tr>
<td>THEORETICAL FOUNDATIONS OF THE STUDY</td>
<td>29</td>
</tr>
<tr>
<td>Applied Behavior Analysis</td>
<td>29</td>
</tr>
<tr>
<td>CURRENT EMPIRICAL LITERATURE RELEVANT TO RESEARCH QUESTIONS/HYPOTHESES</td>
<td>32</td>
</tr>
<tr>
<td>The Effect of EIBI Characteristics</td>
<td>32</td>
</tr>
<tr>
<td>Child’s Age at Intake</td>
<td>33</td>
</tr>
<tr>
<td>Intensity</td>
<td>34</td>
</tr>
<tr>
<td>Duration</td>
<td>36</td>
</tr>
<tr>
<td>Verbal Behavior</td>
<td>37</td>
</tr>
<tr>
<td>Positive Reinforcement</td>
<td>40</td>
</tr>
<tr>
<td>Mand Training and Communication in Children with ASD</td>
<td>41</td>
</tr>
<tr>
<td>Summary</td>
<td>42</td>
</tr>
<tr>
<td>CHAPTER III 45</td>
<td></td>
</tr>
<tr>
<td>METHODOLOGY 45</td>
<td></td>
</tr>
<tr>
<td>Overview of the Research Methodology</td>
<td>45</td>
</tr>
<tr>
<td>Setting</td>
<td>45</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1: Demographics of the Participants .......................................................... 49
Table 2: Preferred Items Identified from Preference Assessments ...................... 68
Table 3: The Result of the Participants Performance Across Phases .................. 82
Table 4: Interobserver Agreement Results of the Participants ......................... 82
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Flow Chart of Mand Training Steps</td>
<td>63</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Flow Chart of Dependent Variable</td>
<td>65</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Percentage of Correct Responses of Unprompted Mands by Participants</td>
<td>77</td>
</tr>
</tbody>
</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABA</td>
<td>Applied Behavior Analysis (ABA)</td>
</tr>
<tr>
<td>ASD</td>
<td>Autism Spectrum Disorder</td>
</tr>
<tr>
<td>EI</td>
<td>Early Intervention</td>
</tr>
<tr>
<td>EIBI</td>
<td>Early Intensive Behavioral Intervention (EIBI)</td>
</tr>
<tr>
<td>MT</td>
<td>Mand Training</td>
</tr>
<tr>
<td>MO</td>
<td>Motivation Operations</td>
</tr>
<tr>
<td>VB</td>
<td>Verbal Behavior</td>
</tr>
<tr>
<td>VB-MAPP</td>
<td>The Verbal Behavior Milestone Assessment and Placement Program</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

General Description

Individuals with autism spectrum disorder (ASD) are characterized by deficits in social communication, social interaction, and the presence of restricted, repetitive behaviors (Eshraghi et al., 2020). In recent years, the number of individuals with ASD has increased dramatically both in the United States and around the world (Baio et al., 2018). According to the Centers for Disease Control and Prevention (CDC), 1 in 44 children aged 8 or younger have a diagnosis of ASD (Maenner et al., 2021). It is reported that boys are four times more likely to be diagnosed with ASD than girls (Baio et al., 2018; CDC, 2018; Maenner, 2021).

Individuals with ASD are facing many developmental challenges. Language and communication skills are one of three core deficits. Language and communication deficits are characterized by a delay or absence in communicative gestures and spoken language development (CDC, 2018). Also, these challenges include the ability to initiate or maintain conversation and unusual language use such as echolalia (Prelock & Nelson, 2012). Social communication and social interaction deficits are another core of three core deficit areas used to diagnose ASD. Social communication and social interaction are characterized by challenges in social-emotional reciprocity, a lack of initiation, an abnormal approach in a social context, or failure in back-and-forth conversational exchanges. Also, social communication challenge includes a limited interest in sharing emotional and affective responses (Prelock & Hutchins, 2018).

The increasing prevalence has raised the need for evidence-based interventions to remedy the negative impact of ASD symptoms on children's everyday functioning (Caron et al., 2017).
Unfortunately, currently, there are no evidence-based pharmacotherapies to treat the core symptoms associated with ASD (Reichow et al., 2018). However, some interventions have been proven effective for young children with ASD at home or in school settings (Reichow et al., 2018), which include early intervention (EI), especially early intensive behavioral intervention programs (EIBI) (Caron et al., 2017).

According to Klintwall and Eikeseth (2014), “Early and Intensive Behavioral Intervention (EIBI) is the use of evidence-based principles and procedures from Applied Behavior Analysis (ABA) to help young children with developmental delays to acquire adaptive and functional skills” (p. 117). The basic characteristic of EIBI is the intensity of delivering the treatment. The main characteristics of EIBI are use of one-on-one treatment in early age, implementation in either home, school, or clinical settings for a range of 20 to 40 hours per week across one to four years of the child's life (Långh et al., 2020).

Previous research has suggested that EI is a cost-effective strategy for children with disabilities, especially children with ASD. Many researchers proved that the earlier the intervention is applied, the more effective it is likely to be, which may lead to a decrease in the symptoms of the disability before the school age (Vivanti et al., 2017). Also, more intensive interventions are preferred for the intervention's success (Vivanti et al., 2017). Additionally, previous research findings showed that EI improved cognitive performance, language skills, and adaptive behavior skills for children with ASD (Correll et al., 2018).

One of the early language intervention strategies is using verbal behavior (VB), particularly mand training (MT), to target language development and facilitate functional communication in young children with limited language. For early language learners, the mand repertoire is critical. Previous research indicated that mand training is considered one of the
evidence-based interventions for teaching language to children with ASD (National Autism Center, 2009). When specific items, activities, actions, information, or other stimuli are delivered or controlled by another person, mand training intervention increases the possibility of obtaining access to those desired stimuli (Albert et al., 2012). The ability of young children with ASD to express their wants and needs is limited. This limited communication skill can lead to the same disruptive behaviors that have previously gotten them what they want or need (Albert et al., 2012). Mand training intervention is considered an effective strategy to enhance communication skills for children with ASD and one of the top instructional priorities (Sundberg & Michael, 2001). Manding facilitates the development of reciprocal speaker and listener roles, which are critical for improving verbal competence (Albert et al., 2012). In addition, other verbal operants are learned because of mand training intervention (Russel and Reinecke, 2018).

**Significance of the Study**

The increasing prevalence of ASD has increased the need for evidence-based behavioral interventions to remedy the negative impacts of ASD symptoms on children's overall functioning (Caron et al., 2017). There are many negative impacts that children with ASD may face if they are left untreated. First, late intervention or treatment for children with ASD may hinder a child’s overall development, including social, emotional, behavioral, and academic. Late diagnoses and interventions for children with ASD may affect child development (Happé et al., 2016). Second, the child’s condition will get worse with time. Third, it will cost much more money from a long-term perspective than early intervention (Grant, 2005). In addition, late diagnoses and intervention for children with ASD lead to late mastering of speech, one of the major challenges that children with ASD face (Vivanti et al., 2017).
When children are diagnosed with ASD at an early age, early intervention is required to be provided to the child from birth to three and can be extended to five by federal laws (i.e., IDEA) (Grant, 2005). Due to the lack of medicine that can be used to occur ASD symptoms, many treatments have been used to remedy developmental delays (Sorensen, 2014). Behavioral treatments for children with ASD are currently considered an evidence-based intervention (Schreibman et al., 2015). According to previous research, early intervention plays an essential role in children with ASD’s lives (Raches et al., 2018). The Individual with Disabilities Education Act (IDEA) expanded the right to a free and appropriate public education for children aged birth to three years old by adding early intervention programs (Coogel & Hanline, 2014).

Ramey and Ramey (1998) stated that early intervention is defined as comprehensive services designed for children and their families to improve child development in the early years (Ramey & Ramey, 1998). The early intervention program was created to address the developmental needs of toddlers and infants at risk of disabilities from birth to three years old and their families (Trohanis, 2008). Therefore, a child who is identified with developmental delays in infancy can receive assessment and intervention services (Schwartz & Sandall, 2010).

There are many services included in EI. For example, family intervention, cognitive–behavioral therapy (CBT), social skills training, problem-solving skills training, crisis management and case management (Bird et al., 2010). Many children with ASD often receive occupational therapy, speech therapy or language therapy, one-on-one, behavior management services, adaptive PE, sensory integration training, transportation services, assistive technology/devices, social skills groups, vision services, music therapy, and motor skills intervention (Stahmer, 2006). These services were included as EI and more based on individual needs.
The primary goal of the early intervention (EI) program is to remedy the developmental delays of young children who have or are at risk of disabilities (Grant, 2005). Previous research indicated that good pointing behavior during early age is predictive of children’s good verbal abilities later in life (Vivanti et al., 2017). Also, research indicated that the earlier the intervention is applied for children with ASD, the more effective it is likely to be. Early intervention may lead to a decrease in the symptoms of the disability before school age (Vivanti et al., 2017). The EI may also lower future special education costs by reducing the services needed for children with disabilities (Grant, 2005). Besides, early intervention increases parents’ or caregivers’ awareness and knowledge about their children (Benzies et al., 2013). Also, early interventions may increase independence and improve the quality of life for an individual with a disability (Hebbeler et al., 2007).

As per IDEA, providing early intervention in natural environments is recommended; early interventions should occur at home, where the child is familiar with, or in community settings where they can interact with typically developing children (Woods & Wetherby, 2003). Settings other than natural environments will be acceptable if it provides positive outcomes for the child with a disability (Fava et al., 2011). Therefore, the services should be focused on the best interest of the child’s needs (Fava et al., 2011).

There are many factors that affect the early intervention’ result. For example, the child’s age at intake, intensity, and duration of the interventions are preferred for the intervention's success (Reichow et al., 2014). Additionally, previous research findings showed that EI improved cognitive performance, language skills, and adaptive behavior skills for children with ASD (Correll et al., 2018). Also, early intervention improves early access to effective treatment for children with disabilities (Bird et al., 2010).
Theoretical Basis for the Study

Applied Behavior Analysis

Early intense behavioral intervention (EIBI) was originally developed on the basic principles and procedures of Applied Behavior Analysis (ABA) (Klintwall & Eikeseth, 2014). The main goal behind this theory is to help children with developmental delays to obtain adaptive behavior and functional skills. EIBI aims to target many areas, for example, communication, play, social, emotional, cognitive, and self-help skills. Additionally, it can decrease challenging behaviors such as stereotyped and ritualistic behaviors, eating and sleeping difficulties, attention deficits, and aggressive behaviors using the same principles and procedures (Cooper et al., 2020).

EIBI is based on the theory that children with ASD are able to learn if they have the appropriate learning environment in the same way as typically developing children do (Lovaas & Smith, 1989). Specific ABA principles are applied to the EIBI to give learning opportunities to children with developmental delays. The main principle is to individualize the intervention by using one to one format. Also, the intervention should be implemented in a natural environment where the child can generalize the outcomes gained across settings and people (Kintail & Eikeseth, 2014).

According to Skinner, the three critical elements of ABA are antecedents, behavior, and consequences (A-B-C) (Cooper et al., 2020). Skinner (1957) described the four main principles of applied behavior analysis: first, behaviors are influenced by the environment. That means the child may engage in a particular a behavior due to the function of the behavior, for example, escape or avoidance, attention-seeking, access to tangibles or reinforcements, and instant gratification. Second, behaviors can be more vital or weakened by their consequences after the
behavior. Third, changing behavior is more successful with positive consequences or reinforcement rather than negative consequences. Finally, for socially significant behavioral modifications, behaviors need to be reinforced or disciplined to increase or decrease future behavior. Baer et al., (1968) described the seven dimensions of applied behavior analysis as followed: applied, behavioral, analytic, technological, conceptually systematic, effective, and generalized outcomes are among. These are now the primary defining and evaluating criteria for applied behavior analysis (Cooper et al., 2020).

**Review of Relevant Literature**

**Early Interventions for Children with ASD**

Early intervention (EI) is defined by Ramey and Ramey (1998) as broad services designed for children and their families to improve child development in the early years. A previous study indicated that children who are non-verbal but begin intervention at an early age are more likely to become vocal (Eikeseth et al., 2002). The EI services can help infants and toddlers with disabilities or delays to develop many new skills. Early intervention increases the likelihood of enhanced long-term outcomes (Koegel et al., 2014). For example, EI focuses on increasing communication skills, which leads to reducing or eliminating challenging behaviors in the future (Koegel et al., 2014).

One of the most evidence-based practices of early interventions is EIBI, an intensive intervention focusing more on behavior interventions. According to Klintwall and Eikeseth (2014), “Early and Intensive Behavioral Intervention (EIBI) is the use of evidence-based principles and procedures from Applied Behavior Analysis (ABA) to help young children with developmental delays to acquire adaptive and functional skills” (p. 117). EIBI targets specific
areas, such as communication, play, social skills, cognitive, emotional, and self-help skills (Klintwall & Eikeseth, 2014; Smith et al., 2015).

EIBI helps address the developmental needs of children with ASD (Caron et al., 2017). This intervention improves individual’s levels of adaptive behavior, language skills and reduces the severity of their symptoms, for instance, stereotypical gestures and behavioral disorders (Caron et al., 2017). The primary goal of EIBI is to prepare the child for inclusion in general settings (Klintwall & Eikeseth, 2014).

Success Factors to Implement the EIBI

Reichow et al., (2014) indicated that several variables might affect the outcomes of children with ASD receiving EIBI. These include the intervention provider, the intensity, duration of treatment, and staff supervision schedules (Reichow et al., 2014). There are eight common elements identified as essential to EIBI.

First, the treatment should be individualized, which means it is an intensive intervention that addresses the child’s unique developmental needs, including language and communication, social skills, repetitive behaviors, play skills, etc. (Reichow et al., 2014). The individualized plans should also use behavioral techniques to teach a specific skill (Dionne et al., 2017). The professional may utilize a function-based approach to reduce challenging behaviors that may interrupt the learning process and to teach appropriate alternative behaviors (Caron et al., 2017).

Second, when delivering EI, professionals should follow evidence-based procedures, such as discrete trial procedures established by the University of California at Los Angeles Young Autism Project model or the Lovaas model (UCLA), or the Early Start Denver Model (ESDM) (Dionne et al., 2017; Howard et al., 2014). Lovaas developed a model of EIBI, which is affiliated with UCLA. Lovaas used intensive, highly systematic applied behavior analysis of
reinforcement with children with ASD and published the first study in 1987 (Lovaas, 1987). ESDM is an early intensive behavior intervention based on ABA that provides behavioral therapy for children with ASD younger than 48 months old (Colombi et al., 2018).

Third, a qualified, well-trained behavioral analyst should direct and supervise children with ASD (Dionne et al., 2017). It is recommended that the agent delivering the intervention have advance training in ABA or a board-certified behavioral analyst (BCBA) (Green et al., 2002; Klintwall & Eikeseth, 2014; Paquet et al., 2017).

Fourth, the treatment should start with one-on-one sessions and then gradually move to a group of kids (Howard et al., 2014). At the beginning of the intervention, the child should be with a professional and receive treatment in one-on-one sessions (Howard et al., 2014). Then gradually transition to work with more than two kids. Therefore, the child who receives 20 hours a week or more of one-on-one therapy will receive the treatment full-time with the whole class (Freeman, 2016).

Fifth, ensuring a successful transition into educational settings from one-on-one sessions to the general classroom is essential, for example, transition the child from receiving the treatment at home first, then full time at a special education classroom, then half time at general education classroom, then full-time in a general educational setting (Freeman, 2016). Or the treatment implementation may start at home and then gradually transition to school settings or other environments (Caron et al., 2017).

Sixth, the intervention should be delivered intensively based on the individual needs. The child would receive intensive hours of interventions based on their age and needs weekly. For example, the intervention could be delivered for 20 to 40 hours a week for each child (Howard et al., 2014).
Seventh, the duration of delivering the intervention is an important factor in EIBI. Previous studies suggested that intensive behavior intervention should be delivered to children who is one year old or younger and continue across one to four years of the child’s life (Green et al., 2002). Makrygianni and Reed (2010) reviewed the effectiveness of EIBI programs on children with ASD and found that there was a correlation between the intervention's duration and effectiveness.

Finally, family involvement in different settings. Parents or caregivers trained by behavior analysts should serve as active co-therapists at their home (Howard et al., 2014). Family involvement is an important component of EIBI. Parents manage and assist in the planning and delivery of treatment, which enhances the effectiveness of treatment (Reichow et al., 2018). Also, family involvement helps the child generalize their learned skills in different settings.

Many literature reviews of EIBI with children with ASD were identified. Multiple research teams (i.e., Caron et al., 2017; Eldevik et al., 2009; Howlin et al., 2009; Peters-Scheffer et al., 2011; Reichow et al., 2014; Reichow & Wolery, 2009; Warren et al., 2011) have used EIBI in individuals with ASD with various ages. They have delivered EIBI in different intensities and for various durations.

The overall results of the review indicated that EIBI is an effective intervention for children with ASD in general. Results of the review showed that EIBI improves cognitive performance, language skills, and adaptive behavior skills in children with ASD. The reviews concluded that comprehensive EIBI based on the ABA is an effective intervention for children with ASD.
Verbal Behavior (VB)

Skinner (1957) defined verbal behavior as "behavior reinforced through the mediation of other persons" (p. 2). The same general types of environmental variables influencing nonverbal behavior, such as antecedents and consequences, affect verbal behavior. Nonverbal behavior is strengthened directly by direct communication with the physical environment instead of through another person's mediation (Sundberg & Michael, 2001). Verbal behavior is not restricted to only spoken words or vocal words. Therefore, any form of operant behavior can acquire a verbal function, for example, sign language, fingerspelling, icon selection, Braille, facial expressions, and intonation, is considered verbal behavior (Cooper et al., 2020).

Skinner addressed a taxonomy discussed in terms of their functional relationship with six verbal operators (1957). Each verbal operator consists of a distinct functional response class distinguishable from a specific behavioral instance (Sundberg & Michael, 2001). A learner's fluency using different verbal operators can be evaluated using Skinner's classification system, and any deficit can be addressed using interventions focused on increasing specific operators. For each operator, Skinner labeled the six primaries verbal operants as the following: mand (request), tact (label), echoic (vocal imitation), intraverbal (answer questions or conservation), textual (read written words), and transcription (write and spell words heard) for each operator (Skinner, 1957).

**Mand.** In the current study, mand is particularly important as it is the primary independent variable under investigation. Skinner defined mand as “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (1957, pp. 35-36).

Sundberg and Michael (2001) also described mand as a type of verbal behavior where a
motivative variable controls the response form (2001). These definitions highlight that mand response is functionally maintained by motivational variables, which deal with the value of a specific result at any given moment. Motivation operations (MO) is an essential part of the antecedent control of human behavior (Cooper et al., 2020). The theoretical concept of the mand is strongly linked to that of the establishing operation (EO). Establishing operation (EO) is a general term that describes activities that temporarily increase the reinforcement effectiveness of a specific stimulus and evoke a behavior that has led to access to that stimulus in the past (Michael, 1982).

**Mand Training**

Mand training is a well-recognized evidence-based ABA intervention for teaching requesting behaviors (Sundberg & Michael, 2001). A mand is a verbal response that allows an individual to request their needs. This response is motivated by a motivation for the need and then reinforced when receiving what they are requesting (Cooper et al., 2020; Skinner, 1957). In other words, the mand can be controlled by receiving the consequence. For example, if an individual mands (requests) for food, the consequence is receiving the food. Mands are the only verbal operants elicited by motivation and then reinforced explicitly (Skinner, 1957). A mand can gain access to the desired reinforcer by having this controlling factor. Because mands have control over the delivery of reinforcers, they are essential for early language learners (Skinner, 1957; Sundberg & Michael, 2001). Due to the result of requesting an item and receiving it, the benefit of manding does not only include the increase of unprompted mands in children with ASD, but also may help with generalization and spontaneity of manding, as well as general verbal vocabulary use (Sundberg & Michael, 2001).
Success Factors for Implementing Mand Training Intervention

The first important factor before teaching mand is assessing motivational operations. Assessing motivational operations can be done by conducting a preference assessment to identify the target child’s highly preferred items. Preference assessments can assist in identifying appropriate reinforcers, and mand training intervention should begin with highly preferred reinforcers (Albert et al., 2012). This should be completed to ensure that is the child has a strong desire to obtain a specific item. Manipulating motivational operations can be the second important factor in mand training intervention. To keep motivation high, withholding reinforcers before mand training intervention will work. For the individual to want to obtain the item, manipulating motivational operations is essential and can be done in the natural environment (Cooper et al., 2020).

Finally, prompt plays an essential role in mand training intervention. When the child gives an incorrect or no response, a prompt can be used to help the child respond correctly. When a child expresses interest, prompt response and then give the child the item if the response is correct. If there is no response from the child, using the next level prompt in the hierarchy to prompt again is essential. Prompts must be faded over time so that the child is not dependent on them and can engage in manding independently, which is the main objective (Albert et al., 2012).

Problem Statement

The public law 94-142 expanded the right to a free and appropriate public education for children from birth to age three by adding early intervention programs/services (Coogle & Hanline, 2014). Part C of IDEA authorized early intervention programs by Congress in 1986 (Trohanis, 2008). The number of individuals diagnosed with ASD has recently increased in the
United States and other countries (Caron et al., 2017). Unfortunately, there are only a few evidence-based early intervention practices for children with ASD (Caron et al., 2017).

Early intense behavioral intervention, one of the few evidence-based practice interventions, has been used with young children. Also, EIBI has been researched in different intensities and different durations. Most studies recommended that EIBI should conduct at an early age for more intensity in hours and duration. One of the early interventions is mand training to help develop the language. Many children with ASD have language issues and are unable to request or ask for what they want or need. They may become easily frustrated and experience challenging behaviors when trying to obtain desired items. Some children may use other methods ranging from simply reaching out to the caregiver's hand and leading them to the object they want to tantrum-like and self-injurious behaviors to get what they want.

For children with ASD or other severe language delays, mand training should be an important part of any intervention program (Cooper et al., 2020). Without a suitable mand repertoire, when motivations are strong or have a lot of social environment control, if the child cannot get reinforcement, aversive stimuli may be conditioned by individuals interacting with the child. Challenging behaviors could occur that serve the mand function (Cooper et al., 2020). Unless replacement mands are established, these behaviors and social relationships may become difficult to change. According to Cooper et al. (2020), teaching mand early in a language intervention program can help prevent negative behaviors from serving as mands. The purpose of this study was to examine the effectiveness of an early mand training intervention on mand acquisition in children with ASD.

**Research Question**
The current study aims at examining the effects of a mand training intervention on manding behavior in young children with ASD. The study was conducted to answer the following research questions:

- **Research Question # 1:** Is the mand training intervention effective in increasing unprompted manding behavior in young children with ASD?
  
  o **Hypothesis:** The mand training intervention will be significantly effective in increasing the unprompted manding behavior in young children with ASD.

- **Research Question # 2:** Can the participants generalize the learned manding behavior across different people?
  
  o **Hypothesis:** The participants can generalize the learned manding behavior across different people.

- **Research Question # 3:** Can the participants maintain the learned manding behavior two months after the intervention?
  
  o **Hypothesis:** The participants can maintain the learned manding behavior two months after the intervention.
CHAPTER II

LITERATURE REVIEW

Overview

The public law 94-142 expanded the right to a free and appropriate public education for children three years old or younger by adding early intervention programs (Coogle & Hanline, 2014). Part C of IDEA authorized early intervention programs by Congress in 1986 (Trohanis, 2008). According to the CDC (2016), the number of individuals diagnosed with ASD has recently increased in the United States and other countries. The increasing prevalence of ASD has increased the need for evidence-based behavioral interventions to decrease the impact of symptoms on children's functioning (Caron et al., 2017). Late diagnoses for children with ASD may affect child development (Happé et al., 2016). When children received diagnosis at an early age with ASD, there is a requirement for appropriate intervention for this age (Grant, 2005). Unfortunately, there are only a few evidence-based early intervention practices for children with ASD (Caron et al., 2017).

Mand training should be an important part of any intervention program for children with ASD or other children with severe language delays (Cooper et al., 2020). Children may present problem behaviors that serve the mand function (Cooper et al., 2020). Without a suitable mand repertoire, when motivations are strong, or have a lot of social environment control, a child cannot obtain reinforcement (Cooper et al., 2020). Unless replacement mands are established, these behaviors and social relationships may become difficult to change. Teaching mand in early language intervention programs can help prevent the acquisition of negative behaviors as mands (Cooper et al., 2020).
Since the intensity played an essential role in improving the outcomes for children with ASD, the primary purpose of this study is to examine the effects of EIBI on children with ASD. This study specifically targeted the application, the implementation, and the effects of EIBI. Specifically, the current study focuses on examining the effect of EIBI on mand behavior for children with ASD at an early age. This chapter presents a literature review of the history of ASD and its prevalence. Also, this chapter gives a brief description of the history of Early Intensive Behavioral Intervention (EIBI), approaches, and targeted areas. Additionally, the chapter presents a review of relevant Literature on EIBI for children with ASD. Finally, current empirical literature relevant to research questions and hypotheses was presented at the end of this chapter.

**Historical Background**

**The History of Autism Spectrum Disorder (ASD)**

In 1923, Kanner reported eleven cases of three girls and eight boys between two years to eleven years (Kanner, 1943). Kanner reported that these children had a severe inability to connect to someone else that seemed to be recognizable in infancy (Kanner, 1943). The case studies reported the children had abnormal language development, lacked an intellectual ability for nouns and learning children's songs, demonstrated an inability to develop communication aspects of speech, showed a tendency to display echolalia, had an inability to interpret things seriously and showed sensory sensitivities and repetitive behaviors (Kanner, 1943).

Then in 1944, Asperger published a paper describing children that presented difficulties in many areas (Asperger & Frith, 1991). These children presented difficulties in social skills and
developing verbal communication with others (Asperger & Frith, 1991). Kanner (1943) and Asperger and Frith (1991) described the characteristics of children with ASD.

Then, between 1980 and 1990, the Diagnostic and Statistical Manual of Mental Disorders (DSM) gradually developed their definition of Autism (Buescher et al., 2014). In the beginning, they had ASD and Asperger Disorder as different disorders (Kim et al., 2014). The difference was that children diagnosed with Asperger did not demonstrate language and cognitive impairments (Kim et al., 2014). Currently, children are diagnosed as either higher functioning with ASD or lower functioning with ASD (Kim et al., 2014). Currently, DSM defines ASD as a developmental disability characterized by social and communication impairments, restricted interests, and repetitive behaviors (Christensen et al., 2018).

**Definition and Prevalence of Children with ASD**

Autism has been defined by the Individuals with Disabilities Education Act (IDEA) as “a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance” (IDEA, 2017, p. 1). The number of individuals diagnosed with ASD has recently increased in the United States and other countries (CDC, 2021; Maenner et al., 2021). According to the Centers for Disease Control and Prevention (CDC)’s Autism and Developmental Disabilities Monitoring Division (ADDM) (2021), 23 per 1000 (1 in 44) children have been diagnosed with ASD in the United States (CDC, 2021; Maenner et al., 2021). According to the CDC (2021), there are more boys diagnosed with ASD than girls: it is estimated that boys are diagnosed 4.2 times more than girls (CDC, 2021; Maenner et al., 2021).

**Diagnosis.** According to the CDC, it can be difficult to diagnose ASD as no medical test can be given (Lord et al., 2006). Doctors and specialists usually assess the child's behavior and
development to make a diagnosis (Lord et al., 2006). Children can be diagnosed with ASD at the age of 18 months or younger (Happé et al., 2016). Around the age of two, an experienced professional may consider a diagnosis very reliable (Happé et al., 2016). However, many children do not receive a final diagnosis until they became older (Happé et al., 2016). This delay in diagnosis means kids with ASD may not get the help they need early (Happé et al., 2016).

**Characteristics.** Individuals with ASD have common characteristics that affect their social communication and interaction with others (Lord et al., 2013). Social interaction is one challenging area that children with ASD are facing (Lord et al., 2013). For example, common symptoms in children with ASD can be characterized as avoiding eye and physical contact, preferring to be alone, and easily becoming irritable and anxious (Lord et al., 2013).

According to the Centers for Disease Control and Prevention (CDC, 2016), individuals with ASD usually experience developmental delays in communication and language skills. They also display repetitive behaviors unintentionally (Constantino & Charman, 2016). That includes they may have an obsessive interest in limited areas, enjoy routines, and display repetitive body movements (Constantino & Charman, 2016). Children with ASD also have sensory overload (Lord et al., 2013). Therefore, they might have an unusual reaction and sensitivity to noises, lights, smells, tastes, and textures (Lord et al., 2013).

**Early Intervention**

*History of Early Intervention*

In 1954, the Supreme Court discrimination case Brown v. the Board of Education stated that all children have the right to a decent education (Guinier, 2004). In 1975, the Congress passed the Education of All Handicapped Children Act that required all children of school-age should receive a free and appropriate public education (Yanok, 1986). Early intervention services
were not part of the legislation for infants and toddlers with disabilities before 1986 (Yanok, 1986). In 1990, the act’s name was changed to the Individual with Disabilities Education Act (IDEA). Part C of the IDEA expanded the right to a free and appropriate public education for children aged birth to three years old by adding early intervention programs (Coole & Hanline, 2014; Trohanis, 2008).

**Early Intervention Statistics**

In 2011, 336,895 children at risk of developmental delays were documented receiving early intervention under Part C of IDEA (Fehringer, 2017). According to the National Center for Education Evaluation and Regional Assistance report, data in 2006 showed that 299,848 infants and toddlers were identified and received early intervention services for free under IDEA. All states and jurisdictions build and organize the use of numerous (public and private) federal, state, and local funding to allow their systems to work more efficiently and effectively (Trohanis, 2008). States progressively use private health insurance and relatives’ fees to help cover the costs of Part C services (U.S. Department of Education, 2011). Federal fiscal support exceeds $438.5 million annually through formula grants to states (U.S. Department of Education, 2011). Even though that early intervention can be costly, it may however lower future special education costs by reducing the overall services needed for children with disabilities (Grant, 2005).

**Definition of Early Intervention**

Ramey and Ramey (1998) stated that early intervention is defined as broad services designed for children and their families to improve child development in the early years (Ramey & Ramey, 1998). The program of early intervention was created to address the developmental
needs of toddlers and infants at risk of disabilities from birth to three years old and their families (Trohanis, 2008). Therefore, a child identified with developmental delays in infancy can receive assessment and intervention services (Schwartz & Sandall, 2010). There are many services included in EI, include family intervention, cognitive–behavioral therapy (CBT), social skills training, problem-solving skills training, crisis management and case management (Bird et al., 2010). Children with ASD often receive the following EI services based on individual needs: occupational therapy, one on one speech or language therapy, behavior management services, adaptive PE, sensory integration intervention, transportation services, assistive technology/devices, social skills groups, vision services, music therapy, and motor skills intervention (Stahmer, 2006).

A previous study indicated that children who are non-verbal and begin intervention at an early age are more likely to become vocal (Eikeseth et al., 2002). EI services can help infants and toddlers with disabilities or delays to develop many new skills. EI increases the likelihood of enhanced long-term outcomes (Koegel et al., 2014). For example, EI focuses on increasing communication skills, which leads to reducing or eliminating problem behaviors in the future (Koegel et al., 2014).

The History of EIBI

A colleague of B.F. Skinner named Charles Fester, was the first psychologist to use behavioral principles in children with ASD in 1961-1962 (Lovaas & Smith, 1989). Because the theory was complex and targeted only one behavior, Fester’s program did not expand into a scientific approach and did not get a chance to spread wider (Lovaas & Smith, 1989). In 1964, Wolf et al., experimented more extensive use of behavioral practices with a young child with ASD utilizing conditional reinforcement to help him wear his glasses (Lovaas, 1979). This
intervention showed that the child gained experience in social interaction and eventually communication skills (Lovaas, 1979). Therefore, the behavior intervention, including reinforcement, showed successful results in children with ASD (Lovaas, 1979). Then, parents were taught to use principle-based strategies to improve their children's behavior at home (Berkowitz & Graziano, 2017). Their research expanded the current "Applied Behavior Analysis (ABA)" field by using antecedent management, which is about how comprehensive environmental changes affect individual's behavior (Berkowitz & Graziano, 2017).

Lovaas developed a model of EIBI named Young Autism Project model or the Lovaas model at the University of California at Los Angeles (UCLA) (Lovaas 1987). In the 1960s, Lovaas started using intensive highly systematic applied behavior analysis principles such as reinforcement and punishment to start or to avoid behavior as the child needed (Lovaas, 1979) and published their study in 1987 (Lovaas, 1987). The study reported that 47% of children who received the treatment achieved normal functioning (Lovaas 1987). Since then, behavioral interventions for children with ASD have made great strides, but new research, specifically randomized control studies and symptom-specific outcome measures are still needed (Shea, 2004).

**Approaches/Models to Deliver EIBI**

Based on ABA principles, there are various approaches to deliver EIBI to children with ASD. They include the Lovaas model, Discrete trial training, and the Early Start Denver Model. In these models, reinforcement is the primary change agent for behavioral modification in EIBI applications (Lovaas, 1981; Peters- Scheffer et al., 2011). Reinforcement is generally selected based on the child's preferences through technical personal choice evaluations or at least similar observation of what the child interacts with reliably (Cooper et al., 2007). Using reinforcement
with EIBI increases the effectiveness of the intervention with children with ASD (Klintwall & Eikeseth, 2014). Behaviorally based EIBI could be completed at school, home, or clinic. The following section describes these approaches one by one.

**The Lovaas Model.** Lovaas (1987) conducted a seminal study using Early Behavioral Intervention based on ABA methods for children with ASD (Lovaas, 1987). The UCLA intervention program is an intensive home-based program that utilizes the manual published by Lovaas (Hayward et al., 2009). Children with ASD may work up to 40 hours per week with a therapy team. The program typically lasts for at least two years for young children with ASD and involves about 40 hours of therapy each week (Reichow & Wolery, 2009). They work to improve their social skills and reduce disruptive behavior. Intervention using the Lovaas Method can begin as early as three years old (Leaf & McEachin, 2016). Treatment can last anywhere from two to six years. Children may work with a member of their therapy team for five to seven hours per day, five days a week. Sessions are divided into trials, with breaks taken when the child loses focus. To help children achieve their full potential, the Lovaas treatment heavily depends on discrete trial training (DTT) methods (Leaf & McEachin, 2016).

**Discrete Trial Training/Teaching.** Discrete-trial teaching is another method of EIBI for children with ASD (Rogers & Dawson, 2010). Ryan and Hemmes (2005) defined discrete-trial teaching as “an instructional method that incorporates the principles of applied behavior analysis by breaking down complex tasks into small units and presenting them in a simplified, repeated manner to facilitate learning” (p. 1). The discrete trial is also considered one of the most effective methods for teaching new skills to children with ASD (Ryan & Hemmes, 2005).

**Early Start Denver Model (ESDM).** The ESDM is another approach to deliver early intensive behavior intervention in young children with ASD (Rogers & Dawson, 2010). The
ESDM is an early intensive behavior intervention-based ABA that provides behavioral therapy for children with ASD younger than 48 months (Colombi et al., 2018). The ESDM approach is flexible because it can be used in various of settings, such as homes or clinics (Colombi et al., 2018). In the ESDM, children receive 15 to 20 hours of training per week (Eapen et al., 2013). Parents' or caregivers’ involvement is crucial to the ESDM program (Dawson et al., 2010). Therapists should explain and model their strategies so families can effectively practice them at home (Dawson et al., 2010).

**Behaviorally Based EIBI**

*Target Areas of EIBI*

**Adaptive Behavior.** Adaptive behavior is the ability to evolve and arrange an individual's environment to operate effectively and meet the community's or society's expectations (Staddon, 2016). The Vineland Adaptive Behavior Scale (VABS) is an interview for the parent to evaluate adaptive function in four domains: social, communication, motor, and daily living skills with standard scores based on a large normative sample (Paul et al., 2004). The VABS is considered the best measure of adaptive function and is widely used for children with ASD (Perry et al., 2009).

**Communication.** Communication impairment has been one of the defining characteristics of autism spectrum disorder (ASD) and, it is also the earliest symptom observed (Ramdoss et al., 2010). Expressive and receptive communication skills include verbal behavior, body language, written and spoken language (Goldbart, 2018). Also, the Vineland scale of adaptive behavior evaluates expressive and written communication skills, and the ability to listen (Paul, 2004).
Socialization. Socialization is integrating new members of a social group into the group (Tedeschi, 2017). The EIBI targets this area to help children at an early age integrate with their peers. Vineland's adaptive behavior scale also evaluates interpersonal relationships, leisure, play activities, and interpersonal coping skills (Paul, 2004).

Motor Skills. Motor Skill is the ability to control muscle group movements (Bavosa, 2018). Motor skills involve activities that require small muscle ability, such as a shirt button (Bavosa, 2018). Using gross motor skills involves tasks such as walking or throwing a ball (Bavosa, 2018). The Vineland scale of adaptive behavior is also used to evaluate both gross and fine motor skills (Paul, 2004).

Daily Living Skills. Daily living skills, including personal hygiene, meal preparation, and money management, are essential for independent living (Bal et al., 2015). Also, these skills can be evaluated using the Vineland Scale of Adaptive Behavior on an individual basis, in the environment of the relatives, and in the community (Paul, 2004).

People Who Implement the EIBI. Most people implementing EIBI have a college or equivalent diploma (Kucharczyk et al., 2012). Some centers report that some of their caseworkers are trained in EIBI through specialized training programs such as the National Development Plan (Paquet et al., 2017). They got the training from behavioral intervention, board-certified assistant behavior analysts, or board-certified behavior analysts (BCABA/BCBA) (Paquet et al., 2017). Most of the caseworkers are qualified to work in the program (Paquet et al., 2017). The amount of training hours the institution offers when hiring a person differs among the centers: less than 15 hours, between 16 and 30 hours, between 31 and 45 hours, and more than 45 hours (Paquet et al., 2017).
**The Cost of EIBI.** The EIBI needs to start early, involves many hours per week and many weeks per year for an extended period, is delivered directly to children, and addresses a wide range of needs and accommodate individual differences to be an effective treatment (Jacobson et al., 1998). Therefore, EIBI is an expensive intervention when appropriately done and does not produce a complete recovery (Jacobson et al., 1998). Supplemental Material for Development of the Resource Use Questionnaire (RUQ–P) for Families with Preschool Children with Neurodevelopmental Disorders reported that EIBI is associated with the most significant cost over time (Ungar et al., 2018). The average annual cost of low intensive EIBI treatment or ESDM is about $45,580 (Cidav et al., 2017; Trump & Ayres, 2019).

**Review of Relevant Literature on EIBI**

Seven literature reviews of EIBI were identified. Reichow and Wolery (2009) synthesized studies that examined the effectiveness of EIBI for young children with ASD aged 84 months or younger based only on the University of California at Los Angeles Young Autism Project method (Lovaas method) (Reichow & Wolery, 2009). Reichow and Wolery (2009) included only studies with: (1) an intervention intensity of 18 hours per week and (2) conducted over 12 months or more (Reichow & Wolery, 2009). The review examined adaptive behavior, IQ, language skills and autism severity symptoms of the included studies (Reichow & Wolery, 2009). The overall results of the review indicated that EIBI is an effective intervention for children with ASD (Reichow & Wolery, 2009).

Similarly, Howlin et al., (2009) reviewed studies that examined the effectiveness of early intensive behavioral intervention for children with ASD based only on controlled studies (Howlin et al., 2009). The review included only studies that targeted children with ASD who were aged six or younger, had an intensity of intervention of 12 hours or more per week, and...
lasted for a minimum of 12 months (Howlin et al., 2009). The primary measure in the review was IQ of both groups (Howlin et al., 2009). Additionally, they measured adaptive behavior for the included studies (Howlin et al., 2009). The review’s findings suggested that EIBI is an effective intervention for some but not all young children with ASD (Howlin et al., 2009).

Eldevik et al., (2009) reviewed 34 studies that examined the effects of EIBI on IQ and adaptive behavior of children with ASD (Eldevik et al., 2009). In order for the studies to be included, Eldevik et al. (2009) required the following inclusion criteria: (1) the participants’ age had to be between two to seven years old, (2) the intervention duration had to be 12 months or longer, and (3) there was no specified required intensity (Eldevik et al., 2009). The primary measure in the review was the IQ and adaptive behavior for the included studies (Eldevik et al., 2009). The findings of the meta-analysis concluded that EIBI has positive effects and should be used in children with ASD (Eldevik et al., 2009).

Warren et al., (2011) analyzed studies that were conducted to examine the impact of early intensive behavioral and developmental interventions on children with ASD (Warren et al., 2011). The review included studies with a minimum of eight hours per week and a duration of nine months (Warren et al., 2011). The review included participants aged twelve or younger with ASD (Warren et al., 2011). The results indicated that studies using UCLA-based approaches and the Early Start Denver Model improved cognitive performance, language skills, and adaptive behavior skills of some children with ASD (Warren et al., 2011).

Peters-Scheffer et al., (2011) reviewed 11 studies that examined the effectiveness of comprehensive early intervention programs based on ABA for children with ASD (Peters-Scheffer et al., 2011). The primary measure in the review was IQ, communication, and daily living skills domains of the Vineland Adaptive Behavior Scale and Expressive Language (Peters-
Scheffer et al., 2011). The inclusion criteria required that: (1) participants had to be ten or younger with ASD, (2) had an average intensity of 12 hours per week or more, and (3) had a minimum duration of ten months or more (Peters-Scheffer et al., 2011). The review concluded that comprehensive early intervention program based on ABA is an effective intervention for children with ASD (Peters-Scheffer et al., 2011).

Reichow et al., (2014) systematically reviewed five studies that examined the impact of EIBI on young children with ASD (Reichow et al., 2014). Reichow et al. compared the results of EIBI to generic special education services for children with ASD (Reichow et al., 2014). The review’s criteria required that: (1) children who were six years old or younger and (2) no specified intensity or duration (Reichow et al., 2014). However, the review included studies that had 20 hours of intervention intensity per week and a duration of 14 months or more (Reichow et al., 2014). The primary measure in the review was for IQ, Adaptive Behavior, and language (Reichow et al., 2014). The review’s results concluded that EIBI is an effective intervention for some children with ASD (Reichow et al., 2014). However, the review indicated that EIBI is a potentially evidence-based practice for children with ASD (Reichow et al., 2014).

Caron, Bérubé, and Paquet (2017) reviewed studies conducted between 2005-2015 to examine the effects of EIBI on children with ASD (Caron et al., 2017). The review targeted children with ASD aged seven or younger (Caron et al., 2017). The intervention intensity had to be at least 15 hours per week, and the intervention duration had to be a minimum of six months or more (Caron et al., 2017). The findings of the review revealed that: (1) the variables related to the intervention were poorly described because most studies included did not sufficiently report the information on intervention and participants, and (2) the implementation of EIBI had to be systematically evaluated (Caron et al., 2017).
Theoretical Foundations of the Study

Applied Behavior Analysis

Early Intensive Behavioral Intervention (EIBI) is an effective intervention program for young children with ASD (Colombi et al., 2018). EIBI was developed based on applying evidence-based principles and procedures from Applied Behavior Analysis (ABA) (Klintwall & Eikeseth, 2014). The leading theory of EIBI is using behavior intervention intensively for children with ASD to demonstrate the long-term effect of the treatment (Sorensen, 2014).

Applied Behavior Analysis (ABA) is a scientific approach used to determine the variables behind the behavior changes to enhance socially significant behavior in which tactics derived from behavioral principles are comprehensively applied (Cooper et al., 2020, p. 2). According to Cooper et al. (2020), the definition of ABA includes six essential elements. The first element is that ABA is a science, which means researchers and practitioners in the ABA field follow scientific methods and inquiry attitudes. The second element is that all behavior change procedures must be described and applied systematically and in a technological way. The third element confirmed that not all means of changing behavior identifies as ABA. The field circumscribes only those strategies conceptually derived from the basic principles of conduct. The fourth element is that applied behavior analysis focuses on socially significant behavior. The last two elements are improvement and understanding, which are the main goals of applied behavior analysis. Applied behavior analysis aims to understand improvement and the elements responsible for the improvement in significant behavior (Cooper et al., 2020).

Critical Terms of ABA. According to Skinner, there are three critical terms of ABA: antecedents, behavior, and consequences (A-B-C). The antecedent refers to the external conditions or changes in stimulus that occur before the behavior of interest (Cooper et al., 2020).
According to Cooper et al. (2020), these antecedent events play a significant role in learning and motivation, and they do so regardless of whether they have been planned or even known by the learner or someone in the role of behavior analyst or teacher. A consequence is defined as a change in a stimulus that follows a behavior. Some consequences significantly impact behavior, particularly those related to current motivational states and follow the behavior closely in time; other consequences may have little influence (Skinner, 2019).

**Seven Dimensions of ABA.** Baer et al., (1968) described the current dimensions of applied behavior analysis. These seven dimensions include Applied, Behavioral, Analytic, Technological, Conceptually Systematic, Effective, and Generalize Outcomes. These seven dimensions currently serve as the primary keys for defining and evaluating ABA (Cooper et al., 2020). The seven dimensions will be described briefly based on Baer et al., (1967) article.

**Applied.** The term applied refers to the implementation of ABA interventions in the society after research in a laboratory has been done. Behavior Analysts must concentrate on these ABA implementation principles to change socially important behaviors. As a prioritizing focus, the specific treatment goals decided on are based on their importance to the individuals and their family. The socially significant behaviors are individual to them and are the abilities that will enable this individual to function in their environment more easily and successfully. For an intervention to be socially valid, a significant, meaningful change must be produced and maintained over time.

**Behavioral.** Behavior analysts use ABA to increase some appropriate behavior and decrease inappropriate behaviors. In order to change the behavior, it has to be observable and measurable. If we can see and observe a behavior, we can use data to measure it, and then we can change it (Gilmore, 2019).
**Analytic.** Data must be collected on interventions, then has to be analyzed in order to make data-based decisions. If an intervention that has been used does not demonstrate a change or improvement in the desired behavior when looking at the data, then a change is required. When the intervention is altered and information indicates an increase in the desired behavior, we can demonstrate a reliable connection between the intervention and the rise in positive behavior.

**Technological.** An intervention must be presented in a way that defines all the dimensions clearly and thoroughly enough for it to be replicated by anyone else. All the techniques that represent an intervention should be identified entirely and described to meet these requirements. Once the behavioral intervention is technological, it is easy to replicate it, and treatment integrity is high.

**Conceptually Systematic.** Conceptually Systematic means describing in the language of ABA. The intervention must be research-based and represent applied behavior analysis principles to claim that an intervention is conceptually systematic. Therefore, the procedure has to be described using the ABA principles.

**Effective.** The cornerstone of any applied discipline should be efficient; even for applied behavior analysis, the interventions being used must be effective. In other words, the behavioral techniques used in ABA should enhance the behavior. Therefore, effectiveness is one of the most critical dimensions in ABA.

**Generality.** When a behavior is targeted for change, the behavior change must be designed to occur in the moment or a short time after that. The behavior change, meaning the skills gained within the treatment, should improve over time. The behavior changes after treatment has ended and should be maintained across distinct individuals and environments.
ABA is often performed in a controlled setting or a clinical environment. Although programming occurs initially in this setting, the intervention should be supposed to assess the individual's natural environment.

**ABA and Autism Treatment.** Applied behavior analysis (ABA) includes strategies developed from behavioral principles that have been scientifically established and incorporate all the factors identified by the US National Research Council as characteristic of effective interventions for individuals with ASD in educational and treatment programs (Foxx, 2008). The ABA is a primary strategy for treating problem behavior for individuals with ASD (Foxx, 2008). ABA-based interventions are considered the most effective treatments among evidence-based practices for individuals with ASD (Virués-Ortega, 2010).

Many reviews examined the effectiveness of long-term ABA intervention on young children with ASD and revealed that it led to medium to significant effects across considered outcomes (Peters-Scheffer et al., 2011; Virués-Ortega, 2010). The ABA has delivered hugely effective interventions in areas such as education, developmental disabilities and autism, clinical psychology, behavioral medicine, organizational behavior management, and various other fields and populations. Behavior analysts have long recognized that only one part of the problem is solved by developing interventions that improve client behavior, such as ABA (Slocum et al., 2014).

**Current Empirical Literature Relevant to Research Questions/Hypotheses**

**The Effect of EIBI Characteristics**

Multiple research teams, (for example, Caron et al., 2017; Eldevik et al., 2009; Howlin et al., 2009; Peters-Scheffer et al., 2011; Reichow et al., 2014; Reichow & Wolery, 2009; Warren et al., 2011) have used EIBI with individuals of various ages. These teams have delivered EIBI
with various intensities and durations. These differences in implementation led to different findings and recommendations.

**Child’s Age at Intake**

Child’s age at intake is an essential factor that varies across the studies. Lovaas (1978), for example, conducted a seminal study of young children with ASD and concluded that younger participants demonstrated positive empirical results. Vivanti, Dissanayake and Victorian (2016) examined the effect of EIBI on children with ASD ages 18-48 months and 48-62 months (Vivanti et al., 2016). The results revealed that the younger group achieved superior verbal skills gains compared to the older group (Vivanti et al., 2016). Macdonald et al., (2014) examined the relationship between early intervention and the performance of 38 children with ASD between one to three years old, and the study found that early intervention increases the children’s performance in joint attention, play, imitation, and language (Macdonald et al., 2014).

Moreover, Eapen et al., (2013) examined the relationship between early intervention and the outcomes of young children with ASD with a mean age of 49.6 months (Eapen et al., 2013). The study’s results revealed that early intervention positively affects preschool children, especially in receptive communication, adaptive behavior, and motor skills (Eapen et al., 2013). Devescovi et al., (2016) examined the effects of ESDM on twenty-one toddlers at risk for ASD between 20-36 months old for 15 months (Devescovi et al., 2016). The study’s results indicated that younger participants significantly performed better on cognitive and language skills than their older peers at the post-assessment (Devescovi et al., 2016). Ben-Itzchak and Zachor (2007) worked with young children with ASD between 20 to 30 months old and found that early intervention has resulted in positive outcomes in the following three areas: receptive language, expressive language, and play skills (Ben-Itzchak & Zachor, 2007).
Makrygianni and Reed (2010) analyzed a meta-analytic review to examine the effectiveness of EIBI programs on children with ASD. They found that children at younger ages had better gains than older children in specific domains, such as adaptive behavior and IQ (Makrygianni & Reed, 2010). Woods and Wetherby (2003) examined the effects of EIBI on young children with ASD and reported that there was evidence suggesting that early intervention demonstrated better outcomes on social communication skills (Woods & Wetherby, 2003).

Waters et al., (2018) investigated the effect of EIBI on children with ASD between 18 to 75 months old and indicated that children who received EIBI at an early age demonstrated better outcomes in IQ, nonverbal IQ, adaptive behavior, and academic achievement than children who received it at an older age (Waters et al., 2018). Rogers et al., (2012) examined the effects of EIBI on children with ASD between 14 to 24 months old (Rogers et al., 2012). The study’s results revealed a significant relationship between children’s age and the improvement in their behaviors (Rogers et al., 2012).

However, although the Vivanti et al. study (2016) indicated that the younger group improved verbal skills significantly, there were no significant differences in other areas and skills (Vivanti et al., 2016). Eikeseth et al., (2002) investigated the effect of EIBI on children with ASD between four to seven years old (Eikeseth et al., 2002). The findings revealed that some children might demonstrate substantial gains with EIBI, in adaptive behavior, IQ, and language comprehension (Eikeseth et al., 2002).

**Intensity**

Intensity is a critical factor in the interventions that vary across studies. Lovaas’s (1987) seminal study called for high-intensity intervention for young children with ASD (Lovaas, 1987). Lovaas argued that children should receive treatment at least 40 hours per week on average.
Makrygianni and Reed (2010) reviewed studies to investigate the effectiveness of EIBI programs for children with ASD and found a correlation between the intensity and the effectiveness of the intervention (Makrygianni & Reed, 2010).

Eldevik et al., (2010) investigated the effectiveness of EIBI for 309 children with ASD (Eldevik et al., 2010). The findings revealed that high intervention intensity predicted more gains in both IQ and adaptive behavior of children with ASD (Eldevik et al., 2010). Macdonald et al. (2014) examined the effect of EIBI on children with ASD, with an intensity that ranged from 28 to 30 hours per week (Macdonald et al., 2014). They concluded that increasing the number of intervention hours enhanced the children’s performance in joint attention, play, imitation, and language (Macdonald et al., 2014).

Waters et al. (2018) examined the effects of EIBI on children with ASD providing an intensity of 35 hours per week (Waters et al., 2018). The study supported the claim that increasing the intervention hours played an essential role in improving the overall outcomes in IQ, nonverbal IQ, adaptive behavior, and academic achievement for children with ASD (Waters et al., 2018). Rogers et al. (2012) examined the efficacy of low intensity of ESDM and high intensity in community treatment (Rogers et al., 2012). The study found that the behaviors of children who received more intervention hours improved more than those who received low-intensity hours (Rogers et al., 2012). Ben-Itzchak and Zachor’s (2007) investigated the effect of EIBI on children with ASD for 35 hours per week. This study revealed that increasing the intensity hours of the intervention enhances children with ASD’s outcomes in receptive language, expressive language, and play skills (Ben-Itzchak & Zachor, 2007).

On the other hand, Colombi et al., (2016) implemented ESDM with low intensity for young children with ASD (Colombi et al., 2016). Children with ASD only received six hours per
week; the results indicated that children’s cognitive and adaptive behavior and social skills also improved (Colombi et al., 2016). Moreover, Rivard et al., (2014) investigated the effect of EIBI among 93 children with ASD aged between 33 and 57 months (Rivard et al., 2014). The intensity of the intervention ranged from 16 to 20 hours per week (Rivard et al., 2014). They also found that EIBI improved the children’s intellectual ability and adaptive behaviors (Rivard et al., 2014). The severity of ASD symptoms was also reduced after the intervention (Rivard et al., 2014).

In Eapen et al.’s (2013) study, intervention intensity ranged from 15 to 20 hours per week, and the results showed an overall improvement in adaptive behavior, motor skills, and social communication skills in children with ASD (Eapen et al., 2013). Even low early intervention hours benefit young children with ASD. For example, Devescovi et al. (2016) examined the effects of a three-hour per week ESDM intervention on 21 toddlers at risk for ASD and results indicated that even with low intensity, participants performed significantly better in cognitive and language skills at the post-assessment (Devescovi et al., 2016).

**Duration**

The intervention duration is a critical factor that varies across studies. Lovaas’ (1987) seminal study indicated that intervention should last for at least two years or more to reveal positive outcomes in children with ASD (Lovaas, 1987). Makrygianni and Reed (2010) reviewed the effectiveness of EIBI programs on children with ASD and found that there was a correlation between the duration and the effectiveness of the intervention (Makrygianni & Reed, 2010). For example, Waters et al. (2018) examined the impact of EIBI on children with ASD for three years (Waters et al., 2018). They concluded that longer duration played an essential role in improving
outcomes in IQ, nonverbal IQ, adaptive behavior, and academic achievement in children with ASD (Waters et al., 2018).

In Colombi et al.’s (2016) study, however, children with ASD received six months of EIBI (Colombi et al., 2016). They assessed the outcomes in three and then six months (Colombi et al., 2016). The study’s results indicated that children demonstrated higher gains and better improvement in cognitive and adaptive behavior and social skills after three months of the intervention (Colombi et al., 2016).

Although Rivard et al.’s (2014) study lasted for only 12 months, it revealed significant improvement in the participants' performance, such as intellectual ability and adaptive behaviors (Rivard et al., 2014). The mean duration of Eapen et al.’s (2013) study lasted only ten months but resulted in significant improvement in children's performance in adaptive behavior, motor skills, and receptive communication skills (Eapen et al., 2013). Even though Macdonald et al. (2014)’s study was conducted for only one year, the study's findings showed that participants’ overall outcomes improved in skills, such as joint attention, play, imitation, and language skills (Macdonald et al., 2014).

**Verbal Behavior**

Skinner describes verbal behavior as "behavior reinforced through the mediation of other persons" (1957, p. 14). The same general types of environmental variables influencing nonverbal behavior, such as antecedents and consequences, affect verbal behavior. Nonverbal behavior is strengthened directly by direct communication with the physical environment instead of through another person's mediation (Sundberg & Michael, 2001). Skinner addressed a taxonomy discussed in terms of their functional relationship with six verbal operators (1957).
Each verbal operator consists of a distinct functional response class distinguishable from a specific behavioral instance (Sundberg & Michael, 2001). A learner's fluency using different verbal operators can be evaluated using Skinner's classification system, and any deficit can be addressed using interventions focused on increasing specific operators. For each operator, Skinner labeled the six verbal operants as the following: mand (request), tact (label), echoic (vocal imitation), intraverbal (answer questions or conservation), textual (read written words), and transcription (write and spell words heard) for each operator (Skinner, 1957).

**Mand**

Skinner defined mand as “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (1957, pp. 35-36). Sundberg and Michael (2001) also described mand as a type of verbal behavior where a motivative variable controls the response form (2001). These definitions highlight that mand response is functionally maintained by motivational variables, which deal with the value of a specific result at any given moment. The theoretical concept of mand is strongly linked to that of the establishing operation (EO). Establishing operation (EO) is a general term that describes activities that temporarily increase the reinforcement effectiveness of a specific stimulus and evoke behavior that has led to access to that stimulus in the past (Michael, 1982).

**Tact**

Tact, defined as a response form "evoked by a specific object or event or property of an object or event" (Skinner, 1957, p. 82), is the second most frequently studied verbal operator by Skinner. Instead of establishing an operation, a tact occurs under the functional control of a discriminative stimulus and is maintained by social reinforcers from an individual's verbal
communication. For example, we can verbally react to rain by having a conversation about rain. Skinner (1957) referred to this verbal relationship as tact when the nonverbal properties of the physical environment (e.g., visual or tactile rain stimulation) evoke a verbal response that is followed by generalized stimulus (Cooper et al., 2020).

**Echoic**

The echoic response, which is defined as a “verbal behavior under the functional control of a verbal stimulus with point-to-point correspondence between the stimulus and the response”, is a third commonly studied verbal operant (Skinner, 1957, p. 55). That is, the speaker's reaction sounds identical to the stimulus that evoked it. Echoic occurs when the controlling verbal stimulus and the response product are in the same mode of meaning (e.g., both are auditory), and the stimulus and the response product are similar to each other (Cooper et al., 2020).

**Intraverbal**

An intraverbal is defined as a response that does not correspond formally point-to-point with the verbal stimulus that evoked it (Skinner, 1957). Intraverbal conduct is thought to be maintained by social reinforcement from an individual's verbal communication and is not a replica of the evoking stimulus, unlike the echoic. For example, if someone responds "blue" to the verbal stimulus "red, white, and yellow" after a history of strengthening the temporal contiguity of these words under a variety of conditions, a common intraverbal may be observed (Cooper et al., 2020).

**Textual**

A textual operator is also considered a specific and fundamental verbal operator in which a non-auditory (e.g., written) verbal stimulus controls a vocal (or subvocal) response. In reaction to seeing the printed word cat, an example is to say "cat" (Blair & Farros, 2019). Textual conduct
is reading without the implication that what is being read is understood by the reader.

Understanding what is read is typically recognized as reading comprehension and includes several verbal and nonverbal operators that are functionally distinct (e.g., intraverbal behavior, manding, tacting, listener discrimination) (Cooper et al., 2020).

**Transcription**

Skinner (1957) has two somewhat different ways to define transcription. The first was "the copying of written material" (p. 71), where both writing and exhibiting point-to-point correspondence are the stimulus and response. The second was "taking dictation" (p. 71), where point-to-point correspondence with an auditory spoken stimulus is exhibited in a written response but does not show formal similarity (Blair & Farros, 2019). Taking dictation consists of the words spoken in writing and spelling. The manual production of letters (written, typed, fingerspelled, or punched) and spelling are part of the various repertoires involved in learning this code. With sign language, dictation can also occur (Cooper et al., 2020).

**Positive Reinforcement**

Positive reinforcement is a research-based practice crucial for promoting the use of acceptable behaviors by young children. Positive reinforcement is considered one of the most effective intervention strategies (Ma, 2009). The use of positive reinforcement is also in line with the recommendations made by national special education organizations for early childhood and early childhood education (Hardy & McLeod, 2020).

According to Cooper et al. (2020), the principle of reinforcement is deceptively simple, “the basic operant functional relation for reinforcement is the following: When a type of behavior (R) is followed by reinforcement (SR), there will be an increased future frequency of that type of behavior” (p. 853). All reinforcers share their most essential and defining
characteristics regardless of type or classification. All reinforcers increase the recurrence of behavior immediately following them (Cooper et al., 2020).

**Mand Training and Communication in Children with ASD**

Around nine months to one year, typically developing children begin babbling as a form of verbal communication (West & Iverson, 2021). On the other hand, language development differs and is often slower in children with ASD (Buzhardt et al., 2021). Children with ASD may have difficulty learning to communicate and comprehend what others say to them (Buzhardt et al., 2021). Nonverbal communication, such as hand gestures, eye contact, and facial expressions, may also be difficult. Children with ASD may be unable to effectively communicate their wants or needs through gestures, resulting in inappropriate behaviors to gain access to reinforcers (NIH, 2015).

When typically developing children learn the language, they can use it to control their environment for their benefit, and they do not need additional training when requesting or labeling essential items across the verbal operants (Sundberg & Michael, 2001). Children with ASD, on the other hand, who lack a language repertoire and are unable to make the connection between the items they want or need and the reinforcement they will receive by requesting or labeling those items, have a more difficult time learning the language (Sundberg & Michael, 2001).

Many children with ASD do not develop vocal verbal behavior as their primary form of communication, and they produce fewer sounds and words than children without an ASD diagnosis (Carbone, 2012). The child may become frustrated due to the lack of vocal verbal behavior and sounds, which may lead to the child resorting to any means necessary to obtain the desired item. They may use any other methods that range from simply grabbing the caregiver's
hand and leading them to the object they want to tantrum-like or self-injurious behaviors (National Institute of Deafness and Other Communication Disorders, 2015).

As a result, critical people in the life of a child with ASD must understand what they can do to assist them in learning to communicate and engage in verbal behavior. It is also critical to begin teaching verbal skills early on; therefore, children with ASD may catch up to their peers. Significant improvements in development can be achieved by providing early intervention that includes various skills in areas such as communication, social, play, and academics. Intervention in the early years has been shown to be effective and can make a significant difference in a child's life (Lindgren & Doobay, 2011).

Manding is the first form of verbal behavior that kids develop, occurring early in language development (Bijou & Baer, 1965; Skinner, 1957). A crying baby, for example, is requesting (manding) a bottle of milk. Mands are also essential in daily life, accounting for more than half of all adult communication. It is essential and realistic to start communication interventions for children with ASD by providing mand training. Moreover, the mand should be the first operant chosen for language training and an integral part of any autism treatment program (Cooper et al., 2020). Mands are essential for young language learners because they can control how reinforcers are delivered (Sundberg & Michael, 2001). Additionally, the benefits of the mand include the increase of unprompted mands in children with ASD, which may aid in generalization and spontaneity of manding and overall use of verbal vocabulary (Sundberg & Michael, 2001).

Summary

This chapter provided a systematic review of the literature relevant to several factors affecting the applicability of the result and findings from the EIBI studies. One of them is the age

42
when the child starts the intervention. Most previous research indicated that children five years old or younger demonstrated better improvement than older children. The issue here is the age of initial diagnosis, which may result in not having the opportunity to be included in the EIBI. The intensity played an essential role in improving the outcomes for children with ASD. A minimum of 20 hours is required for EIBI. The commitment of this much time over a minimum duration of two years may be another factor in the limited number of studies implementing this intervention.

The previous studies indicated that duration is a critical factor in delivering EIBI for children with ASD to get better outcomes. However, many researchers find it hard to assess children for two years or more. Besides, some participants may withdraw from the study; for example, in Waters et al. (2018)’s study, by the third year, some children were no longer there (Waters et al., 2018). Besides, other factors may have affected the implications of the studies. For example, most studies included a small sample size; therefore, the results cannot be generalized to all children with ASD. Moreover, the intervention did not show consistent results among participants. In summary, EIBI needs to start early, be provided for many hours a week and for an extended period like many weeks a year, be delivered directly to children, address a wide range of needs, and accommodate individual differences to be an effective treatment.

In addition, this chapter described the mand training intervention based on ABA. The chapter also reviewed mand training intervention for children with ASD. The chapter described how important it is to early start training children with ASD manding to increase their language skills. Also, teaching mand could decrease problem behavior in children with ASD.

Without a suitable mand repertoire, when motivations are strong or have a lot of social environment control, a child cannot obtain reinforcement. As a result, aversive stimuli may be conditioned by individuals interacting with the child. Problem behaviors could occur that serve
the mand function (Cooper et al., 2020). Unless replacement mands are established, these behaviors and social relationships may become difficult to change. According to Cooper et al. (2020), early teaching mand in a language intervention program can help prevent the acquisition of negative behaviors as mands.
CHAPTER III
METHODOLOGY

Overview of the Research Methodology

Chapter three presents the methodology used to evaluate the effectiveness of an early intensive verbal behavior intervention to increase unprompted mand in children with autism spectrum disorder (ASD). This is a single-subject research study that used a multiple baseline across participants design with three children with ASD attending preschool in the greater Pittsburgh area, PA. A mand behavior was scored correct if the participant requested the items vocally or non-vocally by looking, pointing, reaching, touching the item with no other verbalizations within ten seconds of the researcher presenting the item to the participant.

In this study, the researcher aimed to answer the following questions: can the early intensive mand training intervention increase unprompted mand in children with autism spectrum disorder (ASD)? Can they generalize the learned manding behavior to different people? Can they maintain the learned manding behavior two months after the intervention? The inclusion and exclusion criteria for participant recruitment and recruitment procedure were described first in this chapter. Then the research design, measures, and definition of dependent and independent variables are presented, followed by data collection procedures, and treatment integrity.

Setting

The study was conducted at a preschool in the greater Pittsburgh area, PA. All sessions were conducted in the same preschool at a corner table in their classrooms to make sure that the child received the intervention in the natural environment. The intervention was implemented
one on one for each participant. All sessions were videotaped after receiving permissions from their parents.

**Participants**

*Characteristics of Participants*

Three children with an official diagnosis of ASD aged four or younger participated in this study. All participants had some issues with language development and needed an early intervention program. They were attending a preschool program in the greater Pittsburgh area, PA at the time participating in this study. Only children who met all the following inclusion criteria could participate in the study. Table 1 presents the demographics of the participants.

**Inclusion Criteria**

Participants were recruited based on the following criteria: (1) with an official diagnosis of ASD. (2) four years old or younger. (3) with a minimum level 1 of manding skills in the mand domain on the milestone scoring form on the Verbal Behavior Milestones Assessment and Placement Program (VB- MAPP, which was used to assess the participants’ language development in this study prior to the intervention). All participants demonstrated appropriate competency at level 1 of mand domain (more explanation was provided in later section). (4) with a typically developing or slightly below average IQ (65 and above). (5) currently attending a preschool in the greater Pittsburgh area, PA.

**Exclusion Criteria**

No participants would be excluded from the research due to race, ethnicity, or gender. Exclusion criteria for this study are (1) Children older than five. (2) Children with severe challenging behavior, including aggression and self-injury (3) Children with moderate to severe intellectual disabilities (IQ below 55).
**Child 1:** Mark was four years old. He received an official diagnosis of ASD from the psychologist of the Watson institute’s LEAP preschool when he was two years old. He was attending a preschool program from Monday to Friday in the greater Pittsburgh area, PA, when he participated in this study. He was evaluated via teleassessment using Developmental Assessment of Young Children, second edition by the special education teacher at his preschool. He scored 77, which is a 1.53 standard deviation below average in the cognitive domain. Based on the evaluation, Mark demonstrated a delay in the cognitive domain and was determined eligible for receiving early intervention services. Also, Mark was evaluated on his communication skills. He scored 70, which is two standard deviations below average, meaning that he demonstrated a delay in the communication domain. He also received a VB-MAPP assessment prior to the current study. He met two milestones in level 1 in the mand domain, indicating that his mand skills were at the developmental range of between birth to 18 months (see Appendix E). Mark usually manded (asked) for desired items after receiving prompts from others. He received early intervention services for two hours and 45 minutes per day.

**Child 2:** Mary was the second participant in this study. She was three and a half years old. She also received an official diagnosis of ASD from the Watson Institute LEAP preschool’s psychological department when she was three years old. Currently, Mary is attending a full-time preschool program in the greater Pittsburgh area, PA, from Monday to Friday and receiving early intervention services for two hours and 45 minutes per day. She was also assessed via teleassessment using Developmental Assessment of Young Children, second edition by the special education teacher at the Watson Institute LEAP preschool. Her cognitive domain score determined that she was typically developing in IQ, which meant she demonstrated no developmental delay in the cognitive domain. Even though she has some vocabulary, she has
difficulty expressing what she wants. Based on the assessment results, she was recommended to receive speech therapy to improve her functional languages and pragmatic communication skills. Mary received a VB-MAPP assessment before the study. Based on the assessment results, Mary met three milestones in level 1 in the mand domain, indicating that her mand skills were in the developmental range of between birth to 18 months (see Appendix E). Mary has difficulty saying what she wants without prompts from others and she used to go through stuff to get what she wanted. Mary was considered a vocal child, so she had to vocally say the item to get it and was assessed based on that.

**Child 3:** Nour was four years; she received an official diagnosis of ASD from the Watson Institute LEAP preschool’s psychological department when she was three years old. Also, she was attending a preschool program five days a week in the greater Pittsburgh area, PA, and she was receiving early intervention services for two hours and 45 minutes per day. Nour was assessed via teleassessment using Developmental Assessment of Young Children, second edition by the special education teacher at the same school. Her score was 77, which is a 1.53 standard deviation below average in the cognitive domain, meaning she demonstrated a delay in the cognitive domain and was eligible to receive early intervention service. Nour’s communication development was also assessed, and she scored 65, which is a 2.33 standard deviation below average, meaning she showed a delay in the communication domain. Also, she was evaluated via a VB-MAPP assessment before the current study. Results revealed that she met two milestones at level 1 of mand domain, meaning her mands skills were in the developmental range of between birth to 18 months (see Appendix E). Since Nour had minimal language, she had difficulty manding for preferred items. When she wanted something, she would grab it or scream instead of requesting.
Table 1

**Demographics of the Participants**

<table>
<thead>
<tr>
<th>Name of the Participant</th>
<th>Age</th>
<th>Current Language Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>Four years old</td>
<td>Two milestones at level 1 of mand domain</td>
</tr>
<tr>
<td>Mary</td>
<td>Three years and a half</td>
<td>Three milestones at level 1 of mand domain</td>
</tr>
<tr>
<td>Nour</td>
<td>Four years old</td>
<td>Two milestones at level 1 of mand domain</td>
</tr>
</tbody>
</table>

**Materials**

The following materials were used in this study: Data collection sheets, smartphone, iPad, menu of reinforcement items, visual graph, flow charts, and the Verbal Behavior Milestone Assessment and Placement Program. Data collection sheets were used to record the data for participants during sessions. A smartphone was used to time the sessions and responses of each participant. Also, an iPad from Duquesne University’s Special Education Program was used to video record the sessions for all the participants. In this step, the researcher recorded the video using the iPad after obtaining parental permission before starting the sessions. A menu of reinforcement items was used during the intervention. Reinforcement items, including toys, verbal praise, and snacks were identified through preference assessments. The researcher used the Verbal Behavior Milestone Assessment and Placement Program (VB-MAPP; Sundberg, 2008) for each participant to evaluate their mand ability level before the beginning of this study. Flow charts were provided to follow mand training of task analysis presented the implementation step by step and to calculate the percentage of the data.
Measures

The Verbal Behavior Milestone Assessment and Placement Program (VB-MAPP)

Sundberg designed the VB-MAPP program to measure verbal behavior, guide individualized instruction needed to address verbal behavior deficits, and evaluate treatment program progress (Sundberg, 2008). The VB-MAPP assessment program is used with individuals diagnosed with either language delay or autism spectrum disorder (ASD). Sundberg identified the developmental milestones and conducted research in the field of behavior analysis based on B.F. Skinner’s (1957) analysis of verbal behavior.

According to Sundberg (2008), the VB-MAPP Milestones Assessment has been used to evaluate the language, social, academic, and other related competence areas. The VB-MAPP includes 16 domains and five to 15 milestones in each domain. The domains and milestones are sampled in growth and are categorized into three stages during the first four years of life-based on typical development (Sundberg, 2008). The assessment contains 170 milestones balanced across three development levels of language (0-18, 18-30, and 30-48 months) and 16 different verbal operants and related skills (Barnes, Mellor & Rehfeldt, 2014). There are five items in each domain at each level of the assessment (Sundberg, 2008).

According to Barnes et al. (2014), the assessment includes an analysis of factors that can delay the learner's language acquisition and overall progress. Barnes et al. (2014) explained that level one (0-18 months), evaluate early mand, tact, listener, social, visual perceptual and match to sample, independent play, motor imitation, and echoic skills, as well as spontaneous vocal behavior. The second level focused on the same skills assessed in the first level by targeting language skills between 18 to 30 months, for example, more requesting skills (Barnes et al., 2014). The third level is designed to assess typical language skills between 30 and 48 months,
such as expanding the skills targeted in the first two levels and more advanced language skills like pre-academic behaviors in reading, math, and writing (Barnes et al., 2014).

**Sample Item Question.** As an example, from the guide assessment book (Sundberg, 2008), the goal is to determine if a participant mands with prompts. For the participant who is using either sign language or selecting one of the pictures, the question would be, can the child use mand with pointing prompts or imitative? Therefore, if the child has limited or weak early manding or requires physical prompts, then more assessment of the child’s language level is needed. For example, a participant can say cookie when he/she wants one; however, he/she needs someone to prompt them to respond. If a child uses sign language, when he/she wants one or see one; he/she may need an imitative prompt or to hear the word to respond (Sundberg, 2008).

**In this study, the VB-MAPP assessment serves as a tool for determining the eligibility of potential child participants.** In this study, the researcher discussed with the program director about the potential participants and benefits from the study. After receiving the consent forms from parents, the researcher picked the participant who demonstrated low performance in level 1 on the mand section on the VB-MAPP. Therefore, based on the VB-MAPP milestones assessment, children whose manding skills are within level 1 can emit 2-10 mands across two persons and two settings without prompt.

**Reliability and Validity of the Instrument.** Barnes, Mellor and Rehfeldt (2014)’s study evaluated two reliability measures of administering the VB-MAPP. These researchers investigated the administration of the VB-MAPP by two school psychologists on two conditions. In the first condition, the psychologists, who had no experience of administering the VB-MAPP, had to read the administration manual, then perform the evaluation. After further preparation, the
second condition was performed using a VB-MAPP behavior skills preparation (BST) kit consisting of five components: instructions, modeling, rehearsal, feedback, and remedial teaching.

Administration reliability was assessed on a 35-item checklist based on the details found in the instructions in administering VB-MAPP. The study indicated that reading the manual alone resulted in a 57% average administration score on the checklist, with an 83% interobserver reliability (IOR). Reading the manual and receiving special training with a BST kit resulted in an overall administration score of 92%, with an IOR score of 86%. The efficiency of VB-MAPP administration is clearly improved by additional hands-on training involving instructions, modeling, rehearsal, feedback, and remedial teaching. Also, the research administration reliability tests were consistent across the two different levels of staff skills (Barnes et al., 2014).

Montallana et al. (2019) did a survey containing 16 demographic questions and nine multiple-choice questions related to the definitions of four commonly taught verbal operants (mand, tact, intraverbal, and echoic). The goal of the survey’s questions related to the verbal operants was to ensure that the participants understood the verbal operants listed in the VB-MAPP. The survey findings showed that the average score on this quiz was 87.6%, indicating excellent and moderate reliability (Montallana et al., 2019).

One study evaluated the validity of VB-MAPP assessment along with the Promoting the Emergence of Advanced Knowledge Relational Training System (PEAK) assessment (Dixon et al., 2015). In the literature, two forms of validity tests were reported on the VB-MAPP to determine external validity between VB-MAPP and the PEAK assessment. Each assessment was given to forty students with ASD. The study results revealed that both VB-MAPP and PEAK assessments showed good validity, with a total score of $r=0.8266$ and that total scores on the VB-
MAPP are a strong predictor of total scores on the PEAK-combined R2 = 0.6833 (Dixon, et al., 2015).

In another study by Sundberg and Sundberg (2011), construct validity and reliability for the intraverbal part of the VB-MAPP were demonstrated. In this study, 39 typically developing children aged between 23 to 61 months were evaluated on an intraverbal subtest of 80 items, and their findings were compared with those of 71 children with ASD on the same subtest. Reliability tests for intraverbal response scoring in both groups were 93% on average. The results of children with ASD followed a similar trend, but age was not the best predictor of success; a better measure of intraverbal success was the existence of pre-requisite verbal skills (Sundberg & Sundberg, 2011).

Preference Assessment

According to Leaf et al. (2015), preference assessment is a process used by professionals to determine if objects appear to be preferred by the learner and whether the preferred items are more likely to act as future learning reinforcers. They explained that the goal of a preference assessment is to recognize the participant's favorite things to use as rewards or possible "reinforcements" to achieve an appropriate and desirable behavior (Leaf et al., 2015). Preference assessment refers to a variety of procedures used to identify (a) the stimuli chosen differently by the individual, (b) the comparable hierarchical preference value of those stimuli (high preference to low preference), and (c) the conditions under which those preference values change with the modification of task requirements, deprivation states or reinforcement schedules, and (d) if either essentially highly preferred items serve as excellent reinforcers (Cooper et al., 2020).

The Rationale of Preference Assessment. The rationale for doing preference assessments is that extensive research indicated that items identified by preference assessments
are often more effective in the long term as reinforcers than items identified by the judgment of the professional or the parent (Tarbox & Bermudez, 2017). The preference assessment identifies stimuli that are likely to be highly desirable and thus likely to act as motivation operations and reinforcers. As Kelley, Shillingsburg and Bowen (2016) stated, "the value of preference assessments is grounded in the extent to which the identified stimuli ultimately function as reinforcers for socially important behaviors" (p. 394).

**Ways to Conduct Preference Assessment.** Preference assessment should be conducted based on what is appropriate for the individual. According to Cooper et al. (2020), there are several variations of conducting preference assessment including informal assessments, such as asking the target person, asking significant others in the individual's life, or offering an assessment of the pre-task choice. The following section explains more about conducting preference assessment described in Cooper et al. (2020) book.

**Asking the Target Person.** Asking the target person means simply asking the target person what they like. This is a straightforward method to determine stimulus preference. Traditional variations include asking open-ended questions, offering a list of choices to the individual, or asking them to rank a list of choices. Specifically, open-ended questions are an open-ended assessment of stimulus preference orally or in writing, depending on the learner's language skills. Format for choice might include asking questions like: "which would you like to do a lot of hard work to get? "Would you prefer to eat things like chips, cookies, or popcorn, or do things like art projects, play games on computers, or go to the library?". Ranking-ordering refers to giving a list of items or stimuli to the learner and asking him/her to rank order from most to least preferred.
**Asking Significant Others.** It is possible to obtain many potential reinforcers by asking parents, siblings, friends, or caregivers to identify the activities, items, foods, hobbies, or toys they think the learner prefers. For instance, the Reinforcement Assessment for Individuals with Severe Disabilities (RAISD) is an interview protocol that can be used to ask caregivers to identify preferred stimuli in the visual, auditory, olfactory, edible, tactile, and social domains. Significant others then rank the selected items from highly preferred to low-preference. Finally, significant others could be asked to define the circumstances under which they predict that specific products may function as reinforcers (e.g., cookies with milk versus just cookies alone).

**Offering a Pre-Task Choice.** In this approach, the practitioner asks the participant to choose what he wants to earn for doing a task. One item is then selected by the participant from two or three options presented. The following section talks about other formal preference assessment procedures that can be used to identify preferred stimuli.

**Formal Assessments or Trial-Based Assessment.** Trial-based methods enable the administrator to present items to the learner in a series of trials (Cooper et al., 2020). There are different trial-based procedures, for example, including single stimulus (Hagopian, Rush, Lewin & Long, 2001), paired stimulus (Marano et al., 2020), multiple stimulus with replacement (Fisher et al., 1992), and multiple stimulus without replacement (Weaver et al., 2017). Based on predetermined criteria, preferred items are labeled as high, medium, or low preference (Cooper et al., 2020). The more item chosen during trials would be considered a strong preference to the participant, and it is more likely to function as reinforcers.

**Single Stimulus.** A single stimulus method is used when the learner has difficulty picking and choosing between two or more items (Hagopian et al., 2001). The single stimulus method, also known as the successive choice method, involves showing one item in each trial and
documenting the learner's reaction to the item (Pace et al., 1985). The responses to the item and the length of time spent with an item should be recorded.

**Paired Stimulus.** Paired Stimuli is also called the forced-choice method. Every trial presents two items and records the individual's preference between the two (Cooper et al., 2020). The number of times an item was chosen is recorded, and the items are then ranked. This method is said to be the most accurate and takes the most time to implement (Marano et al., 2020).

**Multiple Stimulus with Replacement (MSW).** In an MSW Preference Assessment, the educator places a cluster of items in front of the child and allows him or her to choose one (Davies et al., 2013). After the child plays with or consumes the item, the educator replaces that same item within the array and replaces the unselected items with new ones. Then repeated the same procedures in the following trials.

**Multiple Stimulus without Replacement.** Multiple Stimulus Preference Assessment without Replacement (MSWO) may be a demonstrative tool that creates a ranked arranged list of preferences for a particular person. In this method, the child must select a stimulus from an array of three or more items in MSWO, and the item selected is removed in the following trial while the remaining items remain (Daly et al., 2009). The MSWO assessments permit the child to rank the most favored stimuli among an array of items.

**In this current study, the researcher chose to ask significant others of the child and conduct formal preference assessments on the participants.** Simply asking the child about his/her preferences once could lead to false positives (i.e., as a reinforcer, children can choose an event or stimulus, but it may not be reinforcing) (Cooper et al., 2020). Therefore, the researcher did not assess the participants' preferences due to their young age in the current study. Since it is possible to identify many potential reinforcers by asking parents, siblings, friends, or caregivers
to identify the activities, items, foods, hobbies, or toys they think the learner prefers, the researcher started by asking the caregivers to list at least ten favorite items for their children. In addition, the researcher asked the participants to select an item from five items that significant others have identified as reinforcers (see Appendix A).

In this study, the researcher started by asking parents or caregivers who are knowledgeable about the child’s preferences to perform a preference assessment to decide which items are favored (Tarbox & Bermudez, 2017). This interview aimed to determine potential reinforcers for the child (Lambright, 2011). Hence, the researcher asked a simple question and interviewed parents regarding the child’s favorite items, such as tangible items or appropriate toys, healthy snacks, verbal praise and body contact such as a high five. The following question was asked: Could you please write at least ten favorite tangible items, foods or activities for your child? Those items should be developmentally appropriate for the child's age. Then, the top ten items dictated were used to motivate and increase the value of mand behavior. After identifying the 10 top items, the researcher did a formal preference assessment with the participants using the approach named Multiple Stimulus without Replacement (MSWO) (see Appendix A). To confirm that the child really liked the items that their caregivers identified, the researcher presented the items to the child each time and asked them to select an item (stimulus) from the array (multiple stimuli) without replacement (MSWO). The researcher removed the item selected previously, then continued to the next trial with the remaining items until the last item was picked. This approach can identify the child’s preference by order.
Research Design

Introduction to The Research Design

A multiple baseline across participants design was used in this study. A multiple-baseline design is a type of single subject research design (Coon & Rapp, 2017). The multiple baseline design is created as several concurrent AB designs with staggered phase changes (Hersen, 1990). A multiple baseline is the most widely used experimental design for evaluating treatment effects in applied behavior analysis (Cooper et al., 2020).

Cooper et al. (2020) define a multiple-baseline design across participants as one target behavior identified for more than one participant in the same setting. According to Richards et al. (2016), a multiple-baseline design across participants is an intervention design for more than one individual who expresses the same target behavior in the same setting. Once steady baselines are demonstrated across participants, the intervention should be implemented for the first participant, and then when the dependent variable shows that the intervention had an effect, the researcher can move on to the next participant (Richards et al., 2016). Therefore, the researcher can implement the intervention for the next participant using the same process as the first participant to investigate the effectiveness of the intervention.

The four phases of the study include baseline, intervention, generalization, and follow-up. The baseline phase, wherein the subject is observed, and data are collected, should occur before the intervention is introduced for each participant (Cooper et al., 2020). Next is the intervention phase, and any change with the dependent variable is recorded (Coon & Rapp, 2017). The generalization phase should follow the removal of the intervention, and the generalization sessions should be identical to the data collection during the baseline sessions, across different
people, or settings (Krasny-Pacini & Evans, 2018). The follow-up maintenance sessions phase should be after removing the intervention for a few weeks or more.

Cooper et al. (2020) define a stable baseline as the data presenting no evidence of an upward or downward trend, and all data measures fall within a small range of values. In this study, in the baseline phase, the researcher observed the participants, focused on the target behavior before any intervention and then collected the data until the data showed a stable baseline. Then, the researcher implemented the mand training intervention for the first participant to ensure the effectiveness of the intervention on the target behavior. Once the intervention showed effectiveness, the researcher implemented the intervention onto the second and then the third participants using the same approach. Then, the generalization phase was conducted after completing the intervention phase across all participants. Two months later, the researcher implemented a follow-up phase for all participants.

**The Appropriateness of the Proposed Research Design**

A multiple-baseline design across participants was used to assess the impact of mand training intervention on the occurrence of unprompted mand behavior. This research included four phases, baseline, intervention “mand training”, generalization, and follow-up. The data were collected three sessions a day; session was up to 30 minutes, three days a week until, all completed sessions. The intervention was implemented on the participants to evaluate the efficacy of an early verbal behavioral intervention to increase unprompted manding in children with ASD.

The multiple-baseline design is the most appropriate single-subject research design used in this study because the reversal of target behavior back to baseline is not appropriate or ethical for the experimental intervention (James, 2016). Also, researchers using this design can raise
internal validity by managing the history of each participant (James, 2016; Jhangiani, 2019). Additionally, it increases external validity because it allows for more reliable generalizability of results with other participants who have similar characteristics by showing the impact of intervention with more than one participant (James, 2016). Besides, for evaluating treatment effects in the field of applied behavior analysis, a multiple baseline is the most widely used experimental design (Cooper et al., 2020).

The main element of this design is the implementation of treatment at a different time for each participant (Christ, 2007). The concept is that if the dependent variable changes when treatment is implemented for a single participant, it may be a coincidence or due to a confounding variable. However, if the dependent variable changes when the intervention is implemented on several participants, especially when intervention is implemented at varying times for different participants, in that case, it is highly unlikely to be a coincidence or the result of some confounding variable (Jhangiani, 2019).

In this study, after achieving steady-state responses under baseline conditions, the mand training intervention was implemented on one of the participants, while baseline conditions remained in place for the other participants. The intervention was applied to other participants when the first participant achieved a criterion-level or stable response. So, the researcher implemented the mand training intervention for the first participant to ensure that the intervention had an impact on the target behavior. When the intervention proved to be working, the researcher extended it to the second and third participants in the same manner. After all participants had completed the intervention phase, the generalization phase was conducted. Eight weeks after the intervention phase, the researcher implemented follow-up/maintenance sessions to measure how well the participants retained their learned skills.
Variables

Operational Definition of Manding

According to Skinner (1957), manding refers to “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (pp. 35–36). Sundberg and Michael defined manding as “a type of verbal behavior where the response form is controlled by a motivative variable” (2001, p.702). Manding is also strengthened by a specific reinforcer (Sundberg, 2008). In other words, manding is described as requesting or asking for a favorite item or event (Sundberg, 2008). For example, if an individual requests something to drink, this is considered manding. For example, a researcher shows a child a piece of his/her favorite fruit and waits for ten seconds. When the child asks for the fruit, the researcher would give it to him/her immediately to increase their manding responses. The reinforcement for this mand is the motivating operation (MO) the fruit that was requested by the child and then given.

Independent Variable

Mand training intervention is crucial for language development for people with severe verbal issues (Heron et al., 2017). Mand training was implemented as the intervention in this study, as shown in the flow chart (Figure 1). Mand behavior does not exist independently in individuals with ASD; mand exists from tact and responsive skills training (Heron et al., 2017). When the child wants something (stimulus), he/she will make an appropriate verbal response, which is reinforced by getting what they want (Heron et al., 2017). The most complex element of mand training is that the response needs to be under the proper functional control of MO. Therefore, mand training intervention should only occur when the appropriate MO is high, and essentially the response should be free of additional control sources (Heron et al., 2020).
In this study, the researcher trained the participants to improve their mand ability to request their favorite items during the intervention sessions without prompts. Three children with an official diagnosis of ASD aged four years or younger participated in this study. Sessions occurred three times a day; each session contained ten trials; one item was presented in each trial. These sessions occurred three days a week until the study was completed. Each participant had one attempt to respond to each item. Each session lasted for up to 30 minutes.

After identifying the favorite items for each participant, the researcher started implementing the study. Ten trials were conducted for each item during the intervention phase. The researcher presented the item as an MO to the participant for 10 seconds until they showed interest in the item vocally by saying the name of the item or non-vocally using signs, gestures, or icon exchanges. When the participants did not request (mand) the item, the researcher prompted them. For example, when the participant indicated an interest in a tangible reinforcer, the researcher waited for ten seconds to allow the participant to emit an unprompted mand behavior.

When the participant requested the item during the ten seconds, the researcher immediately gave that specific tangible item as a reinforcer with a complete vocal prompt. If ten seconds passed and the child did not emit an unprompted mand or another vocalization, the researcher would immediately give a complete verbal prompt to encourage a mand corresponding to that tangible reinforcer. Then, the researcher would fade the verbal prompt gradually. The treatment fidelity was measured using the form Appendix C.
Figure 1: Flow Chart of Mand Training Steps

The item was presented as a motivation operation to the participant.

The researcher waited for ten seconds

If the participant requested the item vocally by saying item's name or non-vocally using signs, gestures, and icon exchanges, etc.

The researcher said the item's name and the item was immediately delivered to the participant for ten seconds or until it was consumed by the child.

At the end of each trial, the participant was rewarded with verbal praise and the item if they requested it correctly.

Trial finished.

Then, the researcher presented the next item as a new trial.

A verbal or gesture prompt was used if the participant showed no response to the item.

If the participant requested the item vocally or non-vocally, the researcher said the item's name, and the item was immediately delivered to the participant for ten seconds or until it was consumed by the child.

At the end of each trial, the participant was rewarded with verbal praise and the item if they requested it correctly.

Trial finished.

Then, the researcher presented the next item as a new trial.

The item was not delivered if the participant emitted an incorrect response or did not show any response within ten seconds.

Trial finished.

Then, the researcher presented the next item as a new trial.
**Dependent Variable**

Direct observation was used in this study to observe the mand behavior of the participants. In this study, the dependent variable was the percentage of correct responses of unprompted mand behavior in a session. Unprompted mand behavior can be defined as the behavior when the child requests an item on his/her own without a prompt from the researcher and receives it. A mand behavior was scored as a correct response if the participant requested the item vocally by saying item's name or non-vocally using signs, gestures, or icon exchanges, etc., with no other verbalizations within ten seconds of the researcher showing the item to the participant. An incorrect response was scored when the participant showed no response to the item within ten seconds of its presentation, or requested the item, then refused it or emitted other verbalizations before manding for the target item. The participant had one attempt for each item per session. Therefore, the percentage of correct responses per session was used to record the participants' correct responses or initiation. Then, the researcher calculated the percentage of correct responses (Figure 2) through dividing the number of correct responses by the total number of responses and then multiplying by 100 (Canchola, 2017).
Figure 2: Flow Chart of Dependent Variable

Dependent Variable

Percentage of Correct Responses of Unprompted Mands

How to Measure it?

Number of Correct Responses

Number of Incorrect Responses

Percentage of Correct Responses of Unprompted Mands = \frac{\text{Number of Correct Responses}}{\text{Number of Correct Responses} + \text{Number of Incorrect Responses}} \times 100
Data Collection

The researcher observed the participants in all phases and documented the numbers of correct responses and incorrect responses. A flow chart outlined the steps (Figure 1) was used to help implement the steps. Also, correct and incorrect responses were recorded in a mand data collection sheet using paper and pencil for each trial (Appendix B). In addition, the participants’ performance in all phases was video recorded. Then, the researcher calculated the percentage of correct responses of unprompted mand (Figure 2) by dividing the number of correct responses by the total number of responses (the number of correct responses plus the number of incorrect responses) and multiplying by 100 (Richards et al., 2016).

As mentioned previously, a mand was scored as a correct response if the participant requested the item vocally by saying the name of the item or non-vocally using signs, gestures, or icon exchanges, etc., with no other verbalizations within ten seconds after the researcher or the teacher shows the item to the participant. If the participant showed no response to the item within ten seconds of its presentation or requested it but then refused it or emitted other verbalizations before manding for the target item, it was considered an incorrect response. The participant had one attempt for each item per session. Therefore, the percentage of correct responses per session was used to record the correct responses or initiation from the participant. Then, the researcher calculated the percentage of correct responses (Figure 2) by dividing the number of correct responses by the total number of responses and then multiplying it by 100 (Canchola, 2017).

The mastery criterion in this study was 80% or more correct responses of unprompted mand per session. Specifically, when the participants emitted unprompted mands 80% or more of the trials within a session, which means they had to mand at least eight out of ten (or four out of
five) trials independently without prompts in a session, they were considered to have met the mastery criterion.

**Procedure**

**Recruitment of the Participants**

The researcher went through the Institutional Review Board (IRB) process required by Duquesne University before recruiting the participants or starting observation. The IRB administrative was established to protect the rights of human research subjects recruited to participate in research activities conducted under the auspices of Duquesne University with which it is affiliated. Once the researcher received approval from the IRB board of Duquesne University, she started searching for participants that meet the inclusion criteria.

The researcher sent flyers to all potential settings, including places such as preschools, early intervention programs, behavior clinics (ABA clinics), or daycare centers in the greater Pittsburgh area that serve children with ASD. The researcher contacted the directors/coordinators of these programs/organizations via email and phone calls. They received a flyer with information about the study.

The researcher received a response from a local preschool with potential participants who met the inclusion criteria that could benefit most from the intervention. The program director invited twelve families to participate in this study. Parents or caregivers had to sign a consent form before participating in the study. Only four families were willing to participate and signed the consent forms. After receiving the parents’ permission forms, the researcher started observation and assessed all four potential participants. After assessing the participants, the researcher recruited the participants who demonstrated similar mand behavior in level 1 of VB-MAPP. One child did not meet the inclusion criteria because the VB-MAPP assessment result
showed that he demonstrated significantly lower cognitive functioning than other participants and did not meet the inclusion criteria.

Preference Assessment

After the recruitment of the participants, the researcher started the preference assessment with each participant to identify their favorite items to be used as motivation and reinforcement. First, the researcher interviewed the parents regarding the child's favorite healthy snacks and tangible items, such as toys, to determine potential reinforcers for each child. Then, the researcher conducted a formal preference assessment on the participants to select one from several items that parents identified. These included edible and non-edible items. They are used to increase the value of manding. Table 2 presents the top ten items that were identified for each participant in this study and were used as mand targets and reinforcers throughout this study.

Table 2

Preferred Items Identified from Preference Assessments

<table>
<thead>
<tr>
<th>Child’s Name</th>
<th>Edible</th>
<th>Non-Edible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretzels</td>
<td>Toy Dog</td>
</tr>
<tr>
<td>Mark</td>
<td>Cheese Puff</td>
<td>Ball</td>
</tr>
<tr>
<td></td>
<td>Popcorn</td>
<td>Dinosaurs</td>
</tr>
<tr>
<td></td>
<td>Veggie Straw</td>
<td>Toy Cat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toy Goldfish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building blocks</td>
</tr>
</tbody>
</table>
Training Teachers

The researcher provided training to teachers on how to implement the mand training intervention step by step in their daily environment. The researcher went through the procedure with the teachers until they understood and mastered every step. The researcher gave the data collection sheets to the teacher and explained how to use them to collect data.

Baseline

During the baseline, the researcher sat next to the participant at a table in the regular classroom. Reinforcers including edible and non-edible items were placed near the table. During the baseline, the researcher chose an item from the array and presented it to the participant, then waited for the child for ten seconds to mand for the item. Contingent upon the participant asking
for the item, the researcher picked it up and gave it to the child without saying anything. After
the participant played with or consumed the item, the researcher presented the second item in the
same manner. When the participant showed no response to the item or emitted an incorrect
response, the researcher would not give him/her the item. If the participant failed to execute the
task twice consecutively, the researcher would take a break for two minutes and then start over
the same process mentioned earlier.

Then, the researcher repeated the procedure for the following item. The researcher
presented five trials during each baseline session. Each trial contains one item in all phases.
However, the participant had only one attempt to respond to each item during the baseline
session. The number of sessions was determined based on the data collecting from each
participant. In the baseline phase, the researcher observed the participant and collected data until
the data points' trend and level stabilized. When the data became stable (showed no evidence of
an upward or downward trend), and all the data measures fell no more than 15 % of the variance,
the researcher started implementing the intervention. All three participants were introduced to
the baseline phase at the same time. The first participant had a stable baseline and two sessions
without problem behavior; the baseline phases ended with him, and intervention started for him
alone. At the same time, other participants remained in the baseline phase.

**Intervention Phase**

The flow chart of mand training (Figure 1) presented the implementation procedure step
by step. During all sessions, the researcher sat next to the participant at a table in the same
classroom. The preferred items identified previously, such as toys, were placed near the table.
The participant had one attempt to respond during each session. Three sessions per day were
implemented, up to 30 minutes per session, three days a week. Each session contained 10 trials. Each trial contains one item in all phases.

During the mand training session, the researcher presented the item to the participant as a motivation operation. The researcher did not say anything and waited for ten seconds. If the participant requested the item vocally or non-vocally by looking, pointing, reaching, or touching the targeted item, the researcher said the item’s name, and delivered to the participant for ten seconds, or until the child consumed it, the trial was finished and then moved on to the next item. If the participant showed no response to the item, the researcher would use a verbal or non-verbal (gesture) prompt. At the end of each attempt, the participant was given the item manded for. If the participant emitted an incorrect response or did not show any response within ten seconds, the item was not given, the trial was finished and then moved onto the next item. Again, for each item, the participant could have one attempt to mand for correctly without a prompt. Then, the researcher would repeat the same procedure onto the next item. In the next mand training session, the item was presented again, and the researcher allowed ten seconds after instruction. Then, the researcher rewarded the participant immediately following the correct response without prompt. After that, the researcher repeated the procedure for the next session until ten items were presented.

**Generalization**

After the intervention, the researcher measured the child’s ability to generalize the skill to another adult. Once the intervention phase was completed for each participant, the generalization phase was introduced immediately on the next day’s session. During this phase, one session (or five trials) was conducted for each participant with another adult other than the researcher. In this study, their regular teachers, whom the participants usually worked with during a typical day,
were the adult who did the generalization session. Also, the generalization session was conducted in the same setting. The main goal of the generalization phase was to evaluate if the participants could emit mands for their favorite items at the same level across different people.

The assessment process of generalization was identical to that of the baseline phase. The teacher sat next to the participant at a table. The favorite items were presented. The teacher chose an item from an array, then presented it to the participant, and waited for ten seconds for him/her to ask for/mand for it vocally or non-vocally. Upon the participant requesting the item without a prompt, the teacher would say the item's name (e.g., “ball” if the item was a ball), then give it to him/her. After the participant manipulated/consume the item, the teacher would move on to the second item using the same procedure.

**Follow-Up**

Follow-up/maintenance sessions were conducted two months after the completion of the intervention. The main aim of the follow-up was to assess how well the participants could maintain their learned manding behavior over time. Each follow-up session contained ten trials; each trial involved one item. All procedures and settings in this phase were the same as in the intervention phase.

**Interobserver Agreement and Fidelity of Implementation**

**Interobserver Agreement**

According to Richards, Taylor and Ramasamy (2016), the interobserver agreement is “two or more observers record the target behavior independently and simultaneously; later, results are compared to determine if the target behavior is being measured reliably” (p.76). A minimum of twenty percent of the intervention sessions should be used to calculate interobserver agreement. The interobserver agreement was used to ensure the integrity of the process.
In this study, the researcher observed the study and calculated the data. In addition, the iPad was used to video record all sessions involving all participants after receiving parental permissions. This step was to ensure interobserver agreement can be calculated accurately using the video recording. A Registered Behavior Technician (RBT) who works in clinical settings under the supervision of a Board-Certified Behavior Analyst (BCBA) but was not involved in the study was recruited by the researcher to serve as the second observer. Then, the researcher explained to the second observer the purpose of the study, how to score the data, and how to use the data collection forms. The RBT independently watched all video recordings from all phases and scored on the data collection sheet. IOA was calculated for 100% of the data across all phases for all participants. Therefore, the second observer scored each session and compared the scoring of the researcher. So, trial-by-trial IOA measures the number of trials with agreement divided by the total number of trials. Then, the interobserver agreement was calculated by dividing the number of agreements of responses by the total number of agreements and disagreements of responses, then multiplying by 100 (Canchola, 2017). Also, the mean of each phase was calculated. The results of the interobserver agreement are explained and presented in chapter four.

**Treatment Integrity**

Treatment integrity refers to the extent to which an intervention is carried out as planned (Cooper et al., 2020). In this study, a treatment integrity checklist was created to measure the research fidelity of implementation (Appendix C). The treatment integrity checklist contained seven main areas: organization, baseline, intervention, teaching procedure, generalization, follow-up, and data collection. The second observer reviewed at least 50% of the trials
recordings and rated the checklist items “Y” for observed and "N" for not observed. The treatment integrity results are also presented in chapter four.

**Social Validity**

After the study was completed, a brief social validity scale survey (Appendix D) was developed by the researcher to evaluate satisfaction. The survey was administered to teachers to assess their satisfaction with the intervention and implementation. The survey contained five questions on a scale of one to five, with five being strongly agreed and one being strongly disagree.

**Data Analysis**

The current study aimed to examine the effects of EIBI on mand behavior for children with ASD. Visual analyses were used to present the changes that happened in manding behavior during the intervention. The visual analysis displayed information that examined the variability, level, and trend modifications for visual assessment to measure the change occurred during the intervention. Trend is applied to predict future behavioral measures under the same conditions (Horner et al., 2017). Also, Horner et al. (2017) explained variability as the frequency and duration to which numerous behavioral measures obtain varying results. The level of visual analyses is reported as a value on the vertical axis that a series of behavioral measures combine around (Horner et al., 2017). In single-subject design, visual analysis may be more beneficial than statistics to help readers understand the results of the studies (Alnahdi, 2013).

The participants' percentage of correct responses of unprompted mand behavior in a session after receiving mand training was reported to answer the research questions. Also, this study reported the number of mands acquired by each participant. In addition, visual analysis was created to present the significant effects in increasing manding behavior across participants.
The x-axis presents sessions in baseline, intervention, generalization, and follow-up. Each session in baseline and generalization contains five trials, and each session in the intervention and follow-up phases contains ten trials. The y-axis presents the percentage of correct responses of unprompted mands emitted by the participants.
CHAPTER IV
RESULTS

This chapter presents the data collected from the three participants in this study. Also, the results of the intervention are visually analyzed and graphed, then discussed in this chapter. The interobserver agreement and treatment integrity data were also analyzed and calculated. Additionally, the result of the social validity data collected from teachers are discussed.

Figure 3 shows the percentage of correct response of unprompted mands for each session across the four phases. The x-axis presents sessions in baseline, intervention, generalization, and follow-up. As mentioned earlier, each session in baseline and generalization phases contains five trials and each session in the intervention and follow-up phases contains ten trials. The y-axis presents the percentage of correct response of unprompted mands by the participants. The mastery criterion in this study is at least 80% correct response per session. In other words, when the participants emitted 80% or above correct response of unprompted mands of all trials within a session, they are considered that they met the mastery criterion. That means the participants had to mand at least eight out of ten, or four out of five trials in a session independently without prompts.
Figure 3

Percentage of Correct Responses of Unprompted Mands by Participants
Results of the Participants

Mark

Baseline Phase. The graph in Figure 3 above presents the percentage of correct response of unprompted mands from Mark across four phases. During the baseline phase, the researcher implemented two sessions on Mark, each session contained five trials and he demonstrated 0% of correct response of unprompted mands on both sessions. Both sessions showed consistent results. A visually stable baseline was defined as a line with scores that varied by no more than 10%. This indicated the intervention was ready to be implemented on him.

Intervention Phase. During the intervention phase, mand training was implemented on Mark as the first participant. After receiving that, the level of Mark's correct response of unprompted mand behavior increased in the intervention phase. Mark’s average percentage of correct response of unprompted mands was 66.67%, ranging between 20% - 90% (see Table 3). Mark received mand training three sessions a day, and on the second day, he reached the mastery criterion of 80% correct response by the fourth session. However, to ensure he really mastered it, the researcher trained him for two more sessions, and he demonstrated 90% correct response in both sessions. In summary, there is high variability between the baseline and the intervention phases upon receiving mand training intervention.

Generalization Phase. In the generalization phase, one session was conducted on Mark that contained five trials with his regular teacher (instead of the researcher). Mark's high performance continued and remained the mastery criterion, which was 80% correct response. The results indicated the effectiveness of this intervention. Therefore, after confirming the
effectiveness of early mand training intervention, the researcher implemented the intervention onto the second participant.

Follow-Up Phase. Three follow-up/maintenance sessions were conducted two months after the completion of the generalization phase on Mark. Each session contains ten trials; each trial contains one item. All procedures and settings in this phase were the same as the implementation of the intervention phase. The result of the follow-up sessions indicated an excellent level of skill maintenance. He had an average 93.3% correct response with a range of 90%-100%.

Mary

Baseline Phase. In the baseline phase, Mary did not emit any unprompted mands (see the graph in Figure 3 above). The researcher had to stop a few times during baseline sessions because of her challenging behavior or distractions. Therefore, sessions conducted with less than five trials were not counted. Five sessions were conducted on Mary in the baseline phase. When Mary’s baseline became stable, the researcher introduced the intervention to her once it showed effectiveness with Mark.

Intervention Phase. In the intervention phase, six sessions were conducted on Mary. The level of Mary's performance reached the mastery criterion by the fourth session and reached 90% correct response by the second day. Mary's performance increased dramatically in the intervention phase. Her average correct response of unprompted mands was 75%, range from 40% - 90% (see Table 3). Even though the last two sessions were conducted after one week of no
training, she still demonstrated 90% accuracy, indicating that she gave 9 out of 10 correct responses for the last two sessions.

**Generalization Phase.** As showed on the graph in Figure 3 above, Mary’s manding performance significantly increased upon receiving the mand training intervention. In the generalization phase, one session that contained five trials was implemented on Mary with her regular teacher. Mary was able to remain the mastery criterion of 80% correct response.

**Follow-Up Phase.** During the follow-up maintenance sessions, Mary was assessed for 3 sessions (or 30 trials) about eight weeks after the generalization sessions. She had an average performance of 80% accuracy with a range of 70% - 90%. Although she demonstrated some variability, her average performance indicated strong skill maintenance.

**Nour**

**Baseline Phase.** During the baseline phase, six sessions were conducted on Nour, but she did not emit any correct response of unprompted mands, as presented on the graph in Figure 3 above. Some sessions were not counted since less than five trials were conducted. The intervention was to be implemented on Nour when she had a stable baseline, or when her baseline data became stable (with no trend) and after the intervention showed effectiveness with Mary, the second participant.

**Intervention Phase.** During the intervention phase, ten sessions were conducted on Nour. Nour's performance reached the mastery criterion (80%) by the third session, on the first day. The level of Nour's correct responses of unprompted mand behavior continued to increase in the intervention phase, and her average correct response of unprompted mand was 69%, and an
increasing trend with a range of 10% - 90% (see Table 3). Therefore, her level of performance was increased from 0% to 90%. Even though Nour reached the mastery criterion by the first day, the researcher kept implementing the intervention on her because Nour showed an improvement in her vocabulary. That was, instead of just reaching for the item, Nour started echoing what the researcher said. Then, she began to vocally mand for her preferred items without prompt, for example, ball, car, and green for a green toy dinosaur.

**Generalization Phase.** One session was conducted on Nour with her regular teacher that contained five trials in the generalization phase. Nour had a high level of performance and reached the mastery criterion of 80%. The graph in Figure 3 above showed high variability between the baseline, intervention, and generalization phases upon receiving mand training intervention.

**Follow-Up Phase.** Nour was assessed for correct response of unprompted mand during the follow-up/maintenance sessions two months after the generalization session. The researcher conducted three sessions (30 trials) on Nour. Nour’s performance demonstrated a range of variability. She had an average of 63.33% correct response of unprompted mands with a range of 50% - 80%. In the last session of this phase, Nour was still able to reach 80% accuracy. However, her overall performance during this phase was below the mastery criterion.
Table 3

The Result of the Participants Performance Across Phases

<table>
<thead>
<tr>
<th>Child’s Name</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Generalization</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Mark</td>
<td>0</td>
<td>20%- 90%</td>
<td>66.67%</td>
<td>24.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>90%– 100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>93.3%</td>
<td>4.7</td>
</tr>
<tr>
<td>Mary</td>
<td>0</td>
<td>40%- 90%</td>
<td>70%</td>
<td>18.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70%– 90%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Nour</td>
<td>0</td>
<td>10%- 90%</td>
<td>69%</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50%– 80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63.3%</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Interobserver Agreement (IOA)

IOA was calculated for 100% of the data across all phases for all participants. As represented in Table 4, the IOA results varied across participants, but all were above 95%. Specifically, for Mark, the average IOA score for all sessions across phases was 99.6%, which ranges from 98% to 100%. The IOA score of all sessions across phases for Mary was 99.1%, and 99.3% for Nour. These numbers indicated a satisfactory level of agreement between the researcher and the second observer.

Table 4

Interobserver Agreement Results of the Participants

<table>
<thead>
<tr>
<th>Child’s Name</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Generalization</th>
<th>Follow-up</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>100%</td>
<td>98.3%</td>
<td>100%</td>
<td>100%</td>
<td>99.6%</td>
</tr>
<tr>
<td>Mary</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>96.7%</td>
<td>99.1%</td>
</tr>
<tr>
<td>Nour</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
<td>98.3%</td>
<td>99.3%</td>
</tr>
</tbody>
</table>
Treatment Integrity

The second observer reviewed 50% of all trial recordings, coded the items on the checklist and rated them “Y” for observed, and "N" for not observed. Treatment integrity for Mark was 99%, with a range of 95% to 100%. The 95% score was based on the researcher’s performance during Mark’s baseline phase. The researcher failed the third item on the Treatment Integrity Checklist (Appendix C) “Potential manding items are available” for Mark and. That was because some items were not available at the school. However, the researcher made sure to use items that could deliver the same value. The balls used were different in size and color. Therefore, treatment integrity for both Mark and Mary was 99%, with a range of 95% - 100%. Nour’s treatment integrity was 99%, with a range of 95% to 100%. This score 95% was based on the researcher’s performance on Nour’s follow-up phase. The researcher failed the third item on the Treatment Integrity Checklist (Appendix C) “Potential manding items are available”. Specifically, in one of the follow-up sessions, the item (Green Dinosaur) was not available at school, so the researcher had to use another green dinosaur to replace the original one, which showed the same value.

Social Validity

As mentioned in previous chapter, the researcher developed a brief social validity scale survey (Appendix D) to evaluate satisfaction. The survey was administered to teachers to assess their satisfaction with the intervention and implementation. The survey contained five questions on a scale from one to five, with five being strongly agreed, and 1 being strongly disagree. All teachers rated the five questions with the highest rating (that is 5). Their rate indicated a high level of the social validity of this study. The participants’ teachers all reported that they think manding is a critical communication skill for the child. Also, they indicated that the procedures
used in the study were easy to understand and implement. Additionally, they reported that they would continue using mand training intervention procedures with the child and other children who need it. Overall, they are satisfied with the outcomes of the intervention.
CHAPTER V
DISCUSSION

This chapter starts with a summary of the results of the current study, then, presents a detailed discussion and analysis of the results. The study's findings confirmed the efficacy of this early mand training intervention on language development in young children with ASD, which was consistent with the previous studies reviewed in chapter two. In addition, the limitations of this study are presented and discussed. Finally, recommendations for future research are provided.

Summary of the Results

The results of the current study showed that the early mand training for children with an official diagnosis of ASD was very effective in increasing mand acquisitions within a short time for all these participants. There was a significant increase in the correct response of unprompted mands in all three participants. During the baseline phase, all three participants showed zero correct responses of unprompted mands in all trials, with occurrence of disruptive behavior: for example, crying, leaving the seat, or throwing the items away. However, a significant increase in their performance was achieved upon receiving early mand training. More specifically, all three participants displayed improvement in their language development: all participants demonstrated a mastery level of 80% or above correct response of unprompted mands in all sessions across the intervention, generalization, and follow-up phases.

The results of the study showed an increase trend between the baseline and the intervention for all participants. For Mark, the level of correct responses of unprompted mand behavior increased in the intervention phase. During the intervention phase, Mark’s average
correct response of unprompted mands was 66.67%, with an increasing trend ranging between 20% - 90%. In the generalization phase across another adult, one session was conducted on Mark and his performance remained high and surpassed the mastery criterion of 80% or above. In the follow-up phase, three follow-up maintenance sessions were conducted two months after the completion of the generalization phase on Mark. The result of the follow-up sessions showed an outstanding level of maintaining the learned skill. He had an average performance of 83.3% correct response of unprompted mand with a range of 80%- 90%.

Mary's performance reached and passed the mastery criterion by the fourth session that was 90% by the second day. That means her correct response of unprompted mand behavior increased significantly in the intervention phase, with an average 75%, and an increasing trend with a range of 40% - 90%. In the generalization phase, one session was implemented on Mary with her regular teacher, and she showed a high level of performance and reached the mastery criterion of 80% or above. During the follow-up/maintenance phase, Mary was assessed for 3 sessions (30 trials) eight weeks after the generalization session and she had an average performance of 80% correct response rate with a range of 70% - 90%.

One session was conducted on Nour with her regular teacher that contained five trials in the generalization phase; Nour's had a high level of performance and reached the mastery criterion, which was 80%. Nour was assessed during the follow-up maintenance sessions eight weeks after the generalization session. Nour had an average accuracy of 63.3% with a range between 50% - 80 %. Nour's correct responses of unprompted mand behavior increased in the intervention phase. Her average correct response of unprompted mands was 69%, with an increasing trend ranging between 10% - 90%.
Discussion of Research Results

The following section discussed the effects of the current mand training on language development in young children with ASD and reviewed several essential factors when implementing such interventions. Implications for research and practice were also addressed thereafter. Finally, limitation of the current study and recommendations for future studies were presented.

The Effect of Early Mand Training on Language Development in Young Children with ASD

One of the early language intervention strategies is using verbal behavior (VB), particularly mand training (MT) intervention, to target language development and facilitate functional communication in young children with limited language. According to previous research, mand training is one of the evidence-based interventions for teaching language to young children with ASD (National Autism Center, 2009). Mand repertoire is essential for early language learners to express their needs to obtain access to specific items or information in an appropriate way.

Mand is the first type of verbal behavior acquired by infants. For example, a crying baby requests (manding) a bottle of milk. Mands are also important in daily life, for example, communication, education, work, and self-advocacy. Mand is very essential in developing language skills. Children need to have language skills in order to learn better. Additionally, children need language for self-advocacy. Mands can help children with ASD to use their words to advocate for their needs and wants. Mand training intervention is recognized as an effective strategy to improve communication skills in children with ASD and is considered one of the top teaching priorities (Sundberg & Michael, 2001). Manding promotes the development of
reciprocal expressive and receptive language, which is essential in improving verbal competence (Albert et al., 2012).

The current study is very significant because many young children with an official diagnosis of ASD have limited language to express their wants and needs. Verbal language is important because it is how neurotypical people expect communication in daily life, for example, at work, and in school. Without showing the need for verbal requests in education, self-advocacy, and employment, people with ASD will continue to be excluded. Furthermore, children with speech and language delays have been reported to face long-term challenges in learning, school achievement, and behavior (Laing, 2002).

Also, this lack of communication could result in some challenging behaviors that have previously obtained what they wanted or needed (Albert et al., 2012). For example, some children with ASD may cry to obtain what they need because this is the only way they learned instead of being taught to mand for help in a more appropriate way. Others may disturb the environment instead of just requesting a break.

The current study is critical because it enriches the literature on the use of verbal behavior approach as early intervention for young children with ASD who has speech and language impairments. The results of this study have proven that young children with ASD can increase their manding behavior upon receiving mand training intervention at an early age. These findings agree with those of previous studies (such as Albert et al., 2012; Russell et al., 2018; Sundberg & Michael, 2001; and Sundberg et al., 2002).

Jennett et al. (2008)’s study confirmed that mand training intervention is an effective method in teaching children with ASD to make requests, which aligns with the results of the
current study. Following mand training intervention, there was also a significant increase in the percentage of correct responses of unprompted mands emitted by the participants in their study. In both the intervention and generalization phases, all participants demonstrated mastery of at least 80% correct response. Participants were also able to maintain their performance in the generalization phase with adults other than the researcher.

The current study involved three children with ASD aged four years and younger. The special education program director chose these children due to their limited language skills, specifically lack of unprompted mands. This study used preferred items to increase the value of unprompted mands. The intervention was implemented three days a week, three sessions a day, or until the demonstrated mastery of at least 80%. The study's findings showed that the early mand training intervention significantly increased unprompted mands for children with ASD. This finding was consistent with previous findings and confirmed the effectiveness of early intervention for children with ASD.

Additionally, three follow-up maintenance sessions were conducted two months after completing the generalization phase on participants. Each session contains ten trials; each trial contains one item. The result of the follow-up sessions revealed an outstanding level of maintaining the skill, especially for Mark and Mary. These results indicated the effectiveness of early mand training intervention on language development in young children with an official diagnosis of ASD. This result aligned with a previous study by O'Reilly et al. (2012) in which the participants showed a high level of performance in follow-up sessions.

Results of the current study also show that early mand training intervention promoted vocalization in some young children with ASD who were nonverbal. For example, Nour was one of the participants who had minimal language before the study. Encouragingly, during the
intervention, Nour started echoing what the researcher said, and gradually, she started saying the names of some items used as MOs without prompts. This is consistent with the findings of a previous study by Dras et al. (1999), who used mand training intervention to successfully establish an echoic repertoire in young children with ASD.

**Early Intervention for Children with ASD**

The average age of autism spectrum disorder (ASD) diagnosis in the United States is 4.3 years old and has not changed significantly over the past years (Manner et al., 2016), mainly due to delays in referrals for diagnostic and evaluation. This suggests that it is common for children to be diagnosed after preschool is common. Other developmental challenges may have been more prominent and obscured detection of ASD due to delayed identification and diagnostic overshadowing (Ozonoff, 2018). Therefore, it is critically important to start early intervention once the child receives the official diagnosis.

Early intervention is a cost-effective strategy for children with disabilities, particularly those with ASD (Reichow & Wolery, 2009). Many studies have shown that the earlier the intervention is implemented, the more effective it is likely to be, which may lead to a reduction in the symptoms of the disability before the child reaches school age (Vivanti et al., 2017). Moreover, previous research found that EI improved cognitive functioning, language skills, and adaptive behaviors in children with ASD (Correll et al., 2018). Specifically, in this study, Nour showed more improvement in her vocabulary upon receiving mand training intervention.

In addition, the current study has also found that the high intensity of mand training intervention resulted in quick and significant improvement in the children's performance across various phases. Furthermore, Previous studies indicated that more intensive interventions are preferred for greater intervention success (Vivanti et al., 2017). In this study, the researcher
implemented mand training three days a week, three sessions a day, each session lasted for up to 30 minutes, for children aged four years and younger to ensure the early age at intake of the intervention and the intensity of training.

**Important Factors to Consider When Implementing the Intervention**

During the implementation process, two important factors play critical roles in successful implementation of mand training intervention. The first factor is to assess motivational operations (MO). When teaching mand, the MO can be assessed using a preference assessment to identify highly preferred items. They increased unprompted mands emitted by the participants during mand training intervention. This result is similar with those of the previous studies, indicating MOs play an essential role and show significant implications in interventions (Sundberg, 2004; Langthorne & McGill, 2009).

In this study, preference assessment was used to identify MOs for each participant. The use of MOs was to guarantee that the appropriate conditions control mand behavior. If alternative reinforcements, such as tokens, were used, it might be less difficult to generalize to new environments. Preference assessments can aid in selecting appropriate reinforcers, and mand training intervention should start with highly preferred reinforcers (Albert et al., 2012). This should be done to ensure a strong desire in participants to obtain a particular item using verbal language.

The second important factor in mand training intervention is the use of prompts. Using prompts is an important part of mand training intervention. When a child responds incorrectly or does not respond at all, prompts can be used to help the child respond correctly. When the child shows an interest, the researcher should prompt for a response and give him/her the item if the response is correct. If the child does not respond, it is critical to use the next level of prompt in
the hierarchy to prompt again. The prompts must be faded over time so that the child does not rely on them and can engage in the mand independently, which is the goal of the intervention (Albert et al., 2012; Carbone et al., 2010).

The results of the current study have proven the efficacy of an early mand training intervention involving the use of prompts and reinforcements on language development in young children with an official diagnosis of ASD. These findings align with results of a previous study that also combined the use of reinforcement and prompts in mand training intervention (Bourret et al., 2004). The researchers reported that reinforcement and prompts increase unprompted mand behavior in their participants, too.

**Implications for Research**

This study has several implications for research. For example, researchers could consider implementing the exact strategies in students with other disabilities and with other needs. Certain precautions must be taken in order to implement such practices effectively. The main points in this study are intensity of the intervention and child intake age. In this study, the researcher focused on delivering the intervention early for young children with ASD. So, the study involved three children with ASD aged four years old and younger. Also, the study was conducted in high intensity: three days a week, three sessions a day, each intervention session contained ten trials and lasted for up to 30 minutes. This was done to ensure high intensity of the intervention, so the effects of the intervention can be achieved in a short time.

Additionally, it is important to remain high inter-observer agreement in data collection. The data collection should be taken using either direct observation or indirect observation. Direct
observation means both the researcher and a second qualified observer for the study take the data at the same time. Indirect observation could be reviewing recorded videos by the second qualified observer after the end of the sessions. Therefore, data collection can be done by both observers reviewing the recording videos across sessions independently. Then, agreement and disagreement can be calculated to achieve satisfactory IOA (i.e., 85% or above).

For generalization sessions, there is a need for another adult to implement the intervention to ensure that the participants can generalize their learned skills across different people. The researcher must ensure that those who deliver the intervention have full knowledge and understand every aspect of it. Therefore, a teacher or another professional should be trained well before delivering the intervention correctly.

**Implications for Practice**

ABA practitioners and teachers should know that several factors contributed to the successful implementation of this study. The first consideration is to evaluate motivational operations (MOs). The MOs can be evaluated by performing a preference assessment to identify the child’s highly preferred items. That is because knowing the child's motivation can create a strong desire to obtain a specific item. Therefore, practitioners should learn what motivates the child and use it as a reinforcement for any intervention. In addition, practitioners and teachers should consider doing the preference assessment at the beginning of the school year since acknowledging the child's motivation can help achieve specific desirable behavior. Moreover, preparing the reinforcement at the beginning of the school year helps practitioners create a positive, supportive learning environment.
The second important factor in implementing an intervention is the use of prompts. Prompts can help a child correct his/her response when they do wrong, or do not respond at all. Moreover, it assists learners in increasing the likelihood that the desired behavior will occur. Prompts can be verbal, gestural, physical, visual, or a model. Professionals and teachers should gradually fade the use of prompts once the child’s desirable behavior becomes more stable, so the the child does not rely on the prompts and become as independent as possible.

Professionals and teachers, especially in elementary schools, should seize the opportunity to teach the student using prompts when he/she expresses interests in an item by looking, reaching, or pointing, and say the item's name verbally and waiting a few seconds for the student to echo. Once he/she does, we should immediately give it to the student if he/she says it correctly or give a good approximation. We should prompt them again if the student does not request (mand). This way, the child can gradually learn to express their wants, needs, and request using socially appropriate behaviors and stop using undesirable or challenging behaviors to have their needs met in a natural environment.

Limitation of the Study

Even though this study has proven that mand training is effective in increasing unprompted mand behavior in young children with autism, this study has several limitations. Firstly, the VB-MAPP assessment that was used in this study lacks sufficient information on its psychometric properties conducted by peer reviewed studies (Lotfizadeh et al., 2018; Montallana et al., 2019). Appropriate reliability and validity of evaluations are not a general expectation but a concern that needs scientific assessment (Lotfizadeh et al., 2018).
Secondly, a significant limitation against using multiple baseline designs is that each transition from the baseline to intervention must be planned in a contemporary manner over time (Harvey et al., 2004). This requirement can be traced when working with individual research participants, including multiple designs across participants or settings (Harvey et al., 2004). Also, one of this study's major limitations is the small number of participants. This will limit the generalizability of the results of the current study to other young children with autism since there are concerns over the minimal generalizability of single-subject study findings involving small sample sizes (Alnahdi, 2013). However, if more similar studies are conducted, that may overcome this limitation and improve the generalizability.

Third, all participants in this current study were four years or younger, so the generalization of the findings is not appropriate for children older than four. However, the main goal of this study is to examine the effectiveness of an early mand training intervention using verbal behavior approach in young children at an early age. Thirdly, the inclusion criteria have limited children with other significant health condition or impairments (e.g., IQ below 40) or severe challenging behaviors to participate in this study. Therefore, the results of this study are not applicable for children with significant cognitive impairments (IQ below 40) or severe challenging behaviors. Fourthly, preference assessment was used in this study to determine the motivation operation of each participant. All the items used in the stimulus preference assessment were linked to a history of reinforcement may have influenced the motivating operations. It would be recommended and important to examine stimulus preference assessments with items that participants did not find them moderately reinforcing. Children with ASD need to learn to say no to the non-preferred items or can ask to remove something aversive or undesirable. Fifth, even though one of the criteria is to implement the intervention in natural
settings, there were too much distraction in the target students’ classroom, which might have affected the participants' performance. For example, many sessions were not counted across different phases in this study due to the distraction from other students.

Sixth, the items used in this study were available all the time for children during the day. Therefore, this may affect the child’s performance and progress. Some children may practice manding for these items and perform better, and others may lose interest in manipulating them. Additionally, in this study, only ten items were used with participants. Children should receive more training with other items to increase their mand acquisition and vocabulary. The study was conducted for ten items only due to the researcher's limited time working with the participants. That is because they had only two hours and 45 minutes per day to receive early intervention services.

Seventh, only one generalization session, or five trials, was conducted for each child due to limited staff in the classroom. There were only one teacher and one paraprofessional in each classroom for ten students, so logistically, it was hard to pull out the teacher more than once to do the generalization data collection. Finally, Mary and Nour displayed some challenging behaviors (e.g., crying, troughing items away, leaving the seat and refusing to sit back, etc.) when the intervention was being implemented, which disrupted the researcher’s data collection process, and she had to give them frequent breaks to help them back on track, even though most of these challenging behaviors were not severe. That is why some sessions were not included in either the data collection sheets or the visual analyses because they were not completed.


**Recommendations for Future Research**

This study demonstrated positive effects and indicated the effectiveness of using early mand training intervention to increase mand behavior for children with ASD. The current study could be replicated with a larger sample of students with ASD. In addition, this study was conducted in the greater Pittsburgh area, PA; other researchers could replicate the study in different cities, states, and countries.

In this study, the inclusion criteria have limited all participants' age to four years or younger, so other researchers are recommended to replicate the study with same age of children to have early results. The inclusion criteria in this study have limited the children with significant cognitive impairments or severe problem behavior from participating in this study. So, future research is recommended to replicate the study with other children with significant cognitive impairment or children with challenging behaviors.

This study used only preferred items, so it would be interesting if other researchers examined stimulus preference assessments with items that participants do not consider preferred or reinforcing items. Also, it is recommended if the items are not always available for children during the day. That is recommended to control other variables that may affect the child's performance.

Using prompts can help increase the desirable behavior to occur. Researchers are recommended to use prompts when they see fit while implementing any intervention. They could use either prompt from most to least or from least to most. The researcher must fade the prompt to promote the child's independence.

Practitioners should make sure to prevent prompt dependency. Therefore, it is recommended that they give the prompt only when the child needs it. Once it has been
determined that a prompt was used, work on fading the prompt as soon as possible. If practitioners are going to use a physical prompt, they should start with a faded physical prompt by using a physical prompt.

If they are going to use a verbal prompt, a practitioner may start with a faded verbal prompt. This could be by starting with a portion of what they need to say rather than giving them the entire sentence to repeat. Moreover, it is preferable to use verbal prompts when the practitioner is looking for verbal responses. One of the most important steps to prevent prompt dependency is to give the child the opportunity to emit the behavior before giving the prompt. Therefore, that will help the child become more independent.

The researcher should ensure that the second observer is well trained before collecting data. It is recommended that the second observer is a BCBA or has advanced training in ABA. Also, data collection can be done directly by both the researcher and a second observer or indirectly by reviewing the video recordings. Then, agreement and disagreement should be calculated.

Implementing the intervention in natural settings is the best; however, it would be recommended only if the researcher can control distraction. To ensure that the distractions do not affect the participants' performance. The researcher could start from controlling settings to more natural settings to ensure that participants can generalize the learning skills to different settings.

It is recommended that future researchers collect more extensive generalization data to assess how well the learned skills generalize across people and more follow-up data to see how the participants retain the learned skills over time. Finally, only ten items were used with participants in this study. However, it is recommended that researchers keep training children for a longer duration with more than ten items to increase their mand acquisition and vocabulary.
Conclusion

Many previous studies involving students with ASD used different methods to teach different skills. Numerous studies found that mand training intervention with children with ASD is effective in promoting language development in young children with ASD. This study provides evidence that early behavior intervention is significant for children with ASD. Specifically, mand training could increase unprompted mand behavior and decrease challenging behaviors in young children with ASD. More future research in the field is needed to further validate the practice.


autism spectrum disorder from 2 to 21 years of age. *Autism, 19*, 774–784.  
doi:10.1177/1362361315575840


https://doi.org/10.1901/jaba.1987.20-313


https://doi.org/10.4324/9781351314404-41

doi:10.1016/j.ridd.2006.03.002

doi:10.1186/1471-2393-13-s1-s10


Guinier, L. (2004). From racial liberalism to racial literacy: Brown v. Board of education


doi:10.1177/027112148900900302

https://doi.org/10.4324/9780429487682-2

https://doi.org/10.1016/j.psychres.2018.08.069


doi:10.1177/0145445502026001005


https://doi.org/10.1002/jaba.288


https://doi.org/10.1016/j.jcm.2016.02.012


Kucharczyk, S., Shaw, E., Myles, B. S., Sullivan, L., Szidon, K., & Tuchman-Ginsberg,

Lambright, N. M. (2011). *Using a pairing procedure to develop reinforcers for children on the autism spectrum with a restricted range of preferred items*. Rutgers The State University of New Jersey, Graduate School of Applied and Professional Psychology.


https://doi.org/10.1177/0145445509333173


doi:10.1016/j.rasd.2018.03.006


https://doi.org/10.1007/978-3-319-93203-3_12

https://doi.org/10.1016/j.pcl.2011.10.008


https://doi.org/10.1007/s10864-010-9112-7

intervention (EIBI) for young children with autism spectrum disorders (ASD). The Cochrane Database of Systematic Reviews, 10, 1–17. doi:10.1002/14651858.cd009260.pub3


Appendix A: Preference Assessment

Multiple Stimulus without Replacement (MSWO) for 10 items

| Item A: _________________ |
| Item B: _________________ |
| Item C: _________________ |
| Item D: _________________ |
| Item E: _________________ |

<table>
<thead>
<tr>
<th>Date:</th>
<th>Child name:</th>
<th>Researcher name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial #</td>
<td>Item selected</td>
<td>Placement of item selected</td>
</tr>
<tr>
<td>1</td>
<td>X X X X X X X X X X</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>X X X X X X X X X X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>X X X X X X X X X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>X X X X X X X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>X X X X X X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>X X X X X</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>X X X X</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>X X X</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>X X</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Manding Data Collection Sheet

Learner: _______________  Observer: _______________

Sd: motivating operation + item present + wait 10 seconds  
Response required: multimodal means of communication  
Data collection: (+) unprompted response, (-) prompted response

<table>
<thead>
<tr>
<th>Date</th>
<th>Target</th>
<th>Mode of Communication</th>
<th>Unprompted</th>
<th>Prompted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Vocal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Treatment Integrity Checklist

Y= Observed  N= Not Observed

1. Organization
   1. Instructional area is clean  Y  N
   2. All materials needed are ready  Y  N
   3. Potential manding items are available  Y  N

2. Baseline
   1. Present the item and wait for response  Y  N
   2. Do not provide prompt  Y  N
   3. Do not provide reinforcement  Y  N

3. Intervention
   1. Present the item and wait for response  Y  N
   2. Provide prompts  Y  N
   3. Provide reinforcers based on the preferences assessment  Y  N
   4. Fade prompts  Y  N

4. Teaching Procedure for Teachers to Implement Generalization Session
   1. The researcher trained the teacher how to implement the mand training step by step  Y  N
   2. The researcher trained the teachers personally  Y  N
   3. Provide training through their day environment  Y  N
   4. Provide training until the teacher understands and masters every step  Y  N
   5. Provide the data collecting sheets to the teacher to use them  Y  N
   6. Explain the data sheets to the teacher and how to use them  Y  N

5. Generalization
   1. Present the item and wait for response  Y  N
   2. Provide prompts  Y  N
   3. Provide reinforcers based on the preferences assessment  Y  N
   4. Fade prompts  Y  N

6. Follow-Up
   1. Present the item and wait for response  Y  N
   2. Provide prompts  Y  N
   3. Provide reinforcers based on the preferences assessment  Y  N
   4. Fade prompts  Y  N

7. Data Collection
   1. Number of mand responses are counted daily  Y  N
   2. Number of mand responses are graphed daily  Y  N
   3. Controlling variables for each mand is documented  Y  N
Appendix D: Social Validity Questionnaire

*Choose a number between 1 to 5 with 1*(strongly disagree)* and 5 (strongly agree).*

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I think manding is an important communication skill to the child.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. The procedures used in the study were easy to understand and implement.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I will continue using mand training procedures with the child and other children who need it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I would recommend mand training procedures to others who are seeking to increase manding for children with ASD.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I am satisfied with the child’s outcomes from mand training</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix E: Mand Level 1 from VB-MAPP

**Milestones Assessment: Level 1 (0-18 Months)**

(T) = Direct testing; (O) = Observation; (E) = Either testing or observation; (TO) = Timed observation

<table>
<thead>
<tr>
<th>MAND</th>
<th>TOTAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Does the child use words, signs, or icons to ask for desired items or activities?</strong></td>
<td></td>
</tr>
<tr>
<td>1. Emits 2 words, signs, or icon selections, but may require echoic, imitative, or other prompts, but no physical prompts (e.g., cracker, book) (E)</td>
<td></td>
</tr>
<tr>
<td>2. Emits 4 different mands without prompts (except What do you want?) — the desired item can be present (e.g., music, slinky, ball) (T)</td>
<td></td>
</tr>
<tr>
<td>3. Generalizes 6 mands across 2 people, 2 settings, and 2 different examples of a reinforcer (e.g., mands: bubbles from mom and dad, inside and outside, a red bottle and a blue bottle) (E)</td>
<td></td>
</tr>
<tr>
<td>4. Spontaneously emits (no verbal prompts) 5 mands — the desired item can be present (TO: 60 min.)</td>
<td></td>
</tr>
<tr>
<td>5. Emits 10 different mands without prompts (except, What do you want?) — the desired item can be present (e.g., apple, swing, car, juice) (E)</td>
<td></td>
</tr>
</tbody>
</table>

Comments/notes: