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Does Most-to-Least Prompt Fading Lead to Independence in Tooth Brushing in Children With Intellectual Disability?

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by
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Approval Page

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

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Statement of Original Work

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March 24, 2022
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Abstract

Does Most-to-Least Prompt Fading Lead to Independence in Tooth Brushing in Children With Intellectual Disability? John Byrd, 2022: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education and School of Criminal Justice. Keywords: autism, intellectual disability, applied behavior analysis, prompting

The problem identified in this research was that the most-to-least (MTL) prompting strategies used for individuals with intellectual disability (ID) had not been consistently demonstrated in research for personal hygiene, specifically tooth brushing. It has been well known that people with ID acquire skills differently than typically developing individuals (Cengher et al., 2018). Difficulty with developing hygiene skills such as brushing teeth is not limited only to those with physical disabilities because individuals with ID can struggle with hygiene skills as well. MTL prompt fading procedures have been used to teach many skills to individuals with ID (Drummond, 2018).

The design used in this research was a multiple-probe-across-participants design, which is defined as the current performance of the task to identify a starting point for instruction (Creswell, 2012). All probe sessions were nonconsequential and included no prompting. Two preintervention probe sessions were conducted for each participant prior to entry into the intervention. Probe sessions were conducted following mastery of each intervention objective. For each participant, once all intervention objectives were achieved, two maintenance probes were conducted. The maintenance phase entailed two probe sessions, consisting of eight nonconsequential trials each, to determine whether the participant continued to correctly brush teeth without prompting.

The participants in this study did not gain independence in tooth-brushing skills using MTL prompt fading. Moreover, tooth-brushing skills were not maintained over time using MTL prompting. In this research, MTL prompt fading was ineffective in leading children with ID to independence with tooth-brushing skills. Results indicated that MTL prompting could be ideal to use as an intervention for children with ID and to improve maintenance of skills; however, the findings were inconclusive because one participant averaged one of eight steps in the probe session.

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Chapter 1: Introduction

According to Sabielny and Canella-Malone (2014), most-to-least (MTL) and least-to-most (LTM) prompting strategies have been used with children who have an autism spectrum disorder (ASD). MTL and LTM prompting approaches are effective in assisting children with ASD to develop new skills that are geared toward independence (Cengher et al., 2016). MTL and LTM prompt fading are choices for determining the most effective prompting strategies that will also assist persons with intellectual disability (ID) in reducing numbers of errors, increasing skills learned, and ultimately avoiding dependency on using prompts (Sabielny & Canella-Malone, 2014). Individuals with ASD and ID respond to similar strategies that are effective with different types of disability and concomitant learning styles (Sabielny & Canella-Malone, 2014). Using prompts can quickly develop stimulus control that can then be transferred. The transfer of stimulus control occurs when prompts are gradually faded until the correct responses occur consistently with the appropriate stimulus control conditions, such as the direction to "brush your teeth" (Cengher et al., 2016).

Behavior analysts teach personal hygiene skills to individuals with disabilities (Libby et al., 2008). Cengher et al. (2016) stated that interventionists regularly utilize prompts to promote correct responses during skill acquisition for individuals with a developmental disability. The authors contended there have been successes and failures with both MTL and LTM prompting strategies, and they concluded that MTL procedures may have delayed learning but resulted in fewer errors.

Statement of the Problem

The problem identified in this research was that the MTL prompting strategies used for individuals with ID had not been consistently demonstrated in research for

personal hygiene, specifically tooth brushing. It is well known that people with ID acquire skills differently than do typically developing individuals (Cengher et al., 2018). Difficulty with developing hygiene skills such as brushing teeth is not limited only to those with physical disabilities because individuals with ID can struggle with hygiene skills as well. MTL prompt fading procedures have been used to teach many skills to individuals with ID (Drummond, 2018).

Although prompting strategies are tools that practitioners utilize, several studies have compared different prompting strategies to determine the more effective ones (Cooper et al., 2020; McKay et al., 2014; Sabielny & Cannella-Malone, 2014; Walls et al., 1981). In the MTL prompting procedure, the prompts are faded by reducing the prompt level used as the child becomes more proficient. However, the problem with MTL prompt fading is knowing how much to fade during a session. An assessment may be needed to determine what type of prompting the students need as they move through the hierarchy. Also, students could become dependent on the trainer guiding them to the next step rather than the students showing independence (Cooper et al., 2020).

The Topic

This research was designed to explore the topic of using MTL prompt fading with children with ID to teach tooth brushing and examine whether continuous prompt fading with children with ID leads to independence with brushing their teeth. The researcher investigated the MTL prompt fading procedure and its effectiveness with acquiring a personal hygiene skill.

The Research Problem

The area of concern was whether MTL prompt fading procedures lead to independent tooth brushing for individuals with an ID. The research addressed this issue

to determine if using the MTL prompt fading technique would increase independence for individuals with an ID at the research site. Cengher et al. (2016), Cooper et al. (2020), and Deppisch (2013) asserted there was some level of success in utilizing this method; however, the researcher implemented MTL with tooth brushing among the students with ID at the research site to determine if students could increase their independence.

Background and Justification

When using both MTL and LTM prompt fading techniques with students with an ID, they are slow to acquire skills (Libby et al., 2008). Even requesting or prompting students to independently emit the same response does not mean the students will be able to perform it the next time it is requested of them. Meanwhile, prompting does have its advantages. In particular, if prompting is not used, then the researcher would need to wait until the student displayed the target behavior before reinforcing it. Obviously, if a student does not have an instructional history with prompting, then waiting for the behavior to occur will take longer than prompting the behavior. Indeed, the behavior may not even occur without prompting (Libby et al., 2008).

MTL prompting provides the student with a set prompt before the student performs the desired behavior (Cengher et al., 2018). It is a more intrusive way of prompting students to engage in a behavior than LTM; the LTM prompting method gives the student the opportunity to perform the behavior independently before prompting. The disadvantage of utilizing the LTM prompting method is that it may take a significant amount of time for the student to perform the behavior independently (McKay et al., 2014). Meanwhile, MTL prompting may also be time consuming for behaviors that are resistant to being learned. For example, using MTL prompting may be time consuming to get to independence because the researcher may actually be prompting too much in an

effort to prevent errors in performing the steps of the tooth-brushing sequence.

MTL and LTM prompt fading have been viewed as effective methods for individuals with ID (Cengher et al., 2018; Drummond, 2018). Strides have been made towards building independence with individuals who have an ID (Drummond, 2018). Horner and Keilitz (1975) highlighted the need for teaching basic self-care in ID participants. One of those basic self-care needs that was highlighted involved tooth brushing. The research of Horner and Keilitz showed that using task analysis, LTM prompting, and token reinforcement fostered improved tooth-brushing behaviors with some of the participants more quickly than others. It may be the case that the MTL prompting procedure enables ID students to learn tooth-brushing behaviors more quickly and more uniformly than LTM prompting, as reported by Horner and Keilitz. Thus, the gap that remains in the literature is whether or not MTL prompting similarly fosters learning of tooth-brushing skills in individuals with ID. This research investigated the gap to see if MTL prompt fading is effective for individuals with ID for this specific skill.

Deficiencies in the Evidence

Although MTL prompt fading has shown some successes (Cengher et al., 2016), it has also shown inconsistencies and has not proven to be conclusive in creating independence among individuals with an ID (Cengher et al., 2016). While there may not be total independence, Cengher et al. (2016) stated that, when using the MTL prompting procedure, there are fewer errors that impede learning to independently perform a task and reduce delayed learning.

Audience

The primary audience for this research involves individuals who work with persons diagnosed with an ID, including educators and direct support professionals,

because they are directly affected. Other audiences include parents of individuals with an ID. These individuals are responsible for the care and support of people with ID and use MTL and LTM prompt fading instruction with individuals with ID. These audiences will be able to utilize the information resulting from the research to assist with determining if the MTL prompt fading procedure is effective in teaching personal hygiene skills to individuals with a disability. Individuals with ID will also benefit from the study because their oral health will improve.

Setting of the Study

This study took place at an independent living facility in central Florida. The program is considered a behavioral health program that also offers a day program for individuals with an ID. The program provides assistance and respite to families of individuals with an ID. The participants receive up to 2 days a week of assistance where they receive reinforcement of appropriate behaviors. They also receive one-on-one services with a therapist who provides the personal assistance based on the clients' needs. The facility provides services for up to 10 patients for 6 hours a day.

Researcher's Role

This researcher currently works at the behavioral health site as a Registered Behavior Technician, assisting the behavior analyst and direct support professionals who support individuals with an ID. While this researcher has worked at the research site for only 1 year, he has over 20 years of experience working in education with students with an ID. This includes working in the public school system as a teacher's assistant in the unit for students with ASD.

Purpose of the Study

The purpose of this study was to investigate if MTL prompt fading leads to

independence in tooth brushing in children with an ID. These skills allow individuals with ID to engage more independently in social situations (Deppisch, 2013).

Definition of Terms

For the purpose of this applied dissertation, the following terms are defined.

Least-to-Most (LTM) Prompting

This term refers to a systematic way of fading prompts starting with the least intrusive prompts and advancing to the most intrusive prompts dependent upon the student's response (Neitzel & Wolery, 2009).

Most-to-Least (MTL) Prompting

This term refers to a strategy that systematically fades the teacher's assistance to an individual learning a task from the most help to the least help (Neitzel & Wolery, 2009).

Prompting

This term refers to an instructional strategy used to provide assistance to get the learner from incorrect responses to correct responses (Neitzel & Wolery, 2009).

Task Analysis

This term refers to a process designed to assist in understanding responses to a sequence of steps that teach or reinforce a complex skill (Libby et al., 2008).

Chapter 2: Literature Review

Introduction

This chapter consists of a review of literature regarding the MTL and LTM processes and effects on a person with an ID. The literature reported in this review was derived from research-based articles gathered from academic databases (e.g., Psychnet), scholarly academic journals, and theses reviews. This review of literature focused on the following topics: the nature of ID, ASD prompt fading procedures in applied behavior analysis for individuals with ID, and promising applications of faded prompting, including oral health and tooth brushing. This chapter ends with a brief summary followed by the research questions.

Intellectual Disability

Description

The prevalence of individuals living with an ID highlights the need to utilize prompting to assist them. Prevalence is defined as the number of individuals living with the condition (American Speech-Language-Hearing Association, 2019). Boat and Wu (2015) contended that there is a wide range of prevalence reports of individuals with an ID. The authors stated that 8.7 to 36.8 per 1,000 individuals have an ID and indicated that this wide range includes individuals with a mild ID. Zablotsky et al. (2019) conducted a study regarding the prevalence and trends of individuals with an ID. These authors concluded from the research on individuals who were ages 3 to 17, with data from 2009 to 2017 from the National Health Interview Survey, that there was an overall increase in the prevalence of IDs, 0.9% to 1.2%, $p < .05$.

The American Psychiatric Association (2013) has defined ID as a neurodevelopmental disorder that begins in a person's childhood and is categorized by a

person's intellectual difficulties, including conceptual, social, and practical areas of living. In order for an individual to be diagnosed with an ID, three activities take place (Cengher et al., 2018; Drummond, 2018): The person will be observed, the parents will be interviewed, and the person will undergo testing for intelligence and adaptive behavior. If a child is found to have both a low IQ and adaptive behavior score (i.e., below a standard score of 70), he or she will be diagnosed with an ID. This means that some persons are not able to function and perform everyday activities in life. As a result, they will need assistance in various areas to ensure daily functioning (Ackerlund Brandt et al., 2016; Cengher et al., 2018; Dominick et al., 2007; Drummond, 2018).

Adaptive Skills and Intellectual Disability

Adaptive skills are necessary for individuals with a developmental disability (Drummond, 2018; Eisenhower et al., 2005). These adaptive skills are needed for daily living as well as independent functioning. These skills range from personal hygiene to participating in recreational activities. Adaptive skills are often associated with behavior chains (Drummond, 2018). Behavior chains call for a sequence of events in the desired behavior displayed, such as brushing teeth. The chain of behavior events includes picking up the toothbrush and toothpaste, placing toothpaste on the toothbrush, brushing teeth, and rinsing. These behaviors are sequential and call for a behavior chain.

To teach these chains of behavior events to individuals with ID, the adaptive skills must be taught using a behavior intervention program with the ultimate goal of reaching independence. Adaptive behavior is reflective of the extent an individual can be independent (Drummond, 2018). The behavior interventions target adaptive behaviors to promote independent living. As a result, parents, behavior analysts, direct support professionals, and teachers must understand the importance and the role adaptive

behavior plays in independence (Drummond, 2018). Parents play the most significant role in reinforcing the adaptive behaviors. Parents spend the most time with their children outside of school activities. As a result, they can reinforce adaptive behaviors consistently and routinely. In addition to the behavior interventions, parents and caregivers must also ensure general maintenance of the skills learned. This assists with reinforcing the skills learned and ensuring the skills remain routine. Research has highlighted the significant role parents and caregivers play to ensure the skills are taught, practiced, and reinforced (Drummond, 2018; Goldson, 2009; Greene, 2016; Hartley et al., 2008).

Insights From the Literature on ASD

When it comes to developmental disorders, autism is one of the most extensively researched of the developmental disorders (Centers for Disease Control and Prevention, 2018). Fortunately, research from the ASD literature can provide useful insights concerning how to develop effective interventions for other developmental disorders that are not as well researched. ID, like ASD, is defined as a developmental disability. ASD has been characterized by an impairment in reciprocal social interactions, abnormal development and use of language, and repetitive behaviors (Maenner et al., 2020). According to a report by the Centers for Disease Control and Prevention published on March 27, 2020, approximately one in 54 eight-year-old children were diagnosed with an ASD in 2016 across the 11 sites that provided data for their study (Maenner et al., 2020). Roughly 33% of those individuals with ASD also met diagnostic criteria for ID (Maenner et al., 2020). The onset of ASD is usually seen before 3 years of age; however, autism may be diagnosed in a child at 18 months old (Maenner et al., 2020).

The potential benefits of consulting the ASD literature when considering issues specifically for ID individuals may be suggested by the fact that ID and ASD are frequent

co-occurring neurodevelopmental disorders that affect 2% to 3% of the population (Dunlap & Bunton-Pierce, 1999; Gillberg, 1999; Happe, 1998; Matson & Shoemaker, 2009). It is important to remember that ID consists of significant limitations in functions concerning intellect and behavior adaption, whereas ASD typically consists of deficiencies in communication, social interaction, restricted behavior, repetitive behavior, interests, and activities (National Research Council, 2001; Szatmari et al., 1989). Maenner et al. (2020) found that, among children with ASD, 33% have a co-occurring ID. Even when children with ASD have higher intelligence, they often require the same strategies as individuals with ID to master adaptive behaviors (Maenner et al., 2020). Rodríguez-Medina et al. (2016) contended that higher functioning children with autism need direct instruction in adaptive behavior.

For children with communication deficiencies that typically co-occur with either ASD or ID, teachers must understand the cognitive learning processes that will allow them to counter the limitations in mastery of adaptive behavior, while at the same time using this knowledge to overcome these communication deficiencies (Downs et al., 2008). This involves the ability to utilize combinations of instructional techniques or the identification of a technique that works for these individuals. For example, discrete trial teaching is a method that has been utilized for years with students with ASD or ID (Downs et al., 2008; Garcia-Albea et al., 2014; Maulik et al., 2011). This technique utilizes simple instructional cues, prompting, positive reinforcement, and formative assessment. Further evidence suggesting commonalities in the literature for both ASD and ID individuals with respect to teaching specific skills are reviewed next.

Adaptive skills are necessary for everyone (Drummond, 2018). The same instructional strategies are used with individuals with ASD and ID, such as prompting, to

develop adaptive skills. Adaptive and cognitive skills are needed for independence in daily living (Drummond, 2018). This is inclusive of personal hygiene care. Drummond (2018) reported that prompting is important in daily living. If the prompting is successful, the students will be able to display the necessary skill without the use of prompting, thereby allowing them to live and perform that skill independently.

Individuals with an ID can experience a range of complications throughout their lives, including barriers to quality services (Waldron et al., 2017). Consequently, assistance is provided to reinforce everyday skills that improve their quality of life and their independence. Poor oral health is the major condition that has affected individuals with an ID (Waldron et al., 2017). Oral health allows individuals to smile, chew, speak, and make facial expressions without the discomfort of pain (Wilson et al., 2018).

Untreated dental issues have complications that lead to major health issues and poor health in general (Waldron et al., 2017). These complications include both periodontal gum loss and tooth decay. Poor health has an impact on the person's quality of life (Wilson et al., 2018). In addition to affecting a person's physical health, it has been known to have psychological implications as well. These issues affect individuals with and without ID. This underscores the need to teach individuals with an ID how to properly maintain their personal hygiene (Wilson et al., 2018).

Developmental disabilities among individuals create unique challenges for them in maintaining the various aspects of their health, including oral health (Wilson et al., 2018). Oral health is important for all individuals. Given this, it is extremely important for individuals with an intellectual disability because of their experience with poor oral health (Ward et al., 2019). The lack of appropriate oral health care exacerbates other issues such as chewing, gum disease, digestion, and diet (Wilson et al., 2018). As a result,

individuals may need assistance with completing this seemingly normal and routine activity. This will assist in preventing oral malformations, tooth decay, periodontal gum disease, and malocclusion (National Institute of Dental and Craniofacial Research, 2018). Poor oral health is preventable with assistance in establishing good oral hygiene habits (Ward et al., 2019).

Applied Behavior Analysis Procedures

Applied behavior analysis (ABA) is "the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior, and experimentation is used to identify the variables responsible for behavior change" (Cooper et al., 2020, p. 92). ABA is further described as the field of study that applies these principles to the skills observed and displayed (Cooper, 1982; Slocum et al., 2014). This approach has been used in assisting individuals who have an ID to develop skills. Research has indicated that ABA can be effective in improving the adaptive and behavior issues of individuals with an ID (Simpson, 2001; Slocum et al., 2014).

ABA creates comprehensive skills training programs for clients to participate in to develop their independence (Medeiros, 2015; Shattuck et al., 2007). This includes assisting individuals with performing the skills repetitively so that the individual becomes fluent in performing the skill. Problem behaviors may interfere with the acquisition of new operants as well as fluency. These problem behaviors, such as self-injurious behavior, aggression, property destruction, sexual misconduct, and running away, further complicate the ability to be successful with the utilization of ABA concepts (Medeiros, 2015). With the seriousness of these conflicting behaviors displayed and the untoward perception by society, services rendered by a behavior analyst are deemed important and lifesaving to the population with an ID (Shattuck et al., 2007; Stauch et al., 2018).

The Antecedent-Behavior-Consequence Paradigm

Slocum and Tiger (2011) stated that behavior analysts use response chaining to teach tasks such as personal, health, play, and vocational skills. Response chaining includes separating tasks into components using task analysis, followed by teaching sequential steps using prompting. This is done in an effort for the student to perform the task independently (Slocum & Tiger, 2011). Previous research has demonstrated the use of task analysis and errorless learning to teach a variety of nonleisure computer skills and other leisure activities (Jerome et al., 2007). There are three variations of task chaining: total task, forward, and backwards chaining (Bancroft et al., 2011; Slocum & Tiger, 2011).

The analysis of behavior is normally conducted using the antecedent-behavior-consequence learning paradigm (Webster, 2020). It is associated with skill development within the ABA framework (Webster, 2020). The antecedent-behavior-consequence paradigm (i.e., operant conditioning paradigm) is perhaps the most highly prevalent method for teaching desired behaviors to individuals with autism with or without ID. The antecedent refers to the event, action, or circumstance that transpires before a behavior. Antecedents may be manipulated to create a desired outcome (Slocum et al., 2014; Webster, 2020). The behavior is the reactant to the antecedent. It can also be identified as the target behavior when a specific behavioral response is sought after applying the antecedent (Slocum et al., 2014; Webster, 2020). Given behaviors are shaped by consequences, which are the responses or actions that follow the behavior. In a controlled learning environment, behavior is shaped by consequences of desired behaviors; these consequences can be punitive, non-reactive, or rewarding (Slocum et al., 2014; Webster, 2020).

Stimulus Control

When working with children who are diagnosed with ID, prompts are needed to teach children new behaviors, and prompting strategies that assist with transferring their stimulus control from the prompt to a natural stimulus are beneficial (Cengher et al., 2016, 2018). The goal is to move the person from the prompting stage to independence (Cengher et al., 2016, 2018; Reeve, 2015). It is believed that the continuous prompt fading of a behavior would ultimately decrease the need for prompting and activate an internal stimulus that would make the activity routine and normal. The process of shifting stimulus control from the prompts to the initial instruction has to be done systematically using the principles of ABA. While the MTL prompt fading procedure is the most intrusive procedure, it is ultimately designed to create independence for a person (Cengher et al., 2016, 2018).

Reinforcement

Reinforcement has been described as one of the essential elements to learning (Mozingo, 2017; Slocum et al., 2014). Positive reinforcement has been established as beneficial in developing skills for individuals with ID (Slocum et al., 2014). Positive reinforcement is a procedure in which a behavior increases when it is followed by specific stimuli. In general, individuals with ID need intensive reinforcement to develop the skills desired, with the ultimate goal being independence in performing the desired skill (Slocum et al., 2014). Positive reinforcement can also be successful in assisting the individual with reaching independence in skill acquisition (Slocum et al., 2014). These strategies are effective for typically developing individuals as well as those with cognitive disabilities. Strategies such as task analysis, chaining, and prompting impact the individual's ability to learn the skill (Slocum et al., 2014). This allows for the

reinforcement of necessary skills such as hygiene, which is needed for all persons.

Task Analysis

Tooth brushing is a daily activity completed by everyone (Libby et al., 2008). While it may not seem to be a complex task, it is for some individuals with ID. The task of tooth brushing involves responses that include picking up the toothbrush and toothpaste, squeezing the toothpaste on to the toothbrush, brushing all of the teeth thoroughly, and then rinsing out the mouth thoroughly (Libby et al., 2008). These steps are sequential and must occur in a certain order, such as when to pick up the toothbrush and put the toothpaste on the toothbrush, brush teeth, and rinse. The teeth should be brushed prior to rinsing the mouth out. The use of task analysis assists in understanding responses to sequence the steps necessary to teach a complex skill (Libby et al., 2008). Response prompts such as vocal instructions, modeling, and physical guidance assist in teaching these chained procedures (Libby et al., 2008).

Sabielny and Cannella-Malone (2014) showed that MTL prompt fading is highly effective in teaching individuals with ID how to fold pants and shirts. In their study, these authors conducted an alternating treatment design study to compare two different prompting strategies of physical and physical plus vocal to see which was most effective. While one strategy was not more effective than the other, the authors concluded that MTL prompt fading was the most effective strategy when compared to other physical prompting strategies for individuals with varying disabilities. They found that MTL prompting strategies enabled participants with ID to learn the behavior chains for folding shirts and pants. The current study examined whether the MTL prompting strategy has similar positive effects for the behavior chain of tooth-brushing behavior for individuals with ID.

Chaining

Forward chaining is a system of teaching the first step in the chain and then prompting each subsequent step. When the first step is independent, the prompting moves to Step 2. The process begins with teaching the first step, and when the individual masters it, the first step is then followed up with additional sequential steps. Upon mastery of each step, including subsequent steps, the goal is for the previous and current steps to be performed accurately. Reinforcement is provided once the individual masters the previous steps as well as the newly prompted step in the chain. Backward chaining is described as teaching the last step in the chain. As the last step is mastered, the second to the last step and so forth are included. This is continued until the initial step is included and mastered (Bancroft et al., 2011; Slocum & Tiger, 2011). In general, forward and backward chaining have not been reliably demonstrated to be effective for teaching entire tasks because individuals with ID tend not to have all of the steps in their repertoire (Slocum & Tiger, 2011). For example, individuals with ID cannot be expected to prepare a packaged cake mix if they have not learned how to remove eggs from their shells.

Prompting and Prompt Fading

Total task pertains collectively to all of the steps required to perform a task. Reinforcement is supplied at each step the individual completes correctly, which eventually leads to higher levels of independence as each step is mastered (Certo et al., 1985; Raymond, 2011). Prompting has been used extensively as a means to increase the number of desired steps in the total task response chain in children with ID, as well as individuals with ASD (Laarhoven et al., 2018). Studies have shown that prompting procedures are effective for increasing a wide variety of individual behaviors within the total task in both of these populations and not just those associated with oral health.

Prompting techniques are commonly used in teaching hygiene to individuals with ID or more severe ASD (Brown, 2012; Jordan, 1999; Koegel et al., 2001; MacFarland & Fisher, 2021; Poche et al., 1982).

Many individuals with more severe autism and ID similarly rely on the assistance of others to complete everyday routine tasks besides just those associated with hygiene (Laarhoven et al., 2018). Walsh et al. (2014) stated that those support strategies include visual or auditory supports, task lists, alarms, environmental adaptations, workplace accommodations, and other support aid devices. These support services received can be reduced or faded over time as students become increasingly independent in performing desired behaviors (Laarhoven et al., 2018). MTL prompting has become widespread in use because it has been shown to successfully assist individuals in gaining their independence in performing a wide range of behaviors associated with routine life skills (Laarhoven et al., 2018). Some of these disparate behaviors that have been shown to be effectively shaped via MTL prompting procedures are reviewed next.

Types of Prompting Procedures Used With Individuals With ID

Many studies conducted since the 1970s have examined different prompting procedures used with individuals with ID (Sabielny & Canella-Malone, 2014). More recent research has focused on the use of prompting procedures with individuals with ASD (Sabielny & Canella-Malone, 2014). This body of research has not found consistent outcomes, with some studies showing that LTM is more effective than MTL (Sabielny & Canella-Malone, 2014). Others have found that MTL is more effective than LTM (Sabielny & Canella-Malone, 2014). Still others have found that both techniques are effective (Sabielny & Canella-Malone, 2014).

The LTM approach. LTM prompt fading is considered to be the least intrusive

prompt fading strategy (Cengher et al., 2016). While MTL prompt fading is considered to be the most effective, LTM prompt fading is also effective in assisting individuals to gain their independence (Drummond, 2018; Medeiros, 2015). An example of LTM prompt fading is providing a directive and allowing the individual an independent opportunity to emit the response prior to prompting. When the student does not respond appropriately or in a timely manner to the initial prompt, the student is provided increasingly intrusive additional prompts (Cengher et al., 2018).

Ultimately, the goal is to perform errorlessly (Drummond, 2018). This method can be used only when a cue is present. A natural cue is something that a person recognizes, using one of the five senses of sight, taste, smell, feel, or hearing, which directs them to perform a task. The LTM prompt fading begins with the least intrusive prompt and then moves to the most intrusive prompt and ultimately fades to minimize being invasive (Cengher et al., 2018). If a person fails to respond to the prompt in an adequate amount of time, usually within 5 seconds, more intrusive and invasive prompts are provided. This will continue until the desired behavior is achieved. The more intrusive prompts are provided until the desired appropriate response occurs (Cengher et al., 2018).

Probst and Walker (2017) conducted a study and evaluated the effectiveness of the coaching of the least prompts procedures by educational professionals in a classroom to determine if the intervention resulted in personal hygiene skill achievement. The authors concluded that the utilization of LTM prompts with fidelity resulted in the student being able to master the skills being taught. This finding was found for students with comorbid visual impairment and ASD. It should be noted that these students have learning needs that seem to be similar to those of students with ID, who also require

prompting of individual behaviors.

The MTL approach. The previously described findings suggest that MTL prompt fading is an effective evidence-based ABA teaching strategy for individuals who have ID (Gorgan, 2017). The current study explored the effectiveness of using MTL with children with ID to teach tooth brushing that leads to independence. The MTL prompt fading strategy has been known to help individuals with ID develop new skills to increase their independence (Cengher et al., 2018). MTL prompt fading has also assisted individuals who have other disabilities (Reeve, 2015). It should be noted that there are inconsistences highlighted in the research regarding the effectiveness of MTL prompt fading (Cengher et al., 2016). It has been argued that some of the strategies are not useful or successful due to not matching the correct strategy to the needs of the child (Cengher et al., 2018).

The behavior displayed must be appropriately matched to the strategy that is needed by the child. When a comparison was made regarding MTL prompt fading versus LTM prompt fading, research by Cengher et al. (2016) showed that MTL prompt fading has proven to be more successful. This may be due to MTL involving reinforcement of the total task at the onset of training, which increases the speed with which the ABA analyst can rapidly identify steps that require additional reinforcement for mastery to be achieved. For example, when teaching individuals with ID how to wash their hands, the MTL procedure gives less opportunity to make errors because each step in the total task is prompted immediately.

Sabielny and Cannella-Malone (2014) found that MTL prompt fading is the most effective strategy with physical prompts whether or not vocal prompts were concurrently used as well. This conclusion was the result of using MTL prompting strategies with

folding clothes. While MTL prompt fading is considered an effective strategy, there are variables that impact its effectiveness (Cengher et al., 2018). These include, but are not limited to, the children, their motivation, receptiveness to the prompting, and the sequence order (Cengher et al., 2018; Libby et al., 2008).

For prompt fading to be successful, the effectiveness and efficiency must be determined. These are important factors in evaluating the chaining process (Libby et al., 2008). The effectiveness provides the extent to which the prompting produces the predetermined behavioral change (Cengher et al., 2018). The procedure is effective if the task has been completed as targeted (Libby et al., 2008). The efficiency is defined as the length of time it takes to complete the target or the number of errors that occur during the process (Cengher et al., 2018). The efficiency determines the amount of resources that are needed to be effective, including, but not limited to, the time, number of sessions, and errors required to master the skill (Cengher et al., 2018). Ultimately, the goal of prompting is to create and promote the highest level of independence (Reeve, 2015).

While prompting and prompt fading have empirical evidence that they are effective, little is known about the effectiveness of each individual prompt, its role, and under what conditions it is effective (Cengher et al., 2016). There has been little research published regarding what circumstance or what strategy is most effective with a certain behavior displayed with ID individuals. While many literature reviews provide insight into the effectiveness of prompt fading, they do not detail that one prompt fading technique is always more effective than the other (Cengher et al., 2016). As a result, more research is needed to further determine which strategy should be used in a particular circumstance, such as tooth brushing.

The current study focused on the efficacy of MTL prompt fading because the

available evidence suggests that this approach is more efficient than LTM prompting for enabling the participants to successfully learn the steps involved in tooth brushing and become independent, ultimately without prompting (Cengher et al., 2016). More time-consuming prompting is required to shape behaviors using LTM than MTL prompt fading (Cengher et al., 2016). The objective of the current study was to move the students from a prompting phase to independence in the least amount of time as possible.

Another important advantage of MTL prompting is that this method tends to eventually involve less prompt dependence than LTM prompting. While the individual being prompted may make an error, research contends that prompting is designed to avoid errors (Cengher et al., 2016). This may occur in the process of prompting or after a prompt has been given. Cengher et al. (2016) contended that MTL prompt fading is more efficient for participants when considering the errors to criterion. MTL prompt fading begins with the most intrusive prompt and reduces them as the skills are displayed.

Time Delay

While it is believed prompting procedures might delay learning as a result of being intrusive, they result in fewer errors in performing a task. Minimizing the number of errors is crucial in avoiding the development of faulty stimulus control (Cengher et al., 2016). Cengher et al. (2016) contended in their research that, in order to minimize errors, a delay was incorporated between the presentation of the natural discriminative stimulus and the prompt. During the delay, the participants had the opportunity to respond independently, which allowed for skipping some of the prompt fading steps when an independent and correct response was made. This meant a correct behavior was displayed and less instruction had to be given, thereby reducing the dependence on prompts over time.

Areas of Instruction Using Prompting Procedures

In education, a prompt is considered assistance given to a person to perform a certain activity. There are various levels that must be considered when teaching with prompts. A full physical prompt is when the teacher utilizes a hand-over-hand technique to demonstrate what is to be done and exactly how (Ingvarsson & Hollobaugh, 2011; Thomas et al., 2010). A partial physical prompt involves guiding the student in a supportive way that allows the student to do most of the work, such as touching the elbow to prompt a hand gesture (Ingvarsson & Hollobaugh, 2011; Thomas et al., 2010). Modeling is demonstrating the desired action and motivating the student to imitate (Ingvarsson & Hollobaugh, 2011; Thomas et al., 2010). Gestural prompts are defined as pointing, nodding, or using a body movement to provide a cue for action (Ingvarsson & Hollobaugh, 2011; Thomas et al., 2010). A positional refers to placing the children where the cues may prompt them or positioning the children such that they recognize a skill needed to address the cue or prompt (Ingvarsson & Hollobaugh, 2011; Thomas et al., 2010). It is important to examine common areas of instruction in which prompts are quite useful, which include vocational, play, self-help, and oral health (or hygiene).

Vocational

With the advancement of technologies, many technological instruments have now been seen as tools to assist individuals with ASD and ID (Laarhoven et al., 2018; Taylor & Seltzer, 2012). Although a variety of technology is used (e.g., PCs, cell phones, iPods, mobile devices), the use of technology for autism and ID is largely based on mobile devices (Laarhoven et al., 2018). Mobile devices are the technology of choice because they are easy to use, inexpensive, and portable, ultimately providing some level of independence for individuals with disabilities.

Maciag et al. (2000) conducted a study with adults who had ID. The task was for those persons to learn a vocational skill by constructing shipping boxes. This study used a quantitative methodology to evaluate the effectiveness of simultaneous prompting procedures. Instructional training was utilized to implement the training and prompting procedures using two sessions a day. Of the five participants studied, four learned to construct the shipping boxes.

Play

Play skills are another type of total response that poses difficulties for individuals with autism or ID. Prompting methods are used in the play skills domain, just as they are in other areas of autism and ID, such as tooth brushing, vocational, and self-help. (Charman & Baron-Cohen, 1997; Ulke-Kurkcuoglu, 2015). Pretend play allows for an early examination of a person's cognitive, social, and language skills (Ulke-Kurkcuoglu, 2015). Four types of pretend play were identified by Ulke-Kurkcuoglu (2015) while studying children with ASD. The first type involved functional play with pretense, which is where a child pretends to perform an activity. The second type is object substitution, which is where children can use any item as another, even if they are different shapes. The third type is imagining absent objects, which is where children can pretend that they have completed a task with results.

Lastly, assigning absent attributes is where a child can describe the physical illness of someone. Ulke-Kurkcuoglu (2015) examined the effectiveness and efficiency of video modeling versus LTM prompting for teaching pretend play skills to children with ASD. The authors concluded that LTM prompt fading was more effective and efficient than video modeling. An important limitation of the Ulke-Kurkcuoglu study was that the LTM prompting procedure was not contrasted with the MTL procedure, which

likely would have been at least as efficient in shaping the desired behaviors.

Prompting of play skills has been found to be beneficial in assisting individuals with autism (Charman & Baron-Cohen, 1997). Charman and Baron-Cohen (1997) explored the effectiveness of LTM prompting for increasing pretend play behavior in their study. The goal was to explore if individuals with autism could eventually perform the task without prompting. Brown (2012) and Charman and Baron-Cohen (1997) found that children who were diagnosed on the autism spectrum were able to generate pretend play acts; however, they were done at a significantly slower rate than others. Ulke-Kurkcuoglu (2015) found similar outcomes; however, he did not see a difference in video modeling or LTM prompting in teaching pretend play. Very few participants in the study were able to operate independently without first being provided prompts.

Play Legos were used in another study with children as extracurricular activities. Libby et al. (2008) utilized MTL and LTM prompting while teaching children with ASD to build Legos during playtime. While both MTL and LTM prompt fading were used, their study concluded that MTL prompting resulted in the least amount of errors when compared to LTM prompting. All children were reported to have built the play structure as a result of the teacher using MTL prompting.

Self-Help

Self-help skills, such as dressing skills, have been taught to individuals with a disability in an effort to assist them with living independently (Iscan et al., 2016). Generally, skills such as dressing are learned or acquired as individuals develop; however, for some individuals with autism, those skills may have to be repetitiously taught in order for the individual to learn them (Iscan et al., 2016). Systematic teaching allows for individuals with an ID to see the skill repeatedly displayed in an effort for

them to imitate it, ultimately without the use of a prompt.

In order to teach self-help skills such as dressing, Iscan et al. (2016) created a checklist to assist the individual with the necessary steps to achieve the goal. The checklist was used in conjunction with the provision of instruction of the goals and careful measurement of behaviors as they emerged. MTL prompting was implemented by Iscan et al. when teaching self-care skills, specifically teaching students how to dress themselves. Given the difficulty known to be experienced by some ID students and the continuous prompts to teach them, Iscan et al. examined the effects of MTL prompt fading in teaching self-care skills. Utilizing participants with ID, the authors determined that the MTL prompt fading procedure was successful with individuals with ID. Most importantly, Iscan et al. concluded that the individual was able to sustain implementation of the skills learned after the implementation of prompting phase was ended.

Oral Health Care

Wilson et al. (2018) contended that individuals with ID generally have poor oral health. Additionally, having poor oral health puts them at risk for other health issues. Ward et al. (2019) described poor oral health as a health inequity and explained it is preventable. Because of the learning difficulties faced by persons with an ID, prompting skills are necessary to teach them independence in tooth brushing (Sabielny & Canella-Malone, 2014). Poche et al. (1982) demonstrated the importance of prompting skills in teaching tooth brushing. This study involved a task analysis that broke down tooth brushing into 16 observable behaviors. Their results suggested that LTM prompting strategies were successful for preschool individuals who had ASD with respect to improving dental health and specifically reducing tooth plaque levels. In addition, at the end of the training, participants performed approximately 95.6% of the tooth-brushing

behaviors as instructed. Similarly, Horner and Keilitz (1975) conducted a study on the use of prompting skills with tooth brushing. Their study was conducted on students with disabilities in an attempt to teach them independence in tooth brushing. Of the eight individuals participating in the study, they all performed above the initial baseline. Although they all improved, the authors concluded that six of the eight participants performed as indicated using the LTM prompting procedure.

Summary

MTL and LTM prompt fading procedures can assist individuals with ID with obtaining their individual independence in demonstrating skills, regardless of which prompt is used first (Gorgan, 2017). The goal after receiving the prompts is for the person to be able to independently perform the tasks prompted. Prompt fading can assist with developing the needed stimulus control to transfer control to a natural response stage (Gorgan, 2017). This transfer of the stimulus control occurs when the MTL or the LTM prompts are faded, gradually obtaining the correct responses consistently under the appropriate conditions (Cengher et al., 2016).

While Cengher et al. (2016) contended the MTL prompt fading is the most efficient prompting procedure for participants when considering the reduction of errors, LTM prompt fading is also successful with individuals with ASD. The goal is to move the person from the prompt stage to independence (Reeve, 2015) and to minimize the number of errors, which is crucial in avoiding the development of the faulty stimulus control (Cengher et al., 2016).

Research Questions

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

1. To what extent does MTL prompt fading using a tooth-brushing task analysis impact the independence of individuals with ID in brushing their teeth?

2. Does tooth brushing taught with an MTL prompting hierarchy maintain over time?

Chapter 3: Methodology

This research explored the topic of using MTL prompt fading with children with ID to teach tooth brushing. This topic examined whether continuous prompt fading with children with ID leads to independence with brushing their teeth. This topic also investigated the MTL prompt fading procedure and its effectiveness with acquiring a personal hygiene skill. In this chapter, the methodology, research design, participants, instruments, procedures, and data analysis were examined. Ultimately, this chapter provided the details of how this study was conducted.

Research Approach

To fully explore the impact of MTL prompt fading with children with ID to teach tooth brushing, this study utilized a quantitative research methodology. Creswell (2012) described a quantitative methodology as a method for examining a theory by analyzing the relationship of the variables. As a result of examining and analyzing the variables, the investigator examined if continuous prompt fading with children with ID would lead to independence in brushing their teeth. A quantitative method was deemed the most appropriate for this research because this study examined the impact of the variables (Creswell, 2012). A qualitative approach was not appropriate for this study because the research was not examining or exploring a phenomenon. A quantitative methodology ultimately determined if independence in tooth brushing could be obtained from the study's participants.

Participants

The participants in this study included three patients at a local center for autism in central Florida. In order to become a client and enroll in services at the research site, the clients must receive an assessment and have a diagnosis of an ID. The participants

were between the ages of 4 and 10 years old. The race and gender of the patients were not a factor in this research, as all genders and races are treated the same at the research site. The clients were selected from the research site using convenience sampling due to their current enrollment for services and the investigator selecting from this targeted population.

Instruments

The Observed Behavior and Prompt Given per Session Log (see Appendix A) was utilized to document prompts provided by the teacher and responses made by the participants. Specifically, the teacher observation instrument was used to collect the prompt level and number of steps the student performed correctly and incorrectly in tooth brushing. Consequently, a log documenting the progress and error of students was employed and examined for scoring. The data were recorded by both the current researcher who served as the teacher trainer and one other behavioral technician trained on the task steps in order to collect interobserver agreement (IOA). All probe and testing sessions were recorded.

IOA is commonly used to indicate the degree to which two or more observers reported the same behavior (Winkel et al., 2015). The teacher trainer was prepared to master criteria on the use of the current MTL prompting procedure for shaping and maintaining the participants' tooth brushing behaviors. A trial-by-trial IOA was calculated for the probe and intervention sessions. There was 100% IOA for probe sessions and 100% IOA for intervention sessions (Gast & Ledford, 2018). The collection of IOA data ensured that the experiment was conducted with fidelity (Winkel et al., 2015).

Procedures

Design

The design used in this research was a multiple-probe-across-participants design, which is defined as the current performance of the task to identify a starting point for instruction (Creswell, 2012). All probe sessions were nonconsequential and included no prompting. Two preintervention probe sessions were conducted for each participant prior to entry into the intervention. Each preintervention probe session included eight trials (i.e., training sessions), and the first participant received two sessions, or 16 trials in total, before the intervention phase. After the preintervention probes were completed, the first participant entered the intervention. The second participant's preintervention probes were conducted once the first participant had achieved the criterion (see Appendix B) on the first two intervention objectives.

The third participant's preintervention probes were conducted once the second participant had mastered the first two intervention objectives. Probe sessions were conducted following mastery of each intervention objective. For each participant, once all intervention objectives were achieved, two maintenance probes were conducted. The maintenance phase entailed two probe sessions, consisting of eight nonconsequential trials each, to determine whether the participant continued to correctly brush teeth without prompting.

Data Collection

During all probe sessions, the participants were asked to brush their teeth without prompting. Data were collected on the number of correct responses per probe session. The intervention consisted of the teacher instructing participants by using MTL prompting to complete their oral hygiene tooth-brushing skill. The children worked

towards mastering the steps needed to independently brush their own teeth. Data were reported as the number of correct responses per trial. The sessions took place in the classroom during school hours, 2 days a week for 10 to 15 minutes a session. The participants brushed their teeth upon arrival at the facility and then towards the end of the day. The students worked in a bathroom with one doorway. For the morning session, the teacher provided at most five trials for the total task, and the after-lunch session also involved another five trials for the total tooth-brushing task. It was expected that fewer than eight trials would eventually be required once the students learned the tooth-brushing behaviors.

The teacher was positioned next to the students to allow for gestural prompting. Each subsequent step served as the antecedent for the preceding step. The teacher assisted the participants in completing the total task using the prompt level specified in the objective. Data were recorded using the plus and minus system. A plus was recorded for each step completed correctly, with the specified prompt, and a minus was recorded for steps demonstrated incorrectly despite prompting, and there was no correction procedure. Approvals were delivered throughout the session for other behaviors; however, the participants had access only to the predetermined reinforcer if all steps of the task were performed correctly. Data were reported as the number of correct responses out of eight per trial. The intervention phase lasted 6 weeks: 10 (sessions per day) times 2 (days that intervention took place per week) times 6 (weeks) = 120 sessions. Thus, participants were scheduled to receive 120 sessions of intervention.

The Intervention

Each trial consisted of eight steps. During the intervention phase, the MTL prompt hierarchy was employed. The intervention consisted of four objectives. A probe

was conducted following mastery of each objective. The following intervention objectives were set for each participant.

Objective 1. Given a full physical prompt (i.e., hand over hand), Participant X will brush his or her teeth with 90% accuracy across three consecutive sessions.

Objective 2. Given a partial physical prompt (i.e., hand on elbow), Participant X will brush his or her teeth with 80% accuracy across three consecutive sessions.

Objective 3. Given the use of a gestural prompt (i.e., point to the object), Participant X will achieve 80% accuracy across three consecutive sessions.

Objective 4. Given the use of a vocal prompt (i.e., verbal cue), Participant X will achieve 80% accuracy across three consecutive sessions, with two final probe sessions.

Prompts were provided across the four intervention objectives, with the first objective containing the most intrusive prompt that faded to the least intrusive prompt by Objective 4. The prompts used for each step of the tooth-brushing behavior chain were as follows from most to least: full physical prompt (hand over hand), partial physical prompt (hand on elbow), gestural prompt (point to the object), and vocal prompt (verbal cue). The hand-over-hand prompt involved the teacher taking the participant's hand and guiding the behavior. The hand-on-elbow prompt involved the teacher taking the participant's elbow and pushing it gently up. The gestural prompt involved the teacher pointing to the object as a cue to the participant. Finally, the vocal prompt involved a verbal cue to the participant.

Role of the Researcher

The researcher's experience stems from a combination of education and behavioral health experience. The researcher has 17 years of experience and is currently employed as a behavioral health technician at a local behavioral health organization in

Florida. The researcher also has 17 years in behavioral health care at various levels of service, including unit coordinator, program coordinator, and behavioral health technician. While implementing this study, the researcher served as lead and point of contact; however, the researcher did not directly collect the data from the participants. The data were collected from the behavioral health staff working with the clients daily. The researcher did not have a position of authority over the staff collecting the data. The researcher served only as a support staff member for questions that might arise as a result of participating in the study.

Data Analysis

The data collected were visually analyzed based on the patterns observed during both the baseline and intervention phases. This information was displayed by using graphs (see Appendix C) to detail the total frequency of each type of prompt and the number of prompts provided during each session.

Limitations

This research study's potential generalizability was adversely affected by the small sample size and the single organization participating in this study. Thus, the results may not be generalizable to a larger population. While this investigator tried to offer insights and generalizations to a general audience and other investigators, this study's results are narrowed to this research site. The inclusion of multiple sites and a larger sample size may have provided greater insight into individuals with ID and tooth brushing. It is believed that the study's findings will assist the staff at the research site with assisting their clients who are diagnosed with an ID.

Summary

The purpose of this study was to investigate if MTL prompt fading leads to

independence in tooth brushing in children with an ID. This research employed a quantitative methodology, utilizing a single-subject multiple-baselines-across-participants design. The study's participants included three students from a local clinic in central Florida.

Chapter 4: Results

The purpose of this study was to investigate if MTL prompt fading leads to independence in tooth brushing in children with ID. These skills allow individuals with ID to engage more independently in social situations (Deppisch, 2013). The following research questions were established to guide this applied dissertation:

1. To what extent does MTL prompt fading using a tooth-brushing task analysis impact the independence of individuals with ID in brushing their teeth?

2. Does tooth brushing taught with an MTL prompting hierarchy maintain over time?

It was hypothesized that evidence would indicate that MTL prompting leads to independence in tooth brushing for children with ID.

Preliminary Reliability Check

Reliability is a measure of consistency that describes the extent to which a measurement procedure yields the same value when measuring the same variable over time (Cooper et al., 2020; Creswell, 2012). IOA refers to the degree to which two or more trained observers independently record and report the same values after observing the same behaviors (Cooper et al., 2020; Creswell, 2012). To increase reliability and enhance the believability of the data collected, a trial-by-trial IOA was computed. IOA levels should be no less than 80% agreement between observers deeming the agreement acceptable. The trial-by-trial IOA was calculated in regards to the data collected during the probe and intervention phases. The data of the researcher and observer were compared to determine agreement. IOA was calculated using the following formula:

$$\frac{\text{\# of agreements trials}}{\text{\#Total trials}} \times 100 = \%\ \text{agreement}$$

The IOA result found for the baseline phase was 100%, and the IOA result found for the probe phase was 100%. The result found for the intervention phase was 100%. The range of calculations for IOA across each phase of study was 100%, which indicated a high rate of agreement.

Findings for Research Question 1

To what extent does MTL prompt fading using a tooth-brushing task analysis impact the independence of individuals with ID in brushing their teeth? To answer this research question, performance was examined first in terms of frequency of correct and incorrect responses for each of the participants.

Participant 1

As can be seen in the probe graph (see Figure), the preintervention probe indicated that Participant 1 completed one of eight steps for both sessions in the initial probes. The intervention graph (see Appendix C) shows that MTL prompt fading impacted Participant 1. With the most hand-over-hand prompts, Participant 1 started with a score of 100% during intervention. This score was maintained until Sessions 8, 9, and 10. The partial prompting trials were variable, however, with accuracy ranging from five of eight correct to eight of eight correct for the last three trials. Finally, in the gestural prompting condition, in general, performance was correct only four of eight trials, with a range of three of eight correct to six of eight correct. Thus, for Participant 1, the data show that the intervention resulted in an increase from the initial baseline probe of one of eight toward full independence in tooth brushing.

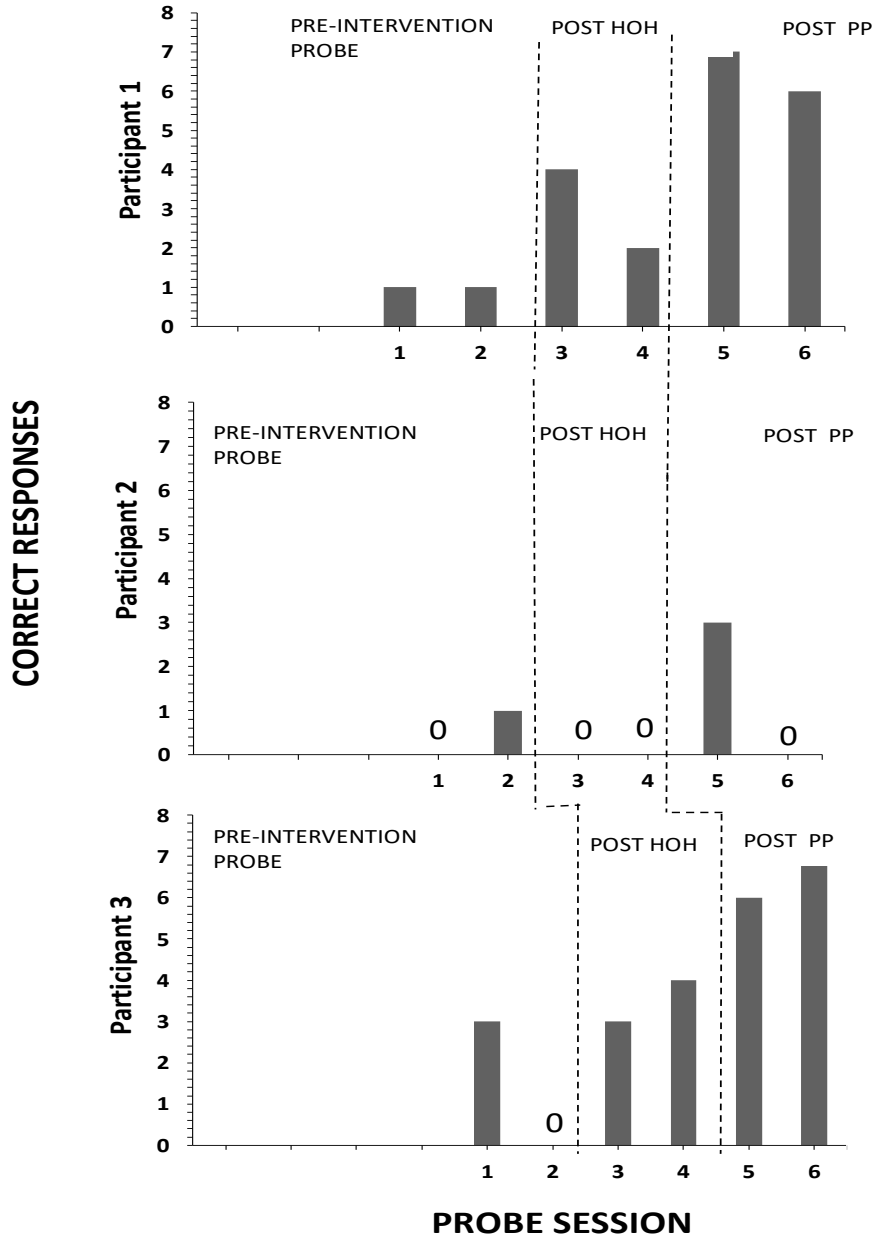
Participant 2

As can be seen in the probe graph (see Figure), Participant 2 received zero of eight steps for the first session and one of eight steps for the second session in the initial

probe in baseline. The intervention graph (see Appendix C) shows that MTL prompt fading impacted Participant 2.

Figure

Multiple Probe Accuracy for Each Participant



Note. The preintervention probes were assessed first. Post-HoH refers to the two probes given after the participant reached criterion performance (i.e., 8 out of 8 correct) in the hand-over-hand condition. Post-PP refers to the two probes taken right after the participant reached criterion performance in the partial prompting conditon.

With the most hand-over-hand prompts, Participant 2 started with a score of 100% during intervention. This score was not maintained until Sessions 14, 15, and 16. Finally, in the gestural prompting condition, in general, performance was correct only two of eight trials, with a range of two of eight correct to five of eight correct. Thus, for Participant 2, the data show that the intervention resulted in an increase from the initial baseline probe of zero of eight toward full independence in tooth brushing.

Participant 3

As can be seen in the probe graph (see Figure), Participant 3 received three of eight steps for the first session and zero of eight steps for the second session in the initial probe baseline phase. Participant 3 did not reach criterion until the eighth trial during intervention. The numbers of steps increased from the preintervention probe, which was three of eight correct. The second initial baseline probe showed zero of eight correct. The intervention graph (see Appendix C) shows that MTL prompt fading impacted Participant 3. With the most hand-over-hand prompts, Participant 3 started with a score of 100% during intervention. This score was not maintained after the second trial until Sessions 6, 7, and 8. In the partial prompting phase, performance went down to seven of eight, and criterion was not met until Sessions 14, 15, and 16. Finally, in the gestural prompting condition, performance was highly variable, with a range of three of eight correct to six of eight correct. Thus, for Participant 3, the data show that the intervention resulted in an increase from the initial baseline probe of zero of eight toward full independence in tooth brushing.

Findings for Research Question 2

Does tooth brushing taught with an MTL prompting hierarchy maintain over time? To answer this research question, the probe performance immediately after meeting

criterion in the partial prompt phase consistently showed substantial gains in performance for Participants 1 and 3 (see Figure). That is, for both Participants 1 and 3, performance ranged from six of eight to seven of eight. For Participant 3, there was limited evidence of maintenance over time, with only three of eight correct responses during the first probe and zero of eight in the last probe.

Summary

The purpose of this study was to investigate if MTL prompt fading leads to independence in tooth brushing in children with ID. In this study, the following questions were answered:

1. To what extent does MTL prompt fading using a tooth-brushing task analysis impact the independence of individuals with ID in brushing their teeth?

2. Does tooth brushing taught with an MTL prompting hierarchy maintain over time?

For all participants, MTL promoting did not lead to complete independence in tooth-brushing skills. In addition, MTL prompting did not perfectly maintain tooth-brushing skills over time. However, all participants did improve their tooth-brushing skills in response to MTL prompting.

Chapter 5: Discussion

Introduction

The purpose of this study was to examine if MTL prompt fading leads to independence in tooth brushing with children with ID. The research explored how MTL impacts individuals with ID and if MTL leads to maintenance over time. It was hypothesized that MTL prompting would be effective in impacting individuals and maintaining over time, as well as result in a fluent performance when exhibiting the skills of brushing teeth. Results of the study found that MTL prompting did not lead to independence in tooth brushing with children with ID but led to an increase in correct responding across all three participants.

Summary of Findings

The participants in this study did not gain independence in tooth-brushing skills using MTL prompt fading. Moreover, tooth-brushing skills were not maintained over time using MTL prompting. In this research, MTL prompt fading was ineffective in leading children with ID to independence with tooth-brushing skills. Results indicated that MTL prompting could be ideal to use as an intervention for children with ID and to improve maintenance of skills; however, the findings were inconclusive because one participant averaged one of eight steps in the probe session. While MTL prompting has been found to be successful for teaching skills, MTL prompting was discovered to be unsuccessful for the two learning outcomes measured: impact on individual with ID, maintenance over time.

Context of Findings

The first research question addressed the extent to which MTL prompt fading using a tooth-brushing task analysis impacts the independence of individuals with ID.

MTL prompting did not lead to independence in tooth brushing for the three participants observed in this study, as indicated by the accuracy they exhibited without prompts in different probe sessions, representing the most intrusive prompts to the least intrusive prompts. Participants 1 and 3 demonstrated almost full independence (i.e., seven of eight correct) after the final probe, while Participant 2 showed rather disappointing performance with zero of eight correct during the last probe of the gestural phase. Thus, for Participants 1 and 3, MTL prompting was effective in approaching independence, which is consistent with the findings in a study conducted by Libby et al. (2008). The study assessed the effectiveness of MTL and LTM prompting in teaching solitary play skills, where two of the five participants displayed independence in playing using the MTL prompting. The study concluded that, for MTL fading effectiveness, eight procedures were required before the two participants gained independence in the task analysis.

The current prompting design may have hindered independent responding in Participant 2. This outcome may have happened because, as noted by Browder et al. (2020), when prompt fading is slow or too intrusive, it can limit the independent performance of individuals. Participant 2's response to prompts is attributed to the most hand-over-hand prompt dependency, where the participant is expected to provide better performance when provided with more prompted responses. Furthermore, the participant displayed a decrease in the number of steps in the task analysis from three of eight to zero of eight in the least gestural phase probe sessions. For this participant, the LTM prompting may have been more effective than MTL, where the first probe session would have included steps without any prompting. The research shows that, despite LTM having the most errors for this participant, it could have been the most effective in

ensuring this person mastered the skill effectively. Admittedly, this possibility is unknown without further investigation.

Participants 1 and 3 showed an increased mastery in tooth-brushing skills, and fewer errors were made in each probe session, which means that MTL can be effective. This outcome is consistent with the study conducted by Iscan et al. (2016), which assessed the effectiveness of the MTL in teaching autistic children how to wear coats. The student displayed different levels of target skill during the beginning and probe stages, with the highest being 100% and the lowest level being 45%. The study concluded that the method was efficient for teaching independence to children with ID after systematic withdrawal of the prompts was done.

The second research question addressed how tooth brushing taught by MTL was maintained over time. On average, Participants 1 and 3 displayed longer maintenance over time, with gestural phase probe performance reaching a maximum of seven of eight correct. Therefore, the research showed that MTL was effective in prompting tooth-brushing maintenance over time for two of the participants. Maintenance over time assessed how long participants could systematically increase their target skill, influenced by time delay. Eight trials during the intervention were completed 2 days a week for a period of 10 to 15 minutes each session. This shows that a fixed time was set between the instruction and the prompt. Participants 1 and 3 showed progress in independently adopting the target skill with the help of increased time delay allocated between the instruction and the prompt. Thus, this study found that reducing the prompt from hand over hand to gestural prompting seemed to be effective for maintaining tooth-brushing behaviors in the ID population.

The average maintenance over time was substantially lower for Participant 2, as

this individual was not able to independently acquire the target skill after the second probe. This outcome can be attributed to the limited attention span and inability of the participant to gain independence in each stage of the probe. In addition, due to the errorless strategy of the MTL prompting, more time was spent on reducing the errors; hence, the prompts provided for this participant were ineffective. MTL relies on increasing time delay over time and focuses on one response prompt for every probe to which the participant could have incorrectly responded. The participant displayed more prompted incorrect responses during the sessions, showing that more controlling prompts should be applied after two sessions (Peacock et al., 2009). This explains why the participant, in general, was not able to acquire the target skill independently and maintain the skill over time.

Prompting or requesting an individual to independently react to the same response is not a guarantee of the individual performing it the next time. At the same time, prompting has its merits. In certain situations, when a teacher fails to use prompting, then an analyst is forced to wait until the individual displays an expected behavior before reinforcement. It is obvious that, when an individual lacks a prompting instructional history, waiting upon the occurrence of the expected behavior is going to require more time than prompting the behavior itself. In some cases, the behavior might not even occur without the prompting (Libby et al., 2008). Cengher et al. (2016) explained prompting using MTL provides an individual with a set of prompting ideas prior to the individual performing the requested task. This has been considered a more intrusive method of prompting individuals in behaviors than LTM; the method provides numerous individuals and students with an opportunity to perform expected behaviors in an independent manner before prompting.

MTL prompting might be considered time consuming for individuals and students who resist the learning process. For instance, MTL becomes time consuming when a researcher considers prompting to be too much of an effort to prevent errors, such as those in the toothbrush sequence. A problem has been noted on whether MTL fading procedures result in the independence of brushing teeth for individuals who have been diagnosed with ID. This study aimed to determine whether the MTL prompt fading technique would increase independence for individuals with ID (Cengher et al., 2016). The work of Deppisch (2013) indicated that there is some level of success with individuals who use this method. This study aimed to identify whether the independence of individuals with ID could be increased.

In most cases, when searching for skills to teach adults and children, clinicians and researchers have opted to focus on the objective of one that improves the quality of life, such as one that increases independence with self-care (Burns et al., 2019). In checking for the impact of MTL on individuals who are diagnosed with ID, the first participant of this study showed an increase of independence as the number of steps and interventions increased. The increase was recorded in two sessions where partial physical prompting was introduced in the intervention phase. This intervention led to an increase towards full independence in tooth brushing. The second participant recorded a decrease towards independence, whereas the third participant showed an increase towards full independence in tooth brushing. The findings of this study are consistent with the works of Burns et al. (2019), which showed a variety of behavioral principles that proved effective in increasing the acquisition of daily living skills.

Prompting techniques have been extensively used as means of increasing the desired steps in the total risk response chain in children diagnosed with ID (Laarhoven et

al., 2018). Studies have concluded that prompting procedures are effective for increasing a vast variety of individual behaviors that have been associated within total risks, not only in oral health but also other skills. This study similarly aimed to investigate whether tooth brushing, taught using the MTL prompting technique, was maintained over time. Participant 1 maintained four of the eight taught steps, Participant 2 maintained a single step from the eight, and Participant 3 maintained four of the eight taught steps.

Over time, MTL prompting failed to maintain the tooth-brushing skills that had been taught to the participants. The findings of the current study contrasted with the work of Yilmaz et al. (2010), whose findings showed that the MTL prompting technique was an effective means that increased and maintained simple progression swimming skills in children diagnosed with autism. On the other hand, a study by Longino et al. (2021) presented results that were consistent with this study, showing that the highest levels of maintenance achieved with a 90% and 100% accuracy lasted only a month as performance began deteriorating during follow-up probes.

Two studies presented by Libby et al. (2008) evaluated two common prompting procedures in teaching children diagnosed with autism how to build Lego structures. The first one compared MTL to LTM and discovered that students who learned how to build Lego structures using the MLA prompting presented fewer errors in their work than the ones who received LTM prompting. All participants in the study learned to build Lego structures more quickly when the teacher used MTL than when LTM was applied. Three participants, nonetheless, appeared to learn more quickly when LTM was applied. The findings of the first study contrasted with the findings of the current study, as the researchers suggested MTL is more efficient when handling children with disabilities and that socially fundamental behaviors can be taught using MTL. The findings additionally

suggested that MTL might prevent errors but, in some cases, can slow the learning process. The second study also contrasted with the findings of the current study as their results showed that acquisition using MTL was higher when compared to LTM and produced fewer errors than LTM did.

According to Libby et al. (2008), ABA has often leaned towards teaching social behaviors to individuals. The teaching process usually involves a series of responses leading to specific behavioral objectives. The authors identified using toothbrushes as one of the most studied behavioral objectives in individuals or children with ASD and ID. In this case, the MTL and LTM strategies can be applied. The question in this case is which of the two methods is effective in behavioral acquisition. The current study found that the participants did not gain independence in tooth-brushing skills. This observation was linked to the use of the MTL fading strategy; as such, it shows the variation in efficiency and efficacy between the two fading strategies. This observation is in line with the work of Libby et al., where there was significant variation between the two fading strategies. In particular, the LTM fading strategy was associated with fast learning and a high level of independence. However, the MTL strategy was heavily associated with minimal errors. While the MTL strategy has minimal errors, it is essential to acknowledge that the lack of independence is due to the slow learning process. As much as it is one of the main characteristics of the MTL strategy, the difference in learning speed is not statistically significant (Libby et al., 2008).

The findings of Cengher et al. (2016) aligned with those of Libby et al. (2008), indicating that MTL and LTM fading strategies have been effective in helping children with ASD. As a result, they may be applied to acquiring new skills in children with ID. However, Cengher et al. argued that the variation between the two strategies is not well

documented. Specifically, several inconsistencies have been identified in the contemporary body of literature. These inconsistencies have been attributed to the difference in the selection of topography. Some of the selected topographies have failed to promote the correct responses.

McKay et al. (2014) recognized that both LTM and MTL strategies can be applied in task analysis procedures. The authors defined task analysis as the evidence-based teaching or instructional delivery methodology. So far, task analysis has been essential in aiding skill acquisition in learners with ID and ASD. However, it is critical to acknowledge that the approach can be categorized as both prompting and fading. Given the variation noted in the works of Libby et al. (2008) and Cengher et al. (2016), it is vital to examine the methods that comprise the prompting and fading strategies. According to McKay et al., the works of Libby et al. were primarily oriented towards simplicity. As a result, it requires teachers to implement a few different prompts. Such simplicity explains the notion that MTL is more effective teaching and skill acquisition technique. However, the lack of independence in skill acquisition indicates a lack of efficacy in the MTL strategies. This implies the need to improve the teaching strategy associated with MTL fading strategies.

In terms of improving strategies, McKay et al. (2014) sought guidelines for different practitioners. An analysis of practitioners indicates that most teachers seek to fade prompts gradually in their teaching technique. McKay et al. stated that such applications are unnecessary. Instead, applying a prompt fading with simple 2s delays is likely to improve the results. This application focuses on the transfer of stimulus control from response prompting to the desired or natural stimuli. However, this improvement largely depends on the required materials and the instructions necessary for task

completion. At the same time, its dependence on the instructions shifts the teaching and acquisition methods to become manually oriented. In the process, a manually guided 2s-delays technique emerges. The merges of manual guidance with 2s delay tend to bring out the inefficacies of MTL prompt fading techniques (McKay et al., 2014).

According to Cooper-Duffy and Hyer (2014), dealing with children in a special education system is often difficult. The difficulty stems from the need for intensive instruction in various skills. While such skills are important, these children also need to acquire academic knowledge. However, the need for intensive instruction often leaves very little time for education. While improvements have been made to the MTL strategy, they are yet to be fully effective. For this reason, Cooper-Duffy and Hyer supported the continued use of a manually oriented approach. In addition to including a manually oriented approach, the focus should be on the child's full development. As a result, the academic needs of children are integrated into skill acquisition strategies. Therefore, the authors recommended developing effective lesson plans and including function task analysis education for different skills and data collection. Such strategies allow a child's education to be evidence based and highly dynamic.

Implications of Findings

There are many implications of the findings in this study related to individuals with ID, teachers, educational administrators, and families. Individuals with ID have special learning needs, and researchers have spent several years attempting to determine the most effective teaching methods to improve their lives. One of the main challenges for children with ID is the development of daily living skills. The fact that daily living skills impacts so many areas of our lives makes it important to find methods that will maximize the learning potential for children with ID.

Children, adolescents, and adults who are diagnosed with ID are likely to engage in behaviors that experts would classify as challenging when compared to their typically developing peers. These behaviors have been associated with numerous negative impacts, including ones associated with society and the education system, and parents are looking for the most effective interventions and function-based assessments to address the challenging behavior in children diagnosed with ID. Drew (2019) conducted a study in which parents served as interventionists with routines of concern being room cleaning, meal time, and tooth brushing. Different topographies of challenging behaviors affected the quality of the routines of the families. Each parent achieved a high-fidelity treatment in each session together with bug-in-ear coaching. Upon the introduction of the intervention, three participants showed an immediate decrease in challenging behaviors and later exhibited reliable reversals upon the reintroduction of the intervention.

For the three participants who were part of the current study, MTL prompting failed to increase their independence in tooth brushing. Additionally, the technique failed to aid in the ability of the participants to maintain the skills. The findings of this study contrast with numerous studies that show the effectiveness of the MTL prompting technique, with many arguing that the technique aids in improving independence and maintaining the skill. Few research studies were consistent with the findings of the current study. This study showed how ineffective MTL prompt fading was in children with ID. The technique can be used, but conclusive results are not guaranteed.

MTL prompting was discovered to be unsuccessful for the learning outcomes that were measured but successful for teaching skills. As such, teacher preparation programs should demonstrate the successful implementation of the technique, especially when preparing students to enter into the education system. Additionally, behavioral parent

training can effectively teach guardians specific interventions to address challenging behavior. This guarantees a decrease in the frequency of reported challenging behaviors and an increase in the socially appropriate ones, as professionals who provide these function-based interventions are limited.

Implications for Educators and the Education System

The findings in this study have numerous implications for teachers and educators. For instance, the primary finding showed a lack of independence in skill acquisition when MTL strategies were used. This outcome implies a lack of efficacy in the methodology. An analysis of skill acquisition and teaching indicates that most teachers have often been blamed in cases where methodologies fail to yield expected outcomes. As a result, teachers need to understand how to teach students with or without ID. So far, studies (Cengher et al., 2016; McKay et al., 2014) have shifted the analysis into the methodology of teaching. Despite the shift, teachers must understand the programs for effective teaching. In particular, their training programs should focus on the benefits of MTL prompt fading strategies. In addition to understanding their benefits, there is a need to understand the various ways in which such strategies can be successfully implemented.

As educators understand the implementation strategy, it is vital to acknowledge that the strategy can be implemented in various areas. Despite the delivery method, it is important to ensure that the selected one has secured the attention of all students. Educators need to focus on student needs; however, it is important to recognize that the results will vary from student to student. As seen in various studies (Cengher et al., 2016; Cooper-Duffy & Hyer, 2014; Libby et al., 2008; McKay et al., 2014), the time required for students to gain independence varies from students to students. As a result, it is critical for educators to focus on the students instead of the time that is taken. Further

analysis shows that the impact of teachers is dependent on the instructional time needed. In this case, educators or instructors need specific skills to ensure that each skill is taught effectively. In some cases, the variation in instructional time may have some effect over the school year. Therefore, the choice of methods should often reflect the needs of the student.

This study has significant implications for the education system. This study found no correlation between the independence of the student and uses of MTL prompting during skill acquisition. While this finding presents a negative aspect, the benefits of using MTL prompting have been well documented. Despite the documentation, it is critical to acknowledge that MTL strategies may not be fully effective. The lack of effectiveness stems from issues of generalization and poor maintenance of skills. As a result, the independent functioning of students with ID is compromised. Therefore, this finding shows the importance of accuracy in the learning process. Apart from accuracy, teachers need to consider performance rates and ensure that the speed of teaching is within the range of competencies. Based on this analysis, the main argument is that fluency in teaching does not necessarily mean teaching faster. Instead, it means that the teaching process should be functional and relatable to a real-life situation. This is an essential component to consider when teaching the students new skills.

This study holds implications for teachers pertaining to how to teach students with or without ID. Teacher preparation programs should include the benefits of MTL and demonstrate how to implement it successfully when preparing their students to enter the field of education. Studies on which skills would benefit the most from this training would not only help children with ID, but children with other learning disabilities as well. Another implication of this study that impacts teachers is related to the instructional time

needed to teach specific skills. With so many skills to be taught, both teaching and learning are imperative for children with ID to be successful. The differences in instructional time could have a cumulative effect over the course of a school year and should be considered when choosing methods to use with children with ID.

When teaching skills to mastery, MTL prompting has been found to be an effective method when teaching students with ID. However, results from this study indicate that MTL prompting may not be the most effective way for impact and maintenance of skills needed for independent functioning in students with ID. While accuracy is an important part of learning, when teaching skills to students with ID, rates of performance need to be considered, or the speed needs to be within normal range of competence. Fluency does not mean to go faster; it means to teach the skill so that it functions in a real-life situation. An important component to consider when mastering a skill should not only be accuracy, but rate as well.

Implications for Parents and Families

Some studies (Libby et al., 2008; Yilmaz et al., 2010) have focused on analyzing MTL and LTM prompt fading strategies from the school perspective. The focus on the school environment primarily focuses on the specific educational needs of the student. As such, the social perspectives and interactions with parents are often overlooked. For this reason, Davenport and Johnston (2015) acknowledged the implications of using prompt fading techniques on families, particularly parents. The study indicated that the use of MTL prompt fading is likely to reduce the time taken for children with ID to acquire skills. From a family perspective, such approaches to skill acquisition and teaching are critical to understanding the needs of children with ID. Therefore, Davenport and Johnston recommended adding MTL programs at home (i.e., a more flexible approach).

The addition of these skills in the family environment is likely to improve the child's quality of life. Further, it will boost the child's learning progress, leading to less need for special education services over time.

The current study showed that additional MTL prompting may be able to help reduce the large number of hours needed to teach skills such as tooth brushing to children with ID. By using MTL prompting, families can possibly reduce the amount of time spent on programs use to teach specific skills, such as tooth brushing, thus helping their children with ID learn more in less time. By adding these programs at home, this could be less time consuming, which may lead to a normal quality of life for the child and family. This finding, if applied to other skills, may make teaching skills using MTL prompting more time effective, which could lead children with ID to need fewer special education services over time.

Limitations of the Study

There were limitations in this study that are often found in single-subject research designs. The first limitation that adversely affected the study involved the small sample size and the single organization participating in the study. As is the nature of single-subject research, the results may not be generalizable to a larger population. While investigation will try to offer insights and generalizations to a general audience and other investigators, this study's results are narrowed to this research site. The inclusion of multiple sites and a larger sample size may have provided a larger insight into individuals with ID and tooth brushing. Moreover, it was believed that the study's findings would assist the staff at the research site with assisting their clients who are diagnosed with ID, which is referred to as external validity.

Limitations to external validity are frequent in single-subject research (Ferguson,

2004; Horner et al., 2005). External validity is questioned regarding the replication with more than one participant as well as replication of the study in other locations or by other researchers. The external validity of this study was limited to participants in this study who received acquisition skills in a specific type of setting, making it difficult to generalize to other children with ID in other settings.

Future Research Directions

Adaptive skills are imperative for success in personal hygiene skills. This study looked at only one component of personal hygiene skills, which was the ability to independently brush teeth. While this is only a small part of hygiene skills, the ability to brush teeth is the key to oral health. Future research should expand on the current findings by expanding the study to a wider level of oral health care, such as flossing and mouth-washing skills. Future research may also focus on whether prompting can help older learners reduce deficiencies in hygiene skills. Another area of future research could focus on generalization. This research focused on the generalization hygiene skills taught using a MTL prompting. Researchers may question whether or not MTL leads to a better ability to independently brush teeth or if skills taught using MTL would generalize across instructors. Lastly, participants in this study participated only 2 days a week. Researchers may want to explore the optimal number of days per week. What would happen if the participants had a full 5 days a week? How would this affect the generalization and maintenance of skills taught?

Future research is needed to further enhance the positive effects of MTL prompting by varying the way this procedure is implemented. For example, the MTL may be most effective when conditions are right for less prompt dependency. The findings of Aykut (2012) argued that different maintenance over time is experienced

when the teaching procedure and the prompts have a 0-second interval and a 4- to 5-second delay. The study noted that three responses were produced from the students with the 0-second delay: a correct response, a wrong response, or no response at all. In the 4- to 5-second time delay, three responses were identified: a correct and incorrect response after 4 seconds, no response before and after 4 seconds, and incorrect responses before the 4 seconds were up.

The time delay was used as reinforcement where the responses before the time delay and after the time delay were reinforced and nonreinforced. The study then utilized the MTL prompting while using reinforcements and concluded that the MTL was more efficient in ensuring the participants provided correct responses within the instructional time and reducing errors (Neitzel & Wolery, 2009). This shows that maintenance over time is dependent on the time delay and the wait time between instructions. Prompts with a zero delay are likely to provide more correct prompted responses, while delay time trials increase the probability of correct unprompted responses. Rapid acquisition of skills is assured when the wait time is acquired, which increases the ability of the participant to adapt the behavior correctly over time within the time delay.

Conclusion

In recent years, researchers have proposed that MTL prompting is an effective evidence-based ABA teaching strategy for individuals who have ID (Gorgan, 2017). In addition, the MTL prompt fading strategy has been shown to help individuals with ID to develop new skills to increase their independence (Cengher et al., 2016). Parents want their children to achieve their full potential and to have the best quality of life possible. The present study found that MTL prompting did not lead to independence in tooth brushing for all participants regarding the impact on individuals with ID and maintenance

over time. Adding more days for the participants to achieve the hygiene skills acquisition would have been a useful strategy, and additional days in the participants' schedule would have been a great strategy outcome and long-term prognosis for children with ID.

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Appendix A

Observed Behavior and Prompt Given Per Session Log

Observed Behavior and Prompt Given Per Session Log

Skill to Teach: _____

List each step in the skill. For each date you practice, record the following

`+ Completed Independently
`InP In Progress; practiced but needs help
`NI Not Introduced

Steps of Skill	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given	Behavior Observed (+/-) Prompt Given
1 Pick up toothpaste and open								
2 Put toothpaste on brush								
3 Wet toothbrush								
4 Brush bottom left								
5 Brush bottom right								
6 Brush top right								
7 Brush top left								
8 Clean toothbrush, and put back								

Appendix B

Task Analysis (Forward Chaining): Brushing Teeth

Task Analysis (Forward Chaining): Brushing Teeth

1. Student will enter nonconsequential probe procedure for 1 session. Teacher trainer will deliver the antecedent “brush your teeth,” collect data using the “plus or minus” system, with no intervention.

2. After probe procedures, student will enter intervention. Teacher trainer will use full physical prompt with hand over hand for 90% accuracy across 3 consecutive sessions. After criterion is met, student will repeat probe procedure for 2 nonconsequential sessions with no intervention.

3. After the second probe procedure, student will enter intervention. Teacher trainer will use partial physical prompt with hand on elbow for 80% accuracy across 3 consecutive sessions. After criterion is met, student will repeat probe procedure for 2 nonconsequential sessions with no intervention.

4. After the third probe procedure, student will enter intervention. Teacher trainer will use gestural prompt with pointing to object for 80% accuracy across 3 consecutive sessions. After criterion is met, student will repeat probe procedure for 2 nonconsequential sessions with no intervention.

5. After the fourth probe procedure, student will enter intervention. Teacher trainer will use vocal verbal prompt with verbal cues for 80% accuracy across 3 consecutive sessions. After criterion is met, student will repeat probe procedure for 2 nonconsequential sessions with no intervention.

6. After the fifth probe procedure, participant will enter into two maintenance probes. The maintenance phase will entail two probe sessions, consisting of four nonconsequential trials, to check that the participant continues to correctly brush teeth without the prompts. Afterwards, the participant will have completed all session and will be exits from the study. After participant 1 enters the second probe session, participant 2 will enter the first probe session and follow the task analysis. After participant 2 enters the second probe, participant 3 will enter the first probe and follow the task analysis.

Appendix C

Intervention Graph Across Participants

Intervention Graph Across Participants