An Analysis of Graduated Guidance to Teach Spoon-use to Children with Multiple Disabilities

By

Sarah Elizabeth Ivy

Dissertation

Submitted to the Faculty of the

Graduate School of Vanderbilt University

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

in

Special Education

August, 2014

Nashville, Tennessee

Approved:

Deborah D. Hatton, Ph.D.

Joseph H. Wehby, Ph.D.

Erik W. Carter, Ph.D.

Amy Needham, Ph. D.

To the children with multiple disabilities and their families

ACKNOWLEDGEMENTS

No woman is an island. I would like to acknowledge the hugely influential support of the individuals who gave their time and energy to help see this project through to completion. To Michael Tuttle and Jennifer Guerra, thank you for your diligence and attention to detail, your flexibility, and smiling faces. To my committee members, Deborah Hatton, Joseph Wehby, Erik Carter, and Amy Needham, thank you for upholding a scholarly and fair process, for your insights and expertise, and for your availability. Joe, thank you especially for your frequent guidance with methodology and your sharp wit. Deborah, thank you for your generous spirit and stolid faith that I would do well, for taking advantage of the "teachable moments," and for your advocacy, always. Thank you for sharing your wisdom.

Thank you, family and friends, for helping me achieve balance, sometimes better than others. Amanda, you were always with me, wherever. Thank you for helping me keep perspective and dream, for inflating my balloon.

TABLE OF CONTENTS

Page

Appendix

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

Self-feeding difficulties present potentially serious health-risks, a barrier to independence and self-determination, social consequences, challenges for class management, and implications for staffing. Having the pace of food-intake set by another person creates the potential for choking, asphyxiation, aspiration, and complications that could lead to death. Lack of independence in self-feeding could also lead to malnutrition and dehydration, or obesity. For example, findings from a recent study of mothers and their typically developing infants suggest that feeders are more sensitive and responsive to hunger cues than indications of fullness, which may contribute to our current national crises of rising obesity (Hodges, Johnson, Hughes, Hopkinson, & Butte, 2013). Several studies of mother-child interactions with children who have severe visual impairments indicate that mothers have difficulty interpreting their children's attempts to communicate (Fraiberg, 1977; Preisler, 1991a; 1991b; Rogers & Puchalski, 1988; Rowland, 1984); therefore, this population may be at greater risk for adverse consequences. The risk is even greater for children with visual impairment (VI) who have multiple disabilities (MDVI), the majority of children with VI (Hatton, Ivy, & Boyer, 2013). Additionally, children with MDVI require intensive and specialized support to achieve independence in daily living skills (e.g., Gee, Graham, Sailor, & Goetz, 1995; Grisham-Brown, Schuster, Hemmeter, & Collins, 2000; Taras, Matson, & Felps, 1993). Direct instruction to teach eating skills to children with VI, especially those with additional disabilities, needs to be provided early in development,

with consistency and frequency, using effective and efficient procedures so that learners can be independent from an early age in a variety of situations.

In this paper, I first describe learners with severe, uncorrectable visual impairment in the United States. Second, I review the development of eating skills for typically developing students. Third, I synthesize the literature on instructional strategies to teach eating skills to children with multiple disabilities, including children with VI. Fourth, I synthesize the research on response prompting strategies specifically and present a rationale for using graduated guidance to teach eating skills to this group of learners. Fifth, I present research questions. Sixth, I describe the methods used to answer the research questions. Seventh, I present the results of the study. Finally, I discuss the results including implications for practice and future research.

Learners with Visual Impairment

Learners with VI constitute a small but exceptionally diverse group in terms of age, ability level, and visual functioning. It is estimated that one in 1,000 school age children and youth meets eligibility standards for visual impairment, and 10% of students with VI are functionally blind and cannot learn through vision (Erin, 2003). Due to the significant overlap between categories of disability qualifying students to receive special education services, data from the United States Department of Education underestimate the prevalence of students with VI. Because students are categorized according to their eligibility, estimating the number of students with MDVI is also complicated. Students with MDVI may be counted under the category of multiple disabilities. According to the U.S. Department of Commerce, Economics and Statistics Administration U.S. Census Bureau (2011), one-third of school-aged children with VI not attending residential schools for the blind in 2010 had a cognitive disability. It has also been estimated that 65% of students with VI have multiple disabilities (Parker & Pogrund, 2009).

Recently, a national registry of infants and toddlers with VI reported that 68% of young children with severe, uncorrectable visual impairments referred to specialized agencies also had multiple disabilities (Hatton et al., 2013).

A visual impairment can have profound effects on many areas of development (Hatton, Bailey, Burchinal, & Ferrell, 1997; Warren & Hatton, 2003). For example, early in a child's life, caregivers often find it difficult to establish a healthy attachment with their children who do not make eye contact (Rogers & Puchalski, 1988). Additional social consequences begin to emerge when children start attending school and fail to pick up on non-verbal social cues (Preisler, 1993). Also children are less motivated to explore their environment because their curiosity is not being stimulated by their visual surroundings (Sonksen, Levitt, & Kitzinger, 1984). It has been shown repeatedly that children reach for sound later than the visually directed reach is developed (e.g., Brambring, 2007). This lack of exploration affects motor development as well as concept development (Bruce & Muhammad, 2009; Fraiberg, 1977). Unfortunately, children with VI fall further behind in conceptual, skill, and social development due to the lack of incidental learning that typically takes place from observing others (Bigelow, 1995). Finally, even when direct instruction is provided, children with VI may have difficulty maintaining and generalizing skills because reinforcement is often in visual form. Compound the developmental implications of having a visual impairment with additional disabilities, and it is not difficult to understand the struggle to develop language and communication, social, and functional skills to achieve academically and have a high quality of life.

This group of students has been among the children who historically were neglected by the educational system (Wolery & Gast, 2000). Provided adequate support, students with MDVI have learned functional skills and basic communication (Ferrell, 2006; Parker, Davidson, &

Banda, 2007; Parker & Pogrund, 2009). However, students with MDVI are at high risk for not receiving the amount or type of instruction to be independent in even the most basic areas of need. This risk is evident by the large number of adults with MDVI who are dependent on others. In Great Britain, researchers estimated 65.2% of the adult population with intellectual disability who required mealtime support had a visual impairment that contributed to the need for support (Ball et al., 2012). The group of adults requiring moderate support during mealtime had the largest prevalence of VI (73.7%), compared to the full support group (63.2%) and the group requiring only minimal support (41.7%). The large number of adults with VI who need support at mealtime suggests that teaching strategies to help children develop independence at mealtime is a real area of need in students' educational programming.

Development of Eating Skills

Cup and spoon use are commonly the first skills beyond finger feeding that typically developing infants acquire on the road to independent self-feeding. A cross-cultural study of the perceptions of 32 white American and 28 Puerto Rican mothers indicated cultural differences in expectations of when children should begin self-feeding (Schulze, Harwood, & Schoelmerich, 2001). Specifically, 62.5% of American mothers believed their children should be able to use a cup and utensils independently at 9 and 12 months of age, respectively. Significantly fewer Puerto Rican mothers (14.3%) had the same expectations; however, over 50% of these mothers had started teaching spoon use before their children were one year. Infants acquired cup use on average between 8 and 10 months.

Connolly and Dalgleish (1989) observed two cohorts of infants for 6 months each to describe their development of spoon use. Observations of the younger group occurred between 12 and 17 months of age. An older group entered the study at 18 months of age. For both groups

a palmar grasp was used to manipulate the spoon using a preferred hand a majority of the time throughout the study. The authors task analyzed self-feeding with a spoon into four steps: filling the spoon with food, lifting the spoon from a dish to mouth, emptying the contents of the spoon into the mouth, and removing the spoon from the mouth. Several significant differences were found between the two groups for the strategies employed to accomplish self-feeding. Specifically, the older group of infants (a) used a fewer variety of hand grasps and scooping strategies, (b) more often held the contralateral hand on the dish as opposed to up in the air, (c) increased use of wrist rotation and decreased use of a dipping motion to accomplish the filling task, (d) increased use of elbow flexion to lift the spoon to the mouth, (e) increased control of the trajectory of the spoon during lifting, and (f) decreased length of time to complete taking a bite of food from on average 10.4 to 6.8 seconds. This list demonstrates that in the second year of life, infants are hard at work to become more efficient spoon users.

Connolly and Dalgleish (1989) also analyzed changes in visual motor behaviors leading to development of spoon use. These include the transition from visual fixation of the spoon to shifting gaze from the spoon to the dish, the increasing duration of visual monitoring of the spoon as it travels from dish to mouth, and the coordination of visual monitoring of the spoon and opening the mouth to anticipate a bite of food. Ball et al. (2012) listed difficulty locating or identifying food on the plate and getting food from plate to mouth as examples of mealtime difficulties due to visual impairment specifically. These findings suggest that vision plays an important role in developing self-feeding skills, beyond just access to models and reinforcement. Still, research to describe the development of self-feeding for children with VI has not been published, and few intervention studies have included participants with blindness.

Eating Skills Instruction

Much of the intervention research to improve mealtime behaviors was published in the 1970s and typically involved participants with multiple disabilities and cognitive impairments spanning a wide age range. Ando, Yoshimura, and Wakabayashi (1980) found significant differences in self-feeding abilities between younger (6-9 years old) and older (11-14 years old) groups of students with autism and intellectual disability, suggesting that self-feeding interventions are not just appropriate for young children. In fact, researchers have targeted early elementary students as well as adults for intervention. The types of behavior targeted for instruction in the 1970s were surprisingly homogenous, primarily focused on increasing independence and accuracy of eating skills and reducing problem behavior such as finger feeding, throwing food, or stealing food. From a search of the research literature on interventions to teach eating skills with no date restrictions, it appears that spoon use has been the most common target behavior for participants who require the most intensive support during mealtime.

Early research on eating skills instruction. Historically, a most-to-least prompting system or graduated guidance procedure was used to teach spoon use and/or to decrease inappropriate mealtime behaviors (Albin, 1977; Azrin & Armstrong, 1973; Berkowitz, Sherry, & Davis, 1971; Leibowitz & Holcer, 1974; Miller, Patton, & Henton, 1971; O'Brien, Bugle, & Azrin, 1972; Song & Gandhi, 1974; Thompson, 1977). This type of prompting was combined with several strategies to create instructional packages that included reinforcement (e.g., Albin; Azrin & Armstrong; Berkowitz et al.), punishment (e.g., Albin), overcorrection (e.g., Azrin & Armstrong), response blocking (e.g., Miller et al.; O'Brien et al.), restraint (e.g., Song & Gandhi), and mini-meals so that participants had opportunities to practice self-feeding as much

as possible each day (e.g., Azrin & Armstrong). In some cases only punishment (e.g., Groves & Carroccio, 1971) was used. Perhaps the earliest comparative study on acquisition of eating skills, compared modeling to physical guidance to teach students to use a more sophisticated grip of a utensil, and only physical guidance was demonstrated to be effective (Nelson, Cone, & Hanson, 1975). These interventions all led to therapeutic changes in learner behavior; however, due to the lack of detailed reporting and experimental control, little can be inferred about which variables contributed to changes in behavior.

Maintenance and generalization. Issues regarding maintenance and generalization were raised by just a few studies, but have such important implications for instruction that they deserve a closer look. O'Brien and colleagues (1972) found that manual guidance did not affect a 6-year-old girl's motivation to use a spoon correctly until incorrect eating behavior was blocked. Hence, manual guidance was necessary but not sufficient to change the girl's behavior. Furthermore, the child returned to inappropriate eating behavior when the intervention stopped. Albin (1977) faded proximity of staff and reintroduced additional utensils and finger foods over time as students mastered spoon use. Additionally, students were allowed to incrementally transition to mealtime in the cafeteria with other children after they achieved independence in a self-contained setting. These procedures were programmed to promote maintenance of appropriate behavior during mealtime. At least one student showed an increase in inappropriate behavior simultaneous with the re-introduction of plates, forks, and finger foods; however, this inappropriate behavior did not persist. Eighteen months following intervention, students had transitioned to a different facility, and inappropriate mealtime behaviors were infrequently observed. Ulicny, Thompson, Favell, and Thompson (1985) taught a 16-year-old with profound ID to independently self-feed using manual guidance. Following, the researchers trained direct

care staff to implement manual guidance and provided ongoing feedback. However, the majority of adults implemented procedures with poor fidelity, and the student did not maintain her independence.

Perhaps the most important conclusions that can be made from the early research on eating skills instruction are: (a) neither intellectual disability, previously-failed attempts to teach self-feeding, nor older age need be barriers to achieving independence during mealtime; (b) instructional packages that include manual guidance can be effective to teach spoon use; and (c) procedures to promote maintenance and generalization may need to be programmed to achieve meaningful changes in behavior.

Later research on eating skills instruction. Since the 1970s, the number of intervention studies on teaching eating skills has dropped; however, diversity in the dependent variables and types of interventions to improve mealtime behavior has increased dramatically. Over time, researchers have increasingly selected and described participants with specific diagnoses. For example, researchers have used social stories for children with autism (Bledsoe, Myles, & Simpson, 2003), self-monitoring for children with low vision (Ivy, Lather, Hatton, & Wehby, in preparation), and token reinforcement for children with behavior disorders (Sisson & Dixon, 1986b) to increase socially appropriate eating behaviors.

A number of instructional strategies have been studied to increase independent self-feeding. Constant time delay and graduated guidance have been used to teach preschoolers with severe visual impairment and cerebral palsy (Collins, Gast, Wolery, Holcombe, & Leatherby, 1991). System of least prompts was used to teach a 10-year-old with blindness and an emotional/behavioral disorder (Sisson & Dixon, 1986a), and to teach girls, 3-23 years of age, with Rett syndrome (Piazza, Anderson, & Fisher, 1993). Prompt fading and reinforcement were

used to teach self-feeding to a 10-year-old student with deafblindness (Luiselli, 1993). Touch cues with reinforcement or reinforcement and response blocking were used to increase self-feeding for three elementary students with deafblindness (Luiselli, 1988; 1993). The results of a descriptive study of institutional practices in Great Britain showed that types of support provided to participants with VI in particular have included assistance with plate orientation, oral feeding, cutting foods, and guiding hands to food; hand-over-hand assistance; and verbal and physical prompting to open mouth during assisted feeding (Ball et al., 2012).

Eating skills instruction for students with blindness. Only two studies from this body of research targeted skill acquisition of spoon-use for students with blindness (Collins et al., 1991; Sisson & Dixon, 1986a). Both research groups chose systematic response prompting procedures paired with reinforcement as the independent variable. In a review of response prompting, Ivy and Hatton (2014) included both studies. Furthermore, response prompting was shown to have substantial high-quality research supporting its use to teach skill acquisition to learners with blindness. However, neither of these studies met high-quality standards set forth by Horner et al. (2005) due to an inadequate number of replications to show a functional relation. Therefore, results should be interpreted with caution.

Across the two studies, two students with blindness participated. Both were non-verbal and had severe intellectual disability but had sufficient motor ability to finger feed. One three and a half year old girl with hypotonic cerebral palsy functioned at a developmental age of less than one year in all domains (Collins et al., 1991). No previous attempts to teach self-feeding had been made with this child. The other girl was 10 years old and functioned at a developmental age of less than three years old, except her fine motor skills were at a five-year level (Sisson & Dixon, 1986a). Previous attempts to teach self-feeding were not described; however, the child's

mother reported the absence of appropriate utensil use. Baseline data showed that occasionally the participant did use utensils to get food in to her mouth. This girl engaged in serious self-injurious behavior that psychotropic medicines did not alleviate. Prior to instruction on spoon use, self-injurious behavior was successfully treated with differential reinforcement of other behavior.

Collins et al. (1991) used a 3s constant time delay procedure implemented by a university graduate student in the context of snack time with peers. Physical guidance was used as the controlling prompt. Multiple exemplars of food and materials were used to promote generalization, and contingent reinforcement was thinned over time to promote maintenance. Several key findings have implications for future research. First, the student became dependent on prompts to remove the spoon from her mouth, which was resolved by using graduated guidance. Second, massed trials were an ineffective adaptation to improve performance of scooping. Third, constant time delay was not effective to teach the student to release her grasp of the spoon because, researchers speculated, it was not functional for a student without sight to complete this step. Fourth, verbal prompting and reinforcement were necessary and effective to maintain appropriate posture during mealtime. Fifth, generalization to similarly sweet food was greater than that to savory foods, and generalization across skills did not occur. In terms of efficiency, the student required five sessions, or 50 trials, of 0s delay trials until she completed an entire session without resistance to physical guidance. Thereafter, she was independently spoon-feeding within 63 sessions or approximately 10 hours of direct instruction.

Sisson and Dixon (1986a) used a three-step system of least prompts implemented by a university undergraduate student in a self-contained setting. Each session began by manually guiding the student through one complete sequence of spoon or fork use. Thereafter the student

was given the opportunity to independently use her utensils. After 30s of no response or if the student attempted to finger feed, a brief time out was implemented, followed by the SLP procedure. The three steps consisted of a 10s time delay, a verbal prompt, and then manual guidance. Correct responses were praised. Frequency of appropriate utensil use increased immediately upon introduction of the independent variable. No generalization or maintenance data were collected.

Clearly, the research on teaching spoon use to students with MDVI is not sufficient at present to inform practice in this area. Given the substantial amount of research on response prompting and reinforcement to teach skill acquisition more broadly to this group of learners, it seems reasonable and prudent to continue inquiry along these lines to identify the procedures that would be most efficient given a specific set of learner characteristics and environmental variables. Special attention should be paid to strategies that promote maintenance and generalization of skill acquisition.

Response Prompting Procedures

Prompting strategies are used when students do not readily acquire naturally reinforcing behaviors. Because the behaviors rarely occur, they are rarely reinforced. These strategies are used to increase the occurrence of a target behavior and in doing so increase the likelihood the behavior will be reinforced. Reinforcement increases the probability the behavior will reoccur given the same stimulus conditions in the future. From this theoretical description supporting the use of prompting, it makes sense that this would be an effective approach to teach spoon use to students who did acquire the skill on their own or with a more casual approach to instruction. Generally speaking, systematic response prompting procedures fall into categories of time delay or prompting hierarchies.

Time delay. Primarily, time delay procedures vary by the amount of delay inserted between the stimulus and prompt. First with all time delay procedures, some number of 0s trials are administered wherein an instructional cue and controlling prompt are administered simultaneously. Constant time delay (CTD) is characterized by a fixed time delay inserted between an instructional cue and controlling prompt that allows learners to respond independently. Progressive time delay (PTD) is similar except the time delay is gradually increased with subsequent opportunities to respond by some standard increment. Simultaneous prompting (SP) is not generally referred to as a time delay strategy because the prompt is always delivered concurrently with the stimulus (Waugh, Alberto, & Fredrick, 2011); however, it is like a time delay strategy in which the delay is always 0s. Opportunities to respond without prompts are inserted on a regular basis to assess whether the behavior is under stimulus control.

Time delay or SP may be the first choice of prompting strategy to teach students new targets (e.g., recognize new sight words) within a class of behaviors they already have in their repertoire (e.g., ability to read print). Common inclusion criteria in time delay studies include the ability to wait, respond to simple task instructions, and perceive the target stimulus; however, procedures for wait training and providing attending cues have been described in the literature and have been shown to be effective (Walker, 2008; Wolery et al., 1992). Overall, discrete skills are more common than chained skills as targets for time delay instruction. Preschoolers and elementary students are more often taught discrete skills, while the majority of participants in studies using time delay to teach chained tasks have been adolescents (Schuster et al., 1998; Walker; Wolery et al.). Time delay and simultaneous prompts have been used most often with students who have mild to moderate intellectual disabilities, and infrequently with students who have severe or profound intellectual disabilities (Browder, Ahlgrim-Delzell, Spooner, Mims, &

Baker, 2009; Waugh et al., 2011; Wolery et al.). However, researchers who have used time delay to teach chained skills, as compared to discrete skills, have included participants with severe or profound intellectual disabilities more often (Schuster et al., 1998). In studies that taught chained skills to participants with severe disabilities, the number of 0s delay trials extended to as many as five sessions (Dogoe & Banda, 2009), compared to a single session or less in studies that taught discrete skills to participants with mild to moderate disabilities (Wolery et al.). However, the delay interval was comparable across these sets of studies (i.e., on average 4s). Very little evidence has been published to support the use of time delay strategies with learners who are blind; however the reason for this lack of research is unclear (Ivy & Hatton, 2014).

In terms of efficiency, PTD may require less instructional time to reach mastery than CTD, but CTD may result in learning that maintains longer (Schuster et al., 1998; Wolery et al., 1992). Additionally, CTD is a simpler procedure, which may make training professional staff easier and lead to higher fidelity of implementation (Schuster et al.). Few studies have compared simultaneous prompts to CTD procedures, and mixed results suggest the procedures to be fairly comparable in effectiveness and efficiency with SP perhaps being slightly more efficient (Schuster et al.; Wolery et al.).

Prompting hierarchies. Prompting hierarchies call for a change in the type of prompt delivered on subsequent opportunities to respond. Prompting hierarchies vary in the levels of prompts that are planned; yet three is a common number (e.g., physical assistance, modeling, verbal). The different types of prompting hierarchies are named according to their directionality. A hierarchy of prompts that begins with the least intrusive prompt (e.g., verbal instruction) and ends with the most intrusive prompt (e.g., full physical assistance) characterizes the system of least prompts (SLP). In a review of studies that used SLP, 62% of skills taught across studies

were chained tasks; however, the youngest participants were always taught discrete skills. Adolescents with severe or profound intellectual disability were also frequently taught discrete communication or language skills. Most adults, despite their level of intellectual functioning, were taught chained skills applicable to community settings (Doyle, Wolery, Ault, & Gast, 1988). SLP has been the most commonly studied prompting procedure in the literature on learners with blindness across all ability levels and target skills (Ivy & Hatton, 2014).

Most-to-least prompts are similar to SLP except the procedure begins with the most intrusive prompt and moves down the hierarchy with subsequent opportunities to respond until independence is reached. With the MLP system, several trials are performed at each level until the intrusiveness of the prompt is decreased. For graduated guidance (GG), a controlling prompt is selected, and then the amount of assistance is reduced over time as the student begins to perform an activity independently. The difference between GG and prompting hierarchies is that interventionists implementing GG have greater flexibility to decide the level of prompting to administer based on student responses during the activity (Neitzel & Wolery, 2009). Previously, the controlling prompt was always a full or partial physical prompt and changed only in the level of intensity or position of the prompt (e.g., wrist, elbow, or shoulder; Demchak, 1990; Wolery & Gast, 1984). Recently, the definition has expanded to include the use of different types of prompts (i.e., not just physical) for both a controlling prompt and to fade the controlling prompt (Neitzel & Wolery). Often, an opportunity to respond independently is provided before the controlling prompt is administered (Neitzel & Wolery).

A decreasing prompting hierarchy is often used to teach skill acquisition for behaviors not already in a student's repertoire; whereas, a system of least prompts may be a better option to increase fluency of behaviors already occurring (Demchak, 1990). In the case of teaching a new

skill, Wolery and Gast (1984) recommended the use of SLP to determine the level of prompt required for a student to perform a behavior with 100% accuracy, and then the use of most-to-least prompting to fade support. In terms of efficiency, because children are given the opportunity to respond independently before prompts are administered with an SLP procedure, there are more opportunities for student error. Frequency of errors to mastery criterion is a common way researchers measure the efficiency of prompting procedures; therefore, it could be assumed that MLP would be more efficient than SLP on this measure. On other measures of efficiency, it is unclear if one prompting hierarchy is most efficient. Ivy and Hatton (2014) found that a common adaptation to system of least prompts for students with blindness has been to provide manual guidance to participants prior to implementation of the SLP procedure (e.g., Gee et al., 1995; Sisson & Dixon, 1986a; Taras et al., 1993). Given that skills deficits common to learners with VI are in part due to lack of access to visual models, it makes sense to begin instruction by showing these learners how to perform the correct target behavior. Time delay strategies and decreasing prompting hierarchies all begin instruction with a controlling prompt to ensure students perform the target behavior correctly.

Time delay versus hierarchies. Time delay strategies are frequently cited as more efficient (i.e., requiring fewer trials/sessions to criterion, less instructional time, fewer errors to criterion) than prompting hierarchies to teach discrete and chained skills (Demchak, 1990; Handen & Zane, 1987; Schuster et al., 1998; Wolery et al., 1992). Schuster et al. (1998) reviewed five studies that compared CTD and SLP to teach chained skills and found that CTD was more efficient in all cases. In two studies that compared CTD and MLP, CTD was more efficient to teach laundry skills, and MLP was more efficient to teach banking skills. Walker (2008) reviewed two studies comparing PTD and SLP and found PTD to be more efficient to

teach object and sight word identification in terms of sessions to criterion and/or errors to criterion. Time delay strategies and simultaneous prompting are also more conducive to group instruction than are prompting hierarchies. In a review of 47 studies using response prompting for students with disabilities in small group instruction, time delay strategies were used in all but one study, which used SLP (Ledford, Lane, Elam, & Wolery, 2012). Group instruction is desirable to increase opportunities for incidental learning through observation; however, often the materials and modes of instruction are not accessible to students with VI.

Given the findings of comparative research and the theoretical argument against the use of SLP for learners with blindness, CTD or MLP seem to have the most support to teach new skills to this group of learners. In one of the very few studies to look at the efficacy of CTD with this population, spoon use was a target behavior for instruction (Collins et al., 1991). An interesting finding from that study was that students became dependent on prompts for one or more steps in the eating skills sequence and that graduated guidance alleviated the prompt dependency.

When choosing the types of prompts to use, it may be important to consider the reinforcing nature of physical prompts for students. Waiting behavior may be positively reinforced with students who enjoy physical contact, which may lead to prompt dependency. Physical prompts may also negatively reinforce behavior for students who are tactually sensitive. These may be important factors to consider when defining procedures for use with students who are blind because tactual sensitivity and prompt dependency are common (Spencer, Head, Van Dusen Pysh, & Chalfant, 1997). If a decreasing hierarchy of prompts is desirable, Demchak (1990) suggested that a graduated guidance procedure might be more effective than MLP for students who are averse to physical guidance because opportunities to respond independently are

more frequent and occur sooner. For these reasons, graduated guidance might be better suited for students with blindness than CTD or MLP.

Research Questions

Following are the research questions for this study. (a) Is graduated guidance an effective method to teach independent and accurate spoon use to elementary students with significant visual and cognitive disabilities? (b) Given direct instruction in a highly structured context, do students generalize independent and accurate spoon use to similarly structured contexts in different settings without direct instruction? (c) Given direct instruction, do students reach mastery in fewer instructional sessions in each new context? (d) Do students maintain mastery of independent and accurate spoon use approximately 3, 6, and 9 weeks after intervention?

CHAPTER II

METHOD

Participants

Three Caucasian, male participants attended the Tennessee School for the Blind, were between the ages of 4 and 10 at the start of the study, and were receiving services under the eligibility criteria for multiple disabilities. All three students attended school full-time and received direct instruction from a classroom teacher certified to teach students with VI. These students met the following inclusion criteria: (a) had little to no functional vision (evidenced by a recent eye report or parent/teacher report), (b) were motivated by food (evidenced by parent/teacher report and observation), (c) were able to hold a utensil and had sufficient range of motion to complete a scooping action (evidenced by observation and parent/teacher report), (d) used a spoon functionally less than 10% of the time at home and school (evidenced by observational measurement conducted after parental consent was obtained), (e) had an attendance rate above 90% in the month prior to recruitment for this study (evidenced by teacher report), and (f) had hearing within medically normal limits. Students were excluded from participation who (a) refused soft foods for whatever reason (evidence by teacher/parent report), (b) had extreme allergic reactions to foods in the past requiring medical attention (evidenced by parent report), (c) were considered medically fragile (according to medical reports in student's school file), (d) could not maintain grasp of a spoon or small toy for several minutes (evidenced by observation), or (e) had competing behaviors that were thought to explain lack of self-feeding instead of a skills deficit (evidenced by observation and teacher/parent report).

Dallas. Dallas was age 10 years, 8 months at the start of the study. According to annual medical reports in his school records, Dallas had no light perception in either eye due to congenital optic nerve hypoplasia, which was stable since birth. He also had a pituitary abnormality for which he had recently resumed growth hormone treatment and a recently diagnosed seizure disorder for which he began medication during baseline. Additionally, a medical doctor confirmed that Dallas entered puberty just prior to baseline. He was also taking seasonal allergy medication on an as needed basis. Dallas had no medical restrictions related to mealtime.

At the start of the school year, a licensed psychologist employed by the school completed the Scales of Independent Behavior Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996). Dallas received age equivalent scores of 1 year, 7 months for social interaction and communication; 3 year, 1 month for motor skill; and 1 year, 8 months for personal living skill. His broad independence skill level was evaluated at 2 years, 4 months. His support score was 45, indicating he required "frequent or close support or supervision" (Bruininks et al., p. 69). Although the Oregon Project for Preschool Children who are Blind or Visually Impaired – Sixth Edition (OR Project; Anderson, Boigon, Davis, & deWaard, 2007) is not an age-appropriate assessment for children older than 6 years, no other assessment more appropriate for this group of learners exists. This checklist was completed by the interventionist for all three children through classroom observation and interviews with the classroom teacher and child's parent(s). On the cognitive portion of this assessment, Dallas received credit for 70.6% of items in the 1-2 year age range and .09% of items in the 2-3 year age range. On the language portion, Dallas scored 78.9% in the birth-1 year range and 16.7% in the 1-2 year range. On the fine skills portion, he scored 64.3% in the 1-2 year range and 15.4% in the 2-3 year range. Functionally,

Dallas had inconsistent use of a few signs and tangible symbols for expressive purposes. He regularly used a hand flapping motion and vocalized “ba” to indicate need, answer questions, and comment. These communicative signals required much interpretation on the part of the communication partner. Receptively, Dallas responded to dozens of one-step requests made verbally.

Dallas had always been a good eater with a wide range of preferences. Mother reported tactile sensitivity to slimy textures on his hands, but no oral sensitivities. Teacher reported sensitivity to sound as well. Dallas frequently exhibited stereotypic behaviors including hand flapping, head waving, and gently bouncing objects against his cheek. Mother and teacher both indicated visual impairment as the most likely factor interfering with independence at mealtime. Additionally, mother suggested low expectations and teacher suggested low muscle tone and sensory preferences may be significant challenges affecting motivation to maintain an effective posture and to increase efficiency at mealtime. According to a 2011 occupational therapy report, Dallas “required moderate to maximum physical prompts to scoop” but was able to “independently bring spoon to mouth with occasional spillage.” Mother and teacher reported use of hand-over-hand guidance and teacher reported use of graduated guidance in the past to teach utensil use. Both parties said they think that inconsistent use of these procedures explained lack of success. During the 2013/2014 school year when this study was conducted, no mealtime goals and no additional related services were stipulated in his IEP.

Finn. Finn was age 7 years, 5 months at the start of the study. According to annual medical reports in his school records, Finn had no light perception in either eye due to optic nerve hypoplasia, which was diagnosed and stable since birth. He was taking thyroid medication and cortisol throughout the study, and resumed growth hormone treatment around Session 44.

Finn also was administered seasonal allergy medication on an as needed basis throughout the study. Finn had no medical restrictions related to mealtime.

In spring of the current school year, a licensed psychologist employed by the school completed the SIB-R (Bruininks et al., 1996). Finn received age equivalent scores of 8 months for social interaction and communication; 1 year, 3 months for motor skill; and 2 years, 3 months for personal living skill. His broad independence skill level was evaluated at 1 year, 4 months. His support score was 10, indicating he required "pervasive or highly intense levels of support and supervision" (Bruininks et al., p. 69). On the cognitive portion of the OR Project (Anderson et al., 2007), Finn scored 80.0% in the birth-1 year range and 17.6% in the 1-2 year range. On the language portion, he scored 84.2% in the birth-1 year range and .06% in the 1-2 year range. On the fine motor skills portion, he scored 82.6% in the birth-1 year range, and 35.7% in the 1-2 year range. These results were consistent with the results of the OR Project completed by the student's previous classroom teacher in the spring of the previous school year. Functionally, Finn was observed on rare occasion to use single words, but not meaningfully. In 2010, he was reported to have an expressive and receptive language age equivalent skill level of 16-20 months. In 2012, a speech-language report stated that no significant gains in language had been made since 2010. Finn exhibited several pronounced stereotypic behaviors, which the OT reported were limiting him from participation in activities. These behaviors included biting his hands, clapping and waving his hands and forearms, stomping, rocking, and vocalizing loudly.

Finn had a wide range of food preferences and seemed to enjoy mealtimes. He exhibited oral sensitivities to creamy, lumpy textures (e.g., mashed potatoes) and a gag reflex to foods with an unusual or strong odor (e.g., cumin). In addition to visual impairment, his mother and father listed coordination, orientation in space, concept development, cognition, and motivation as

factors challenging his achieving independence at mealtime. His physical therapist also suggested frequent changes in his mealtime routine, low expectations, and short attention span interfered with his success at developing independence. Additionally, the interventionist observed that Finn presented with low tone affecting his posture, tactile sensitivities affecting his spoon grasp, and oral-motor difficulties affecting his ability to orally manipulate foods. In the past, hand-over-hand guidance and reinforcement procedures were used, but not systematically or consistently. During the 2013/2014 school year, Finn's IEP stipulated occupational and physical therapy each once per week for 30 minutes and speech-language therapy twice weekly for 30 minute sessions. However, the school's occupational therapist was on medical leave until Session 30. His IEP listed the following behavioral objective: "Student will feed himself with spoon and fork with touch prompts or less at 70% mastery."

Preston. Preston was age 4 years, 2 months at the start of the study. According to a medical and eye report in his school records, Preston had congenital onset cortical visual impairment, cerebral palsy, and periventricular leukomalacia. According to an ophthalmologist's report in his school records, Preston's visual impairment was described as stable with no light perception. However, according to a functional vision assessment completed by a certified teacher of students with VI, his visual abilities were described as unstable, with inconsistent object perception. Throughout the course of this study, the interventionist noted the student's inconsistent ability to visually perceive the red or blue bowl used during experimental sessions against the beige-colored tray of his Rifton™ chair. Preston was taking a selective serotonin reuptake inhibitor and antihistamine that parents reported had caused a recent gain in appetite and possibly improved behaviors.

Preston had a complicated medical history related to mealtime. From birth until 3 years of age, he had primarily received nutrition from a gastrointestinal tube supplemented by Pediasure administered orally through a straw. For the six months leading up to the start of the study, Preston was receiving all of his nutrition orally with a current meal plan requiring food to be cut in to approximately .25 inch pieces. There were no other food restrictions in place, and results from multiple swallow studies indicated Preston had a normal swallow reflex.

At the start of the school year, a licensed psychologist employed by the school completed the SIB-R (Bruininks et al., 1996). Preston received age equivalent scores of 10 months for social interaction and communication; 9 months for motor skill; and 10 months for personal living skill. His age equivalent score for broad independence was 8 months and support score was 16, in the pervasive support range. On the cognitive portion of the OR Project completed by the interventionist, Preston scored 85.0% in the bith-1 year range and 11.8% in the 1-2 year range. On the language portion of the assessment, he scored 73.9% in the birth-1 year range and 11.1% in the 1-2 year range. On the fine motor skills portion, he scored 69.6% in the birth-1 year range and 14.3% in the 1-2 year range. Functionally, Preston used “bu” or “ba” to communicate “bye” and used signs for *more, finished, eat, and drink*. These signs required interpretation from the communication partner and were not always used meaningfully. Preston enjoyed social interaction with adults. Responding to requests to touch various body parts was a preferred activity, which he could do with moderate consistency.

Preston seemed to enjoy mealtimes and had a wide range of food preferences. However, creamy, smooth textures sometimes elicited a gag reflex. This behavior was infrequently observed during experimental sessions. Despite the presence of cerebral palsy, Preston’s teacher and parents both indicated visual impairment and cognitive disability presented the greatest

challenges to his achieving independence at mealtime. His speech-language therapist listed motor skill, specifically difficulty with wrist rotation, as an additional challenge. Neither parents nor professionals indicated any lack of motivation to eat or self-feed. In the past, feeding therapy included hand-over-hand guidance; however, up until the current school year emphasis had been placed on developing oral-motor skill, primarily. During the 2013/2014 school year, Preston's IEP stipulated occupational therapy once per week for 30 minutes, and speech-language therapy and physical therapy each twice weekly for 30 minute sessions. His IEP listed the following behavioral objective: "Student will hold a spoon with physical cues or less, 75% of the time."

Experimental Settings and Materials

Experimental sessions were held Monday through Thursday from mid-December to early-June while school was in session in three different settings per student: (a) afternoon snack in a classroom used for pullout instruction, (b) breakfast in the student's classroom or lunch in the school cafeteria, and (c) dinner at home. All instruction was provided in a one-to-one format. The first author, who is a doctoral candidate, a certified teacher of elementary students with severe/multiple disabilities including sensory impairments, and has approximately 12 years experience providing services to this group of learners, served as the sole interventionist for all students across settings and conditions. Two of the three students participated in a study two-years prior in which the same interventionist provided direct instruction. Materials for each session included food items, drink items, drinking cup, adaptive bowl or plate, adaptive spoon, non-slip mat or suction cup base for bowl or plate, seating/positioning equipment, hand-held trial counter, video camera, tripod, and digital scale. Sessions were recorded with a Sony Handycam HDR-CX220 Digital Camcorder and Sony VCT R100 tripod.

Adaptive equipment. In consultation with students' speech language therapist or physical therapist, teacher, and parents, the research team selected dishware, utensils, and seating/positioning equipment. For each student, the same eating equipment was used across all instructional settings (i.e., snack breakfast, lunch, and dinner) and conditions (i.e., baseline and intervention). Preston used a red or blue scooper bowl measuring 11.4 cm in diameter with a suction-cup base. Dallas and Finn used a blue scooper plate measuring 17.1 cm in diameter with a suction-cup base or dycem to prevent slipping. Seating and positioning equipment were held constant across conditions within a given setting, but varied by setting. Although seating and positioning equipment varied across settings, equipment was provided where appropriate to support near optimal positioning. Optimal positioning was defined as maintaining an approximate 90-degree angle at the hip, knee, and ankle joints. Specific seating and positioning equipment used in each setting are described below.

Snack. All three students received direct instruction in the pullout setting during snack at school, between 12:30-3:00 pm. The time students were pulled for instruction was held constant across sessions to the extent possible. Instruction occurred in the same empty classroom for all students, adjacent to students' regular classrooms. Students sat facing a mirror and video camera with materials on an eating surface directly in front of them. Dallas and Finn used a regular child-size chair (height = 40.6 cm, depth = 33 cm) and wooden table (height = 66 cm). Additionally, Finn used a footstool (height = 15.9 cm). Preston used a Rifton™ Stationary Chair (Model r612) with tray. Primarily, the interventionist sat or stood behind or beside the student.

Breakfast. For generalization, Preston was seen during breakfast in his regular classroom, between 7:45-8:15 am. Preston used the same seating equipment during breakfast and snack. During breakfast, Preston sat within 2-3 ft of his peers who were seated at a child-size

horseshoe table for breakfast. Some students were allowed to free play during this time or were being fed in adaptive seating equipment in the same area of the classroom. Up to 6 other students, one teacher, one therapist, and two teaching assistants were present during breakfast. Some of Preston's peers were verbal, and conversation was ongoing among students and adults.

Lunch. For generalization, Dallas and Finn were seen during lunch in the school cafeteria, between 10:45-11:15 am. Six classes were served lunch in the cafeteria during this block of time. Students sat at tables by class with teachers and support staff. Tables were spaced approximately six feet from each other. Including students, teachers, classroom aides, therapists, and cafeteria staff, approximately 50-60 persons were present in the cafeteria during this time on any given day. For experimental sessions, students were brought from their class's lunch table to a nearby table and chair near the perimeter of the cafeteria, within 4-8 feet of other students. This arrangement was necessary to protect non-participating students from being video recorded. For Finn, his lunchtime table and chair were each 8.9 cm shorter than those used during snack, and so a footstool was not necessary. For Dallas, chair and table height were identical as that used during snack.

Dinner. For generalization, all three students were seen at home during dinner. Dinner sessions were held consistently at 4:30 pm for Preston and 6:30 pm for Dallas and Finn. Preston ate dinner in a Rifton™ Stationary Chair (Model E770) with tray, similar to that used at school. He ate dinner at the same time as his preschool-aged brother, who ate at a typical-sized table next to him. Dallas and Finn ate dinner at a typical-sized dinner table seated in adult-sized chairs with their parents present. Dallas freely moved between the dinner table and a nearby counter where milk was available to him. Additional positioning equipment was not provided so as not to interfere with his regular routine. For Dallas, table height at dinner was approximately 6 inches

taller than snack. For Finn, table height at dinner was approximately the same height as the table used for snack. A piece of cut foam and Cando™ wedge was positioned against his seatback for additional lumbar support. A plastic container was used for a footstool.

Food selection. In each setting, multiple exemplars of food were used to the extent possible to promote generalization of skill acquisition. Only food items available through the school were used during snack, breakfast, and lunch. At home, parents provided and prepared food for sessions during dinner. Foods varied across sessions and settings according to what was available and individual student preferences. Every effort was made to provide the widest variety of highly preferred food items within the constraints imposed by availability. Snack foods included 8-ounce microwaveable cups of spaghetti and meatballs, beef stew, chicken and noodles, chicken and rice, chicken dumplings, lasagna, beans and franks, macaroni and cheese, and ravioli; chocolate and vanilla pudding cups; applesauce; fruit cocktail; fresh chopped cucumber; pears; banana; strawberries; and cottage cheese. Breakfast foods included scrambled eggs and ham, pancakes, muffin, banana, and oatmeal. Lunch foods included beans, mixed vegetables, hashbrowns, various fruits, diced turkey or chicken, salad, carrots, and sweet potatoes, among others. Dinner foods included macaroni and cheese, diced pork or chicken, steamed broccoli, green beans, corn, beef goulash, shepherd's pie, casseroles, and chicken alfredo, among others. Approximately half way through the intervention condition, a small piece of chocolate was given to Dallas for "dessert" during snack sessions only. A drink item (e.g., water, milk, juice, or Pediasure) was available to students during almost every session.

Measurement System

The measurement system for this study included three types of measures: (a) a descriptive assessment completed prior to experimentation, (b) the dependent measure, and (c)

procedural fidelity. For each of these measures, the response definitions and data collection methods are described in this section, followed by the procedures used to train two independent coders to demonstrate reliability of the dependent measure and procedural fidelity. The author (also the interventionist) was the primary data collector for all three measures.

Descriptive assessment. Data were collected on student and teacher/parent behaviors to describe instruction and performance during mealtime prior to baseline for each student. During mealtimes prior to baseline, a 10s partial interval recording method was used to estimate the frequency of nine behaviors, defined in the following section: (a) access to food, (b) physical prompt, (c) verbal prompt, (d) utensil use, (e) touch food, (f) finger feed, (g) food spill, (h) reinforcement, and (i) adult fed. That is, the author recorded the occurrence or non-occurrence of each behavior during each 10s interval. Observational sessions continued for 10 minutes from a student's first bite or until the last bite, whichever came first. Data were collected live using pencil and paper. The observer received audio signals in 10s intervals through headphones using an application called *Interval Minder* operated by an iPhone 4s. The data collection form for this descriptive assessment can be found in the Appendix.

Response definitions. *Access to food* was defined as students having food within arms reach on dishware intended for the student. Non-examples may have included food in serving bowls or other children's plates. In the home setting, non-examples may have included parents giving food to their children prior to having set up a dinner placement. *Utensil use* was defined as a student attempt to use a spoon or fork to put food in the mouth, regardless of success or level of support provided. This definition excluded use of a knife or use of a spoon for any other purpose (e.g., banging). *Touch food* was defined as a student making contact with food using the fingers, but not finger feeding, regardless of how long the student remained in contact with food.

Making contact with food using other parts of the body (e.g., putting an elbow in a plate of food) would not have counted. *Finger feed* was defined as bringing food to the mouth using fingers, regardless of success. This behavior was counted only when students attempted to put a new bite of food in their mouth. For example, licking fingers would not have counted; however, grabbing a hand full of spaghetti to put in mouth would have been counted. *Food spill* was defined as an attempt to self-feed using a utensil and dropping food from the utensil so that it does not land on any dishware. Non-examples may have included knocking over a drinking cup or throwing food. *Adult fed* was defined as instances in which an adult put food in a child's mouth, without active participation from the child, with or without use of utensils. This behavior did not include an adult helping a child to take a drink. A *physical prompt* was defined as all forms of adult assistance to eat in which physical contact was made with target children. Examples may have included touch cues and manual guidance. Non-examples may have included forms of reinforcement such as patting a student's back or gestures such as pushing a child's plate toward him or her. A *verbal prompt* was defined as adult language (i.e., verbal or sign) or vocalization used to indicate to target students to take a specific action related to eating. Examples may have included directives to students to improve their performance even if not directly related to spoon use (e.g., "hold your head up" or "use your napkin"). Non-examples may have included statements not meant to prompt a specific action such as "you are making a mess" or "are those carrots good?" Finally, *reinforcement (R+)* was defined as any type of encouragement, regardless of specificity, provided specifically to a target student (e.g., a pat on the back or saying "good job,"). Non-examples may have included any instance when a general comment was made to a group or to someone other than the student (e.g., "Paul has been eating really well lately").

Dependent variable. To answer the research questions for this study, data on students' level of independence and accuracy in spoon use were collected using event recording (Altman, 1974). Each bite of food afforded one trial and consisted of six steps: (a) hold spoon, (b) put spoon in bowl, (c) scoop, (d) raise spoon, (e) take a bite, and (f) lower spoon. Sessions lasted for 20 bites or until a student refused to continue eating, whichever came first. Data were collected from video using paper and pencil. The data collection form for the dependent variable can be found in the Appendix.

For each step of the task analysis, six mutually exclusive responses were possible: *independent, independent with verbal, prompted resist, prompted unresist, no response,* or *error*. *Independent* was recorded for steps completed accurately according to the response definitions included in the next section, without any physical or verbal assistance. *Independent with verbal* was recorded for steps completed with verbal assistance, but no physical assistance. *Prompted resist* was recorded for steps resisted but eventually completed accurately with physical assistance from the interventionist regardless of her verbal behavior. *Prompted unresist* was recorded for steps completed accurately with physical assistance from the interventionist, regardless of her verbal behavior, with no resistance to complete the step from the student. *No response* was recorded for missed opportunities to complete a step. *Error* was recorded for steps in which student behavior was incompatible with accurate step completion, regardless of the level of assistance provided.

Response definitions. For this study, spoon use was defined as a chained skill consisting of six steps. The task analysis for spoon use with natural cues (i.e., discriminative stimuli) for each step can be found in Table 1. For observers collecting data, the natural cues served as the start and stop signals for each step.

Table 1
Task analysis of spoon use

Natural cue	Steps
Oriented to spoon	1. Hold spoon
Empty spoon in hand (no food in mouth)	2. Put spoon in bowl
Empty spoon in contact with bowl (no food in mouth)	3. Scoop food
Spoon is full of food	4. Raise spoon (to mouth)
Spoon touches lips	5. Take a bite
Empty spoon	6. Lower spoon

The following operational definitions include dimensions of independence and accuracy. Student hunger and/or the interventionist orienting the student to the spoon when necessary prompted the first step, *hold spoon*. This step referred to students holding the built-up handle of the spoon with two or more fingers and thumb curved around the handle. Non-examples of this behavior may have included refusal or holding the spoon without curvature of at least two fingers. Correct orientation to the spoon was provided by the interventionist whenever necessary. The *hold spoon* behavior was counted as its own step at the beginning of each trial; however, all other steps also required the criteria for *hold spoon* to be met while performing the action.

An empty spoon in the hand with or without the student's contralateral hand on the bowl for orientation prompted the second step, *put spoon to bowl*. This step referred to students resting their spoon on the bowl closest to the dominant hand in a ready position for the next bite. Students also may have completed this step by resting their spoon slightly over the bowl; however, students had to eventually make contact with the bowl or food in a functional manner to be ready to scoop in order to receive credit for completing this step. Non-examples of this behavior may have included any instance in which the spoon was not moved from the table or not held still such as banging or tapping the spoon on the bowl or table or waving the spoon in the air.

The third step, *scoop food,* was prompted by the spoon at rest on the bowl or in contact with food in the bowl when students did not have food in their mouth. To complete this step, students manipulated their spoon to retrieve food from the bowl. Examples of this behavior included dipping the spoon in and out of the bowl with or without lateral movement, or using wrist, elbow, or shoulder rotation to rotate the spoon to complete a scooping motion. At least one-quarter spoonful of food must have been gathered on the spoon to complete this step. Non-examples of this step may have included holding the spoon in a vertical position and dipping it in the food, swirling the spoon in the bowl, or scooping but not retrieving any of the contents in the bowl. In the case of vertically dipping the spoon or swirling the spoon, even if food were collected on the spoon, the behavior would not count as a scoop.

After scooping, a spoon with food in hand prompted the fourth step, *raise spoon to mouth*. To complete this step, at least one-quarter of the spoon had to be holding food, and food should not fall from the spoon. However, a little spillage was tolerated provided that it fell into the bowl, and some food remained on the spoon. Raising the spoon from the bowl to the lips while maintaining an upright position of the spoon constituted this behavior. Non-examples may have included lifting the spoon with no food, lifting too fast so that food fell from the spoon to the table, twisting the spoon regardless of spillage, or lifting the spoon to the cheek instead of the lips.

Contact between the spoon and lips prompted the fifth step, *take a bite.* This behavior involved opening the mouth, inserting the spoon, removing the contents of the spoon, and removing the spoon from the mouth. For this step, some food could remain on the spoon, provided some food remained in the mouth. The spoon had to be completely removed from the mouth and remain in an upright position. At least one-quarter spoonful of food had to be on

spoon for the student to receive credit for this step. Non-examples of this step may have included wiping food on to the lips without opening the mouth, licking the contents off the spoon, or not removing the food from the spoon.

An empty spoon near the mouth prompted the final step of the task, *lower spoon*. This step included students bringing their spoon from their mouth to a resting upright position on the table or bowl. To complete this step, students could bring their arm to rest on the side of the table with the spoon hovering above the bowl or table. Non-examples may have included students lowering their spoon less than half way, bringing spoon down to his lap or past the table, shaking the spoon, holding the spoon upside down or vertical, putting the spoon handle in the bowl, or banging the spoon on table.

Metric. Two metrics were used to answer the research questions. Percentage of independent responses for each *individual step* for each session (i.e., step level data) was used to examine behavior change at the time of introducing GG. Percentage of independent trials per session in which students performed *all steps* independently (i.e., trial level data) was used to assess the achievement of mastery.

Procedural fidelity. To document procedural fidelity, data on interventionist behaviors were collected from video using paper and pencil. The data collection form for this measure can be found in the Appendix. The occurrence or non-occurrence of the following planned and unplanned behaviors (N = 14) was coded on a trial-by-trial basis for 100% of experimental sessions: (a) bowl with food positioned in front of student at table's edge; (b) student oriented to spoon (touch cue/physical guidance if student already has spoon in hand); (c) student encouraged to feed himself with or without prompts; (d) five second time delay provided from beginning of trial for student to demonstrate skill with or without prompts; (e) necessary physical and/or

verbal guidance provided to assist student to complete trial without errors; (f) physical contact maintained if student resisted step with prompting; (g) prompting level decreased from previous trial only if student did not resist action with prompt on previous trial; (h) prompting level increased from previous trial only if student had an error on current or previous trial, was about to make an error, or paused during current or previous trial; (i) student oriented to spoon in the bowl (or spoon was already in bowl) and given five second time delay to demonstrate skill from scoop with or without prompts; (j) student was not blocked from bringing spoon to mouth; (k) attempts to finger feed or self injure were immediately blocked; (l) contingent praise provided if student completed all steps without error; (m) encouragement provided if student completed some but not all steps without error; and (n) correct behavior was not blocked. Procedural fidelity was calculated using the point-by-point method: (number of positive behaviors / total number of behaviors) x 100 (Ayres & Gast, 2010, p. 147).

Reliability. Two independent observers, graduate students in the vision program, were trained to collect reliability data on the dependent measure and procedural fidelity. For demonstration and training purposes, scripts and video recordings of mock experimental sessions were created. A graduate student not affiliated with the study played the role of a student with blindness for those videos. Scripts for baseline and intervention were created, which included several instances of each type of student response (i.e., independent, independent with verbal, etc.; n = 6) and a variety of interventionist responses for each step of the task analysis (n = 6), using multiple exemplars (i.e., types of food). Difficult to code behaviors, such as quick responses and difficult to understand responses, were included. Several video files of varying length were created from those scripts, simulating baseline and intervention conditions. Different

video files were used for (a) demonstration, (b) training, (c) to establish reliability prior to data collection.

Training on the dependent measure and procedural fidelity occurred simultaneously. During the first training session, observers were introduced to the constructs being measured, the coding manual, and were shown videos simulating both conditions for demonstration purposes. The primary observer demonstrated coding the behavior while both observers followed along, completing their own coding forms. After the demonstration, training took place over multiple sessions. In these training sessions, videos were viewed as a group while each observer independently coded one trial at a time. We compared codes and discussed discrepancies between trials. We continued to code one trial at a time until each observer reached at least 90% agreement with the primary observer over at least five consecutive trials, for each condition. Using the remainder of the videos, each observer independently viewed and coded 20 trials at a time until each observer reached at least 80% agreement with the primary observer, for each condition. We compared codes and discussed discrepancies between coding sessions. Prior to beginning data collection for reliability, each observer independently coded baseline experimental video sessions, randomly selected by participant, until reaching at least 80% agreement with the primary observer. Again, we compared codes and discussed discrepancies between coding sessions. In this way, each coder reached at least 80% agreement with the primary observer for each condition using mock videos and for each participant under baseline conditions using experimental video sessions. The results obtained for training were excluded from the results used for reporting reliability. Throughout the study, after each video was coded for reliability, the primary observer reviewed the discrepancies and made notes to the secondary

observer. For each session in which reliability fell below 90%, the secondary observer reviewed the video and notes from the primary observer before coding additional sessions.

For training and reporting, agreement was assessed using the point-by-point method for all measures. For the dependent measure, point-by-point was used to check agreement for each step (N = 6) of each trial, and at the trial level. For summative purposes only, *independent with verbal, prompted resist, and prompted unresist* were collapsed into a category; *no response* and *error* were collapsed into a separate category; and *independent* comprised its own category. This difference between how IOA was calculated for training and reporting purposes is reasonable because disagreement on the type of prompt required does not affect the variable used to determine a functional relation. Only number of independent responses for each step and number of independent trials were used to test a functional relation. For procedural fidelity, point-by-point was used to check agreement for each behavior (N = 14) of each trial. Point-by-point agreement was calculated using the formula: (agreements / agreements plus disagreements) x 100 (Ayres & Gast, 2010, p. 147). Second observer data were also graphed and agreement examined daily to detect drift or bias. The sessions chosen for reporting reliability were randomly selected within each condition, setting, and participant. Trials were time stamped by the primary observer to ensure that all observers were coding the same trial.

Secondary observers were blind to the research questions. However, both observers had some knowledge of single-case design and teaching methods for students with MDVI. To discourage secondary observers from readily distinguishing conditions, a code word was used to indicate the condition for each the session when naming video files (e.g., chase = baseline). Video files were named according to the three-digit participant identification code (e.g., P01),

setting (i.e., snack, breakfast, lunch, dinner), condition, session number (sessions were numbered in chronological order by participant), and date.

Experimental Design

For this single subject study, a multiple probe design (Horner & Baer, 1978) with inter- and intra-subject replication was planned across four participants and three instructional settings: a) pullout instruction, b) classroom or cafeteria instruction, and c) home instruction. Participants were to receive direct instruction in each setting unless they reached mastery criterion in that setting prior to intervention. Because students did not reach mastery before the end of the school year, intra-subject replication was not attempted. Therefore research questions about efficiency of learning in secondary and tertiary settings and maintenance of learning could not be answered. The primary research question about the efficacy of graduated guidance to teach spoon use was addressed with a multiple probe design carried out across three participants in a pullout setting during snack. Generalization sessions, under baseline conditions, were held in the student's regular classroom during breakfast or the school cafeteria during lunch, and at home during dinner to address the secondary research question about generalization of learning.

Baseline data were collected for at least five sessions for each participant and stability achieved before introducing the intervention to any participant. Immediately prior to and after intervention was introduced to the first and second participant, baseline data were collected for subsequent participants in the primary instructional setting. Additionally, immediately prior to and after intervention was introduced to any participant in the primary instructional setting, generalization data were collected for that participant in the secondary and tertiary setting. Subsequent participants began intervention in the primary instructional setting when the previous participant reached 75% independence on at least half of the steps for four consecutive sessions.

Intervention in the secondary and tertiary setting was planned to begin when a participant reached 75% independence at the trial level for at least 3 consecutive sessions in the primary setting. As previously mentioned, participants did not reach this level of mastery, and so intervention was not introduced in subsequent settings. Participants were also slated to enter a maintenance condition after reaching mastery criterion, during which data would be collected 3, 6, and 9 weeks post-intervention under baseline conditions. Because students did not reach mastery in the primary setting before the school year ended, maintenance data could not be collected.

This design allowed for the detection of threats to internal validity including history, maturation, and testing by staggering the onset of treatment in the primary instructional setting over three participants over time. Data at the step and trial level were expected to remain at near zero levels in the primary instructional setting for each participant until the intervention was introduced. After introducing the intervention, as the interventionist began to fade prompts, behavioral changes were expected to occur at the step level, for individual steps. Latency was expected due to initial provision of full manual guidance. Changes were expected to occur as prompts were faded for one or more steps initially, but not for all steps immediately. Trial level data were not expected to change immediately, but improve slowly over time. Step and trial level data collected in generalization settings were expected to increase after GG was introduced in the primary setting, but not reach mastery levels without direct instruction. Again, because students did not reach mastery criterion in the primary instructional setting, questions about efficiency of learning and maintenance could not be answered.

Therapeutic changes in behavior at the step level for three students after introducing GG during snack and not before would be used to infer experimental control and allow change to be

attributed to the independent variable. Efficacy of GG would be established if experimental control was demonstrated and students reached mastery criterion levels, analyzed at the trial level. As stated previously, mastery criterion for efficacy of GG was set at 75% independence at the trial level for at least 3 consecutive sessions.

Consideration was given to several alternative designs. A multiple probe was chosen over a multiple baseline because the latter would have required testing participants under baseline conditions to an extent longer than necessary. Prolonged testing during baseline may inadvertently set up expectations of non-responding (Gast & Ledford, 2010). Withdrawal and reversal designs were ruled out because the behavior, independent spoon use, is assumed not to be readily reversible (Gast & Hammond, 2010).

Procedures

Interviews and observations. Prior to beginning baseline, students were observed once or twice during breakfast, lunch, and dinner to document their participation during mealtimes and the type of support they received. Observations occurred with the full knowledge of the adults being observed. Students were greeted verbally and with physical contact. The observer positioned herself in the room as far from the student as possible still within range to observe all teacher/parent and student behaviors. Once the student had access to food, the observer started the *Interval Minder* application and collected data for 10 consecutive minutes or until the student finished eating, whichever came first. Observations were paused if the student had to go to the bathroom or otherwise left the eating area for a break from mealtime. At the end of each observational session, the observer thanked the participants. No feedback was provided to adults or students.

Each person who provided regular assistance to students during mealtime was interviewed prior to baseline to document the type of support that had been or was being provided. Interviewees were asked to share their knowledge of systematic prompting procedures, recall types of feeding interventions that may have been used in the past, and estimate the amount and type of support they had provided during mealtimes for the student during the current school year. Staff and parents were asked to maintain their current routines with students throughout the course of the study.

During interviews with school staff and parents, information about food preferences, allergies, menus, seating arrangements, adaptive equipment, and scheduling was also collected. The purpose of this portion of the interviews was to come to agreement about the seating arrangements and adaptive equipment to use with each student, and to agree upon a time of day for instruction. Information about food preferences and meals regularly served at home and school was collected to inform food selection for each student. One student had a meal plan in place, which the interventionist was required to review and sign to keep in school files. Interviews were scheduled for a time convenient to parents and school staff. Interview and record review forms can be found in the Appendix.

General procedures. Each student participated in a total of 58-70 experimental sessions, between December and June. Sessions occurred Monday through Thursday while school was in session and lasted approximately 15-20 minutes. Before each session, the interventionist greeted the student and verbally communicated that it was time to eat. The interventionist and student then traveled immediately to the area pre-arranged for instruction. The video camera was turned on before the first bite. To begin the first several sessions with each student, the interventionist helped the student to explore the materials one at a time using hand-under-hand guidance,

labeling each item. These materials included a spoon, dish, and container of food. The interventionist invited the student to smell and taste the food and help empty the contents in to the bowl. The interventionist then removed the dish with food to weigh its contents. After the weight of food was recorded, the interventionist oriented the student's hand to the spoon, which signaled the primary observer to begin data collection when coding from video, and communicated to the student that it was time to eat. Students were encouraged verbally as necessary to use the spoon for self-feeding.

Students were encouraged to complete exactly 20 trials (i.e., 20 bites of food). The interventionist used a hand-held counting device to keep track of the number of trials completed. For sessions when more than 20 bites occurred, only the first 20 trials of each session were coded. During each session, if students performed all steps accurately with or without prompts, they were reinforced with verbal and/or tactile social praise (e.g., great work, pat on back) at the end of the trial. If students performed steps in addition to holding the spoon but not all steps accurately with or without prompts, verbal encouragement was provided (e.g., good try, almost) at the end of the trial. Any attempts students made to finger feed were blocked. One student (Preston) frequently tried to head bang using his spoon, and this behavior was blocked as well.

After students completed their last bite of food, the interventionist encouraged students to sign *finished* and/or gently push the bowl or table away, and turned off the video camera. The interventionist assisted students to clean their hands and face with a wet wipe as needed. After cleaning hands and face, the interventionist communicated *all done/thank you/finished*, assisted students in transitioning to their next activity, and communicated *goodbye*. Teachers or parents were informed of the amount students' ate during their session and given general information

such as whether the student seemed to enjoy the session. The interventionist had no interaction with students between sessions.

Baseline. Baseline sessions afforded students the opportunity to demonstrate independent spoon use. At the beginning of a session, students were given the opportunity to taste the food as during intervention. If students rejected a food item after two tastes, a different food was provided. Students were encouraged to use their spoon with or without help in order to taste the food. Graduated guidance was not implemented during baseline sessions. Except attempts to finger feed or self-injure, errors were not blocked or corrected during baseline sessions. Students were not given specific feedback regarding errors, but were provided contingent reinforcement and encouragement as described under general procedures.

The first trial began after students had the opportunity to taste the food. Students were provided assistance to correctly orient to their spoon at the start of each trial, as necessary. Students were given the opportunity to demonstrate independent spoon use from two positions: (a) oriented to the spoon on the table next to the bowl and (b) oriented to the spoon in the bowl. First, the interventionist oriented the student to the spoon on the table and began a 5s count. If the student independently brought the spoon to the bowl, the interventionist restarted the 5s count from the time the spoon made contact with the bowl. If the student did not independently bring the spoon to the bowl during the first 5s count, then the interventionist removed the spoon from the student's hand, put the spoon in the bowl, oriented the student to the spoon in the bowl, and began another 5s count. If students independently and accurately lowered the spoon directly to the bowl at the end of a trial, the next trial began by orienting the student to the spoon in the bowl. The interventionist verbally encouraged students to use their spoon to eat, provided touch cues at the hand, blocked any attempts to finger feed, and praised and/or encouraged any correct

attempts students made to spoon-feed. One student (Preston) was also given the verbal prompt to *scoop* when oriented to the spoon in the bowl.

Adaptations to baseline. After the first three baseline sessions collected for Dallas and Finn, both students demonstrated counter-therapeutic changes in spoon use behavior and an increase in maladaptive behaviors. In light of this finding, it was decided to decrease the number of trials in baseline from 20 to 10. Due to zero-levels of behavior in baseline for all steps except holding the spoon, all baseline sessions for Preston contained only 10 trials.

Intervention. The only immediate difference between baseline and instructional sessions was the implementation of graduated guidance. Sessions began following the same procedures as in baseline, where students were first provided the opportunity to taste the food. To encourage bilateral hand use, at the start of each trial, the interventionist prompted students to make contact with the dish using the contralateral hand. Each trial began, as in baseline, when the interventionist oriented the student's hand to his spoon on the table or in the bowl. During intervention, students were encouraged to lower the spoon to the bowl instead of the table. However, if the student made an error when lowering the spoon or if the student independently lowered the spoon to the table instead of the bowl, then the next trial began by orienting the student to the spoon on the table.

To implement graduated guidance, the interventionist provided physical assistance at the hand, wrist, forearm, or elbow, and/or verbal prompts at the step level. Instruction began by providing full physical guidance with verbal prompts for every step of the task analysis. Then, the interventionist made decisions to prompt students based on students' behavior in the moment. Decisions regarding the level of support to provide were based on the goal to allow as much independence as possible while preventing errors. The level of support fluctuated in terms of

type (i.e., physical or verbal), intensity, or position of prompt in order to meet this goal. The interventionist maintained or increased her level of support in response to perceived resistance from the student, previous errors, potential for error, or pauses during correct behavior. The interventionist decreased her level of support in response to nonresistance and active participation from the student. The interventionist faded support beginning with the last step of the task analysis.

After students demonstrated independent and accurate spoon use with any step of the task analysis, the interventionist provided the opportunity to perform that step independently without verbal prompts, but kept her hand very close (i.e., shadowing). In the event the student began to make an error, the interventionist immediately provided a brief amount of physical guidance and/or a verbal prompt to the extent necessary for the student to begin the step correctly. If students did not resist guidance, the interventionist immediately faded support. The interventionist tried to provide support so that students were active participants. If students resisted physical guidance, the interventionist continued to provide physical assistance to shape the students' response to a correct response.

Adaptations to intervention. For one student (Dallas), starting on Day 32 (22nd instructional session), additional reinforcement procedures were implemented in response to dissenting behaviors from the student (i.e., stomping, slapping table). This student was given a small piece of chocolate (approximately the size of one M&M) at the beginning of each session, and offered a choice between two food items. Approximately one ounce of juice was provided after every third trial completed correctly with or without prompts. At the end of sessions, the student received a larger piece of chocolate (approximately the size of four M&Ms). All students began receiving verbal corrective feedback for common errors (e.g., banging the spoon, not

holding spoon correctly, lowering the spoon handle into the bowl, and spilling food) at the time these new reinforcement procedures were implemented with Dallas.

Generalization. The same procedures used during baseline sessions were used during generalization sessions. After Dallas and Finn began instruction in the primary instructional setting, willingness to participate in non-instructional sessions increased. Therefore, Dallas and Finn were encouraged to complete up to 20 trials in generalization sessions beginning on Day 15 and Day 21, respectively. Generalization sessions were held in the classroom or school cafeteria, and at home. The interventionist, therefore, approached the student in the setting where sessions took place, which minimized the time and distance for transition. At the beginning of a session, students were given the opportunity to taste the food as during intervention and baseline sessions. At school, if students rejected a food item after two tastes, a different food was provided. At home, participants were served preferred food items. Occasionally, Finn refused a preferred food item served at home. For those sessions, ketchup was effective to motivate Finn to eat.

Social Validity

During the final two weeks of data collection, a social validity assessment was administered to estimate adult participants' perceptions of graduated guidance and the outcomes of the study. During sessions to collect social validity data, the interventionist read aloud from a script that included a short description of graduated guidance and questionnaire. Then participants watched a series of two or three video clips taken from intervention sessions with their student/child. The interventionist was present to answer any questions. Following, each participant completed an 8-item questionnaire. Two questions addressed the perceived efficacy of the procedures in general to teach spoon-use or other functional skills to children with MDVI.

Three questions addressed the perceived need for training to implement the procedures. Two questions addressed the perceived outcome for each child. The last question allowed participants to express any negative perceptions regarding the procedures or outcomes. See the Appendix for the script and questionnaire.

Three 2-min video clips were selected by the interventionist to be representative of the beginning, middle, and end of instruction for each participant. The first video clip was selected from the first or second intervention session. The second video clip was selected from a session in which the participant had reached 75% independence on half of the steps, because this was the criterion set for introducing instruction to the next participant. The third video clip was selected from the week prior to the last week of instruction. The interventionist selected sessions within the given parameters and within which the student had not achieved the highest nor the lowest level of independence. In the final two weeks of instruction, Preston had just reached 75% independence on half of the steps and so only two video clips were selected for this participant. For each session, the total duration (in minutes) minus two minutes was entered into a random number generator to select the start time for each clip.

CHAPTER III

RESULTS

In the week prior to experimental sessions, two students (Dallas and Finn) were observed during mealtimes at school and home. Preston was observed at home and school one month prior to baseline. Following observational assessments, all experimental sessions occurred across 62 days over the course of 7 months (December – June). Baseline was interrupted for approximately 3.5 weeks for winter break in December and January. Intervention was interrupted for approximately 2.5 weeks during April for spring break. Instruction continued for each participant until their last day of school before summer break. In this section, results are reported regarding (a) descriptive assessments, (b) efficacy, (c) generalization, (d) reliability, and (e) social validity.

Descriptive Assessments

Prior to baseline, all three participants were observed during breakfast and lunch at school, and dinner at home. Minimal utensil use was observed, and independent utensil use was observed for only two students, occurring less than 4% of total observed intervals within a mealtime. Independent utensil use occurred in only one setting each for two of three students. Physical and verbal prompts were provided for all three students across settings, except for one student in the home setting. Two students were fed by adults at home, but not at school. For two students, positive reinforcement was provided in the home more frequently than school.

Dallas was observed twice at breakfast, once at lunch, and twice at dinner. Finger foods were served for dinner. A spoon or fork was available and appropriate for use during other mealtimes. Across all mealtimes, on average (ranges reported in parentheses), of the total

observational time he had access to food 98.7% (93.3-100%) of intervals and finger fed himself 77.7% (58.3-100%) of intervals. He received minimal physical (M = 4%, 0-13.3%) or verbal prompting (M = 3.3%, 0-8.3%), and no positive verbal reinforcement. Utensil use with or without prompting was observed 6% of intervals, averaged across all mealtimes (3.3-16.7%). Independent utensil use was observed during only two mealtimes (breakfast) 3.4% of the total intervals within each session. Averaged across all mealtimes, independent utensil use was observed 1.3% of total intervals. During meals when independent utensil use was observed, Dallas received support from his classroom teacher in the form of physical (13.3% and 3.3% of total intervals, for two sessions respectively) and verbal prompting (8.3% and 6.7% of total intervals, respectively).

Finn was observed once at breakfast, twice at lunch, and once at dinner. He had access to a utensil 3 out of 4 meals. Across all mealtimes, on average, of the total observational time Finn had access to food 85.6% (42.4-100%) and finger fed himself 26.3% (0-71.4%) of intervals. He received physical prompting (M = 17.4%, 0-50%) and verbal prompting (M = 9.3%, 0-34.5%) at school and home, but positive verbal reinforcement only at home (6.9% of intervals during one session). During the home visit, he was also fed by an adult 10% of intervals during a single mealtime. Utensil use with or without prompting was observed 14.2% of intervals, averaged across all mealtimes (0-50%). Independent utensil use was observed during a single mealtime (dinner) less than 4% of total intervals for the session. Averaged across all mealtimes, independent utensil use was observed less than 1% of total intervals. During dinner when independent utensil use was observed, Finn received support from a familiar adult in the form of physical (13.8% of total intervals) and verbal prompting (3.5% of total intervals). The same

mealtime was the only one in which positive reinforcement was observed (6.9% of total intervals).

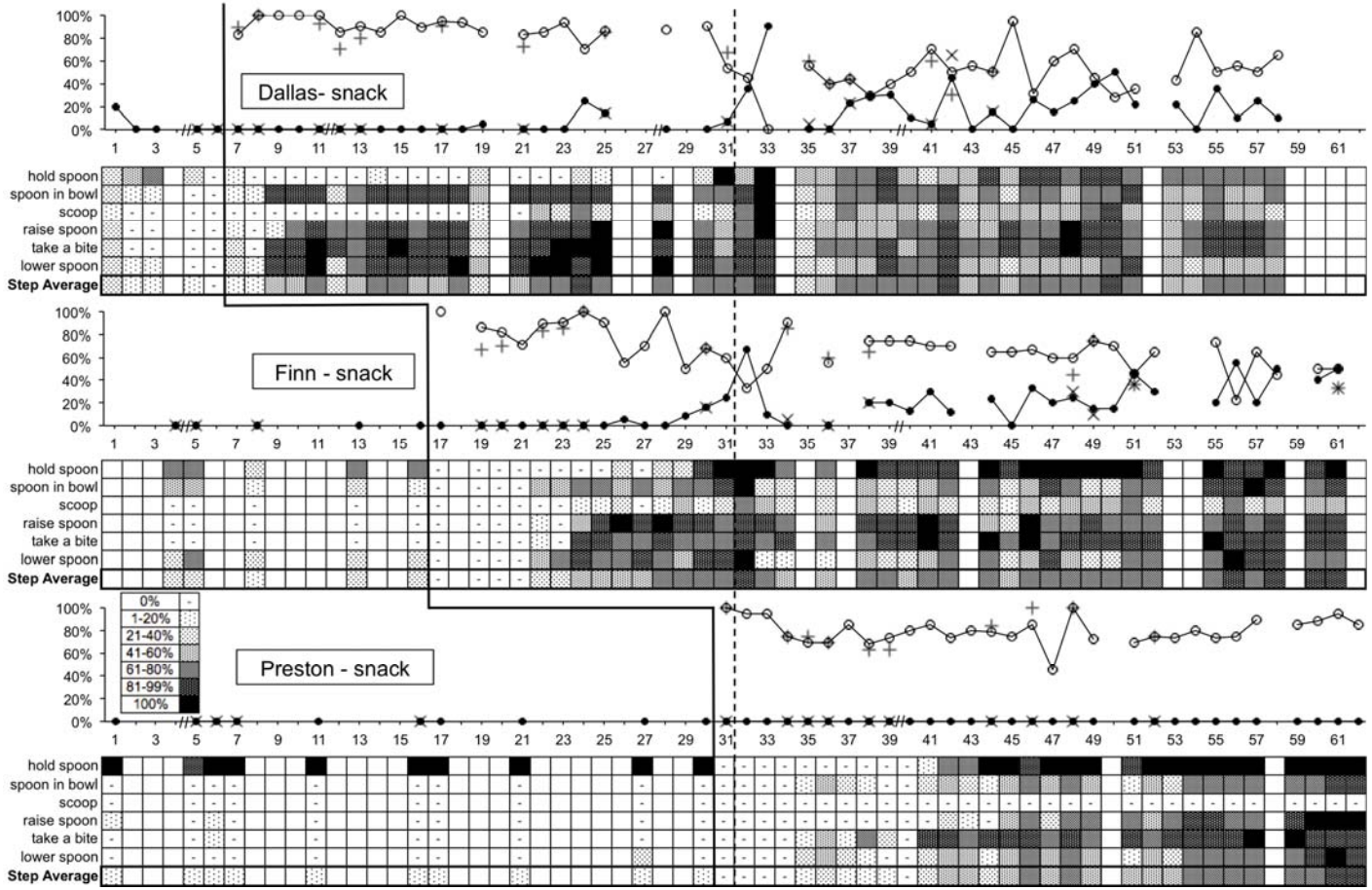
Preston was observed twice each at breakfast, lunch, and dinner. He had access to a utensil for every meal; however, an adult was always in control of the utensil. Across all mealtimes, on average, of the total observational time Preston had access to food 39.5% of intervals (range: 0-76.5%) and finger fed himself 33.2% (0-67.6%) of intervals. Preston typically did not have access to food between bites. Sometimes he had access to a plate of food when he was physically prompted to use a utensil, and sometimes a small piece of food was put on his tray for him to finger feed. Preston received physical prompting (M = 33.2%, 0-67.6%), verbal prompting (M = 30.5%, 0-86.8%), and positive verbal reinforcement (M = 11.2%, 0-28.9%) at school and home. During home visits, he was fed by an adult on average 47.8% of intervals (29.8% and 65.8%). Utensil use with prompting was observed 30.4% of intervals, averaged across all mealtimes (0-64.7%). Independent utensil use was not observed.

Efficacy of Intervention

Data on independent spoon use at the trial level (i.e., bite) and the step level (i.e., each step of the task analysis) were analyzed visually. Data for all three participants in the primary instructional setting (i.e., snack) are displayed in Figure 1. Graphs represent data at the trial level. Tables beneath each graph represent data at the step level. The last row of each table shows the average of step level data for each session. Improvement at the step level is depicted by gradual changes in the shading gradient of table cells during the intervention condition. All three students improved performance above baseline levels for one or more steps within the first 3-5 sessions after intervention began. Scooping proved the most difficult step to master. Two students showed increases in independent scooping above baseline levels within 7-15 sessions. Two students

began showing improvement at the trial level above baseline levels within 9-17 sessions. Overall, trial level data show a therapeutic trend in performance for these two students (Dallas and Finn) during the intervention condition, which was absent during baseline. Student data at the step and trial level were highly variable, and students did not reach mastery criterion.

Figure 1. Results for Efficacy.



Note. Percentage of trials completed correctly, prompted (open circles) and unprompted (closed circles), are graphed for three participants during snack. Days are represented on the x-axis. Second observer data are also graphed for percentage of prompted (+'s) and unprompted (x's) correct trials. Below each graph, in table format, the range of percentage of correct unprompted trials are indicated by step. The legend indicates the percentage range associated with each shade grading. Double hash marks indicate a break from instruction greater than 10 days. The solid line indicates change from baseline to intervention. The vertical dashed line indicates a change in choice, reinforcement, and error feedback procedures for Dallas, and error feedback procedures for Finn and Preston.

Dallas. Mean percentage of independent trials and responses at the step level completed by food item and condition are reported in Table 2. At the start of the study in mid-December, Dallas had minimal skill with using a spoon. For the first baseline session, Dallas used a spoon to independently eat applesauce 20% of opportunities. A different warm meal (e.g., ravioli) was used each day for the remainder of baseline sessions. During the second baseline session, Dallas completed *put spoon in bowl* and *lower spoon* less than 20% of the time, while the *scoop* dropped to 0% accuracy. He was observed to raise an empty spoon to his mouth frequently. Over five sessions, a counter-therapeutic trend and then stability at zero-levels was detected for all steps of spoon use except *hold spoon* and for trial level data.

Table 2

Mean Percentage of Independent Trials and Responses at the Step Level by Food Item and Number of Sessions Foods were Used by Condition in the Primary Instructional Setting (Snack) for Dallas

	Baseline			Intervention		
Food Item	M (trial)	M (step)	N	M (trial)	M (step)	N
Ravioli	0%	5%	1	0%	50.4%	2
Chicken dumplings	0%	18.2%	1	0%	45%	1
Chicken with rice	0%	0%	1	0%	55.2%	1
Spaghettios	-	-	-	5%	35%	1
Beef stew	0%	10.8%	1	0%	66%	2
Chicken noodle	-	-	-	0%	35.9%	2
Lasagna	-	-	-	3.6%	75.5%	4
Beans and franks	-	-	-	0%	57.6%	2
Warm meal total:	0%	8.5%	4	2.77%	53.43%	15
Pudding	-	-	-	33.6%	74%	8
Yogurt	-	-	-	23.3%	69.4%	3
Applesauce	20%	27.5%	1	10%	61.7%	1
Canned fruit	-	-	-	16.0%	63.4%	17
Jello	-	-	-	0%	15.8%	1
Strawberries	-	-	-	0%	53.3%	1
Cold/cool meal total:	20%	27.5%	1	19.12%	64.8%	31
Warm and cold meal total:	4%	12.3%	5	13.3%	61.09%	46

Dallas participated in 46 days of instruction during snack between mid-January and late-May. Dallas used a greater variety of foods during instructional sessions than any other student. Jello was used during the first instructional day (Day 7), and then warm meals were used for the following 15 out of 17 days (Days 8-25). Pudding was used on Days 16 and 24. Beginning Day 28, warm meals were no longer available for snack; therefore, canned fruit (17 days), pudding (6 days), yogurt (3 days), fresh strawberries (1 day), and applesauce (1 day) were served for the remainder of the study. During the third session after introducing GG (Day 9), independence for *put spoon in bowl, take a bite,* and *lower spoon* improved above baseline levels, to over 80% of opportunities. On the 10th day of instruction (Day 16), Dallas had maintained at least 75% independence for four steps (*put spoon in bowl, raise spoon, take a bite,* and *lower spoon*) for four consecutive days. On the 13th day of instruction (Day 19), Dallas took his first independent bite of food (spaghettios) including the *scoop* (5% independence) under intervention conditions. On the 15th day of instruction (Day 22), he independently *scooped* beef stew with 50% independence. On Day 24, Dallas completed a greater percentage of independent trials (25%) eating two different foods (rice with chicken, pudding) under intervention conditions as he did on the first day of baseline eating applesauce (20%). Between the 18th and 19th instructional day (Days 25 and 28, respectively), Dallas was absent due to illness. Upon his return to school on Day 28, food items available changed from warm meals to canned fruit, pudding, etc. Dallas had returned to zero-level independence at the trial level on Day 28 and then reached his highest level of independence throughout the entire study on Day 33. His three highest levels of independence at the trial level were achieved eating pudding on Days 33 (90%), 42 (45%), and 50 (50%). After assistance had been faded for all steps for at least part of one session (starting

Day 19), Dallas returned to 0% independence at the trial level on 10 different instructional days. Pudding was served 2 of those 10 days.

Finn. Mean percentage of independent trials and responses at the step level completed by food item and condition are reported in Table 3. At the start of the study, Finn demonstrated independence for *hold spoon* 65-80% of opportunities and *lower spoon* 30-40% of opportunities. He did not complete an independent *scoop*. Because Finn did not scoop independently, he was not observed to raise a loaded spoon to his mouth or take a bite either. However, like Dallas, Finn was frequently observed to raise an empty spoon to his mouth. During baseline, Finn's data at the trial level remained at zero levels. His data at the individual step level were stable at the time of introducing graduated guidance. Baseline data were collected from mid-December to mid-February using a variety of warm and cold/cool snacks.

Table 3
Mean Percentage of Independent Trials and Responses at the Step Level by Food Item and Number of Sessions Foods were Used by Condition in the Primary Instructional Setting (Snack) for Finn

	Baseline			Intervention		
Food Item	M (trial)	M (step)	N	M (trial)	M (step)	N
Meatballs	-	-	-	0%	55.8%	1
Diced chicken	0%	22.2%	1	0%	49.2%	1
Spaghettios	0%	14.5%	1	-	-	-
Chicken noodle	0%	23.3%	1	-	-	-
Warm meal total:	0%	20%	3	0%	52.5%	2
Pudding	-	-	-	19.1%	60.2%	12
Yogurt	-	-	-	35.1%	2.4%	2
Applesauce	0%	30.8%	1	0%	18.3%	3
Canned fruit	0%	24.2%	1	17.8%	63.5%	19
Cold/cool meal total:	0%	27.5%	2	17.6%	59.7%	36
Warm and cold meal total:	0%	23%	5	16.7%	59.3%	38

Finn participated in 38 days of instruction during snack between mid-February and early-June. During intervention, Finn ate primarily cold/cool snacks (36 days) and mostly canned fruit (19 days). On Day 27 and 36, Finn ate meatballs and diced chicken, respectively. Meat was a highly preferred food item. From the start of intervention, full manual guidance was provided for every step for 4 consecutive days. On the 5th day of instruction (Day 22), the interventionist started fading prompts, and minimal independence (11%) above baseline levels was observed for *raise spoon* and *take a bite.* By Day 23, independence for *put spoon in bowl* and *lower spoon* was well over baseline levels at 60% and 70% of opportunities, respectively. On the 7th instructional day (Day 24), Finn completed a single independent *scoop* (5%). On the 9th instructional day (Day 26), he took his first independent bites of food (pudding) including the *scoop* (22% independence). By the 13th instructional day (Day 30), he was completing at least half of the steps (either *hold spoon, put spoon in bowl*, *raise spoon, take a bite*, or *lower spoon*) with at least 75% independence for 4 consecutive sessions. On Day 32, Finn achieved his highest level of independence throughout the entire study. His three highest levels of independence at the trial level were achieved eating pudding, yogurt, and canned peaches, on Days 32 (66.7%), 56 (55.6%), and 58 (50%), respectively. After Finn took his first bite independently on Day 26, he returned to 0% independence at the trial level on 5 different instructional days, with a variety of foods. Meat, although a highly preferred food item, was used on two of those days.

Preston. Mean percentage of independent trials and responses at the step level completed by food item and condition are reported in Table 4. At the start of the study, Preston was not completing any steps of spoon use, except *hold spoon*. Across 10 baseline sessions, Preston demonstrated *raise spoon* only twice. Frequently, Preston raised an empty spoon to his mouth directly from the table. His data at the individual step level and at the trial level were consistent

across nearly all baseline sessions, which were held from mid-December to mid-March. Throughout the study, Preston ate only cold/cool foods during snack of similar consistency throughout the course of the study.

Table 4

Mean Percentage of Independent Trials and Responses at the Step Level by Food Item and Number of Sessions Foods were Used by Condition in the Primary Instructional Setting (Snack) for Preston

	Baseline			Intervention		
Food Item	M (trial)	M (step)	N	M (trial)	M (step)	N
Pudding	0%	18.4%	4	0%	46.9%	15
Yogurt	-	-	-	0%	59.1%	6
Applesauce	0%	16.7%	5	0%	4.3%	1
Canned fruit	-	-	-	0%	0%	1
Jello	0%	16.7%	1	-		-
Cottage cheese	-	-	-	0%	0%	1
Cucumber	-	-	-	0%	28.9%	2
Banana/Sweet potato	-	-	-	0%	36.3%	4
Meal total:	0%	17.38%	10	0%	42.16%	30

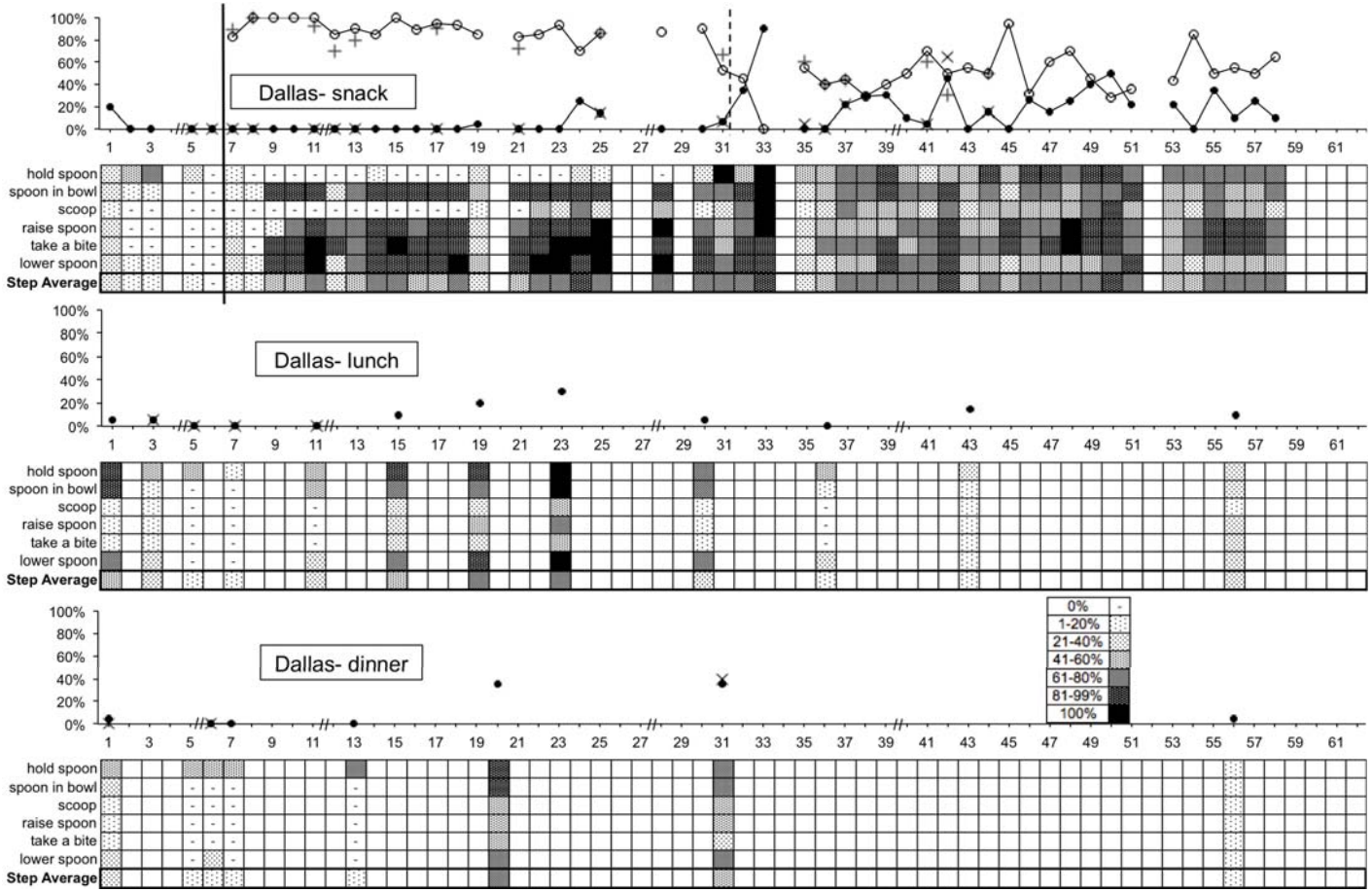
Preston participated in 30 days of instruction during snack between mid-March and early-June. From the start of intervention, full manual guidance was provided for every step for 4 consecutive days. On the 5th day of instruction (Day 35), assistance began to be faded. During Day 35, independence for *put spoon in bowl*, *take a bite*, and *lower spoon* improved above baseline levels. Between Days 39-40, no instructional sessions were held for 2.5 weeks due to a spring break. On Day 40, full manual guidance was provided for all steps and immediately faded in subsequent sessions. Accuracy with all steps except the *scoop* continued to improve

throughout the course of intervention. The school year ended before assistance on the scoop could be faded completely.

Generalization

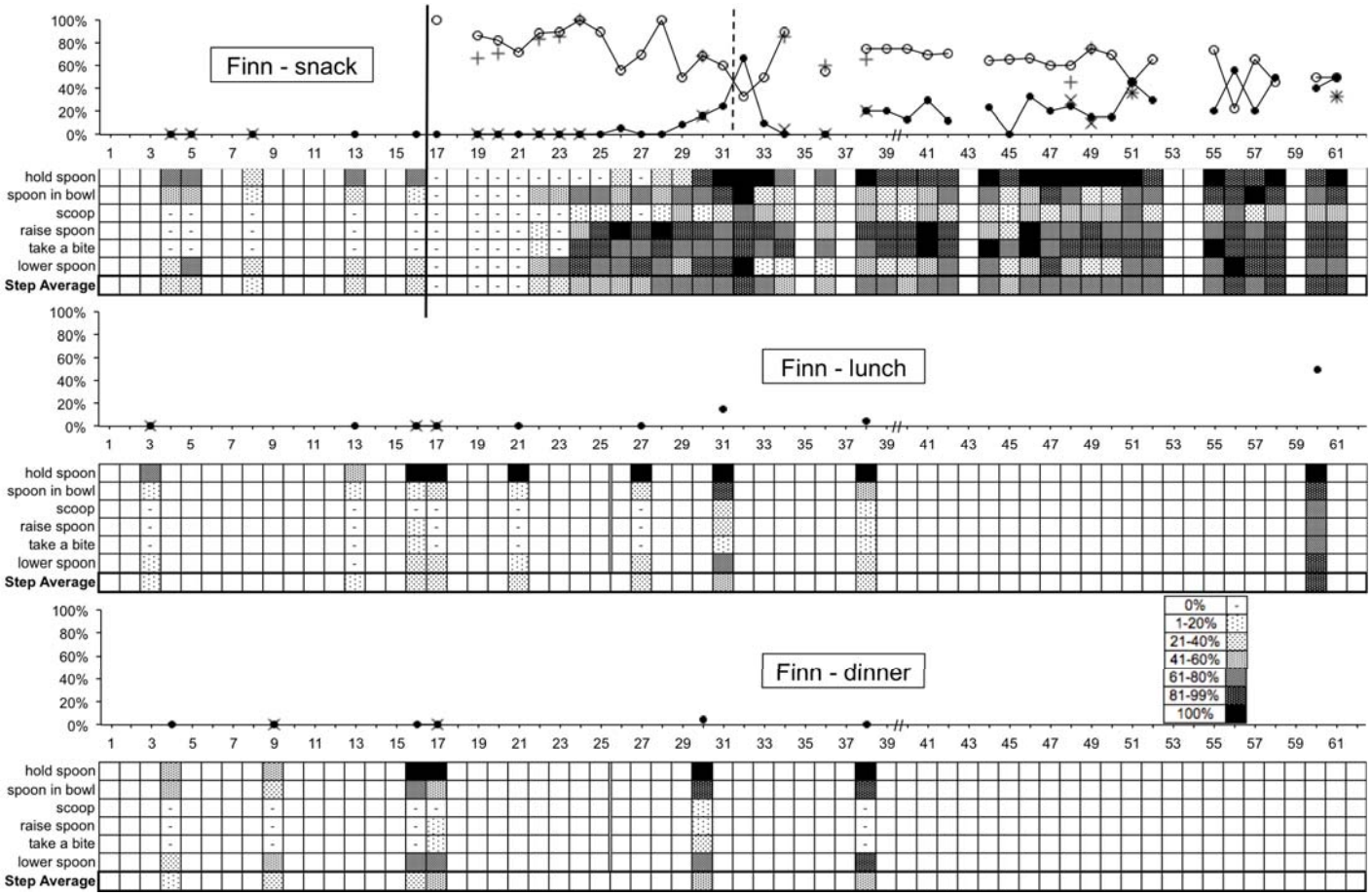
Results for generalization to secondary and tertiary settings were graphed by participant and are displayed in Figures 2-4. Generalization data for two students (Dallas and Finn) show increases in specific steps of spoon use and improved independence at the trial level after intervention was implemented in the primary instructional setting. However, for both participants, generalization data were variable, and improvements initially observed in generalization settings did not maintain over the course of the study. Data for one student (Preston) show little or no generalization of spoon use from the primary instructional setting to secondary or tertiary settings. For Preston, very small improvements (i.e., 5%) were observed for two steps only (i.e., *lower spoon* and *put spoon in bowl*) during only the last two breakfast sessions. Generalization data for Dallas and Finn are presented below.

Figure 2. Generalization Results for Dallas



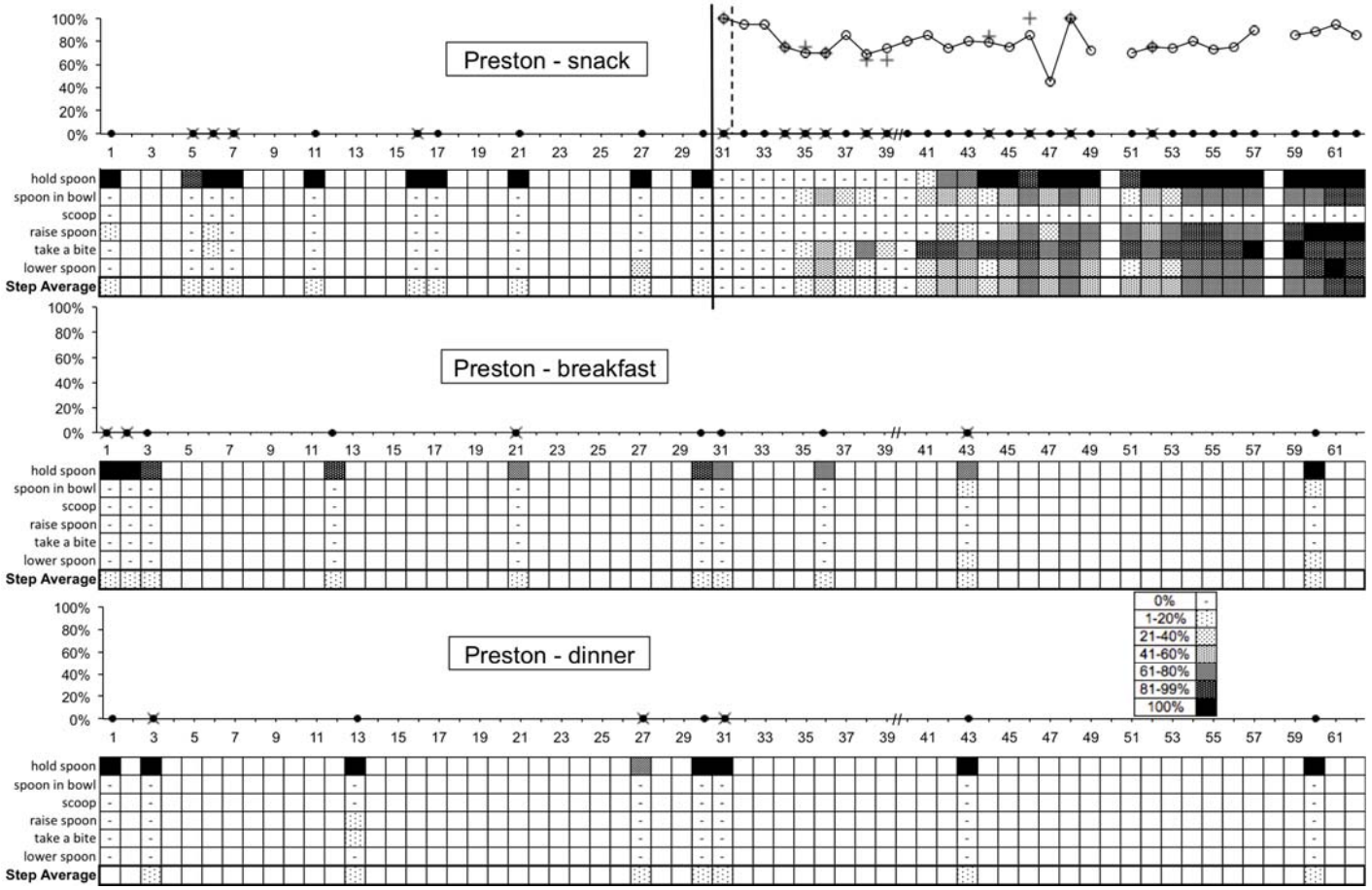
Note. Percentage of trials completed correctly, prompted (open circles) and unprompted (closed circles), are graphed for Dallas across three settings. Days are represented on the x-axis. Second observer data are graphed for percentage of prompted (+'s) and unprompted (x's) correct trials. Below each graph, in table format, the range of percentage of correct unprompted trials are indicated by step. The legend indicates the percentage range associated with each shade grading. Double hash marks indicate a break from instruction greater than 10 days. The solid line indicates change from baseline to intervention. The vertical dashed line indicates a change in choice, reinforcement, and error feedback procedures.

Figure 3. Generalization Results for Finn



Note. Percentage of trials completed correctly, prompted (open circles) and unprompted (closed circles), are graphed for Finn across three settings. Days are represented on the x-axis. Second observer data are graphed for percentage of prompted (+'s) and unprompted (x's) correct trials. Below each graph, in table format, the range of percentage of correct unprompted trials are indicated by step. The legend indicates the percentage range associated with each shade grading. Double hash marks indicate a break from instruction greater than 10 days. The solid line indicates change from baseline to intervention. The vertical dashed line indicates a change in error feedback procedures.

Figure 4. Generalization Results for Preston.



Note. Percentage of trials completed correctly, prompted (open circles) and unprompted (closed circles), are graphed for Preston across three settings. Days are represented on the x-axis. Second observer data are graphed for percentage of prompted (+'s) and unprompted (x's) correct trials. Below each graph, in table format, the range of percentage of correct unprompted trials are indicated by step. The legend indicates the percentage range associated with each shade grading. Double hash marks indicate a break from instruction greater than 10 days. The solid line indicates change from baseline to intervention. The vertical dashed line indicates a change in error feedback procedures.

Dallas. Before GG was introduced with Dallas in the primary instructional setting on Day 7, data taken during lunch and dinner showed a counter-therapeutic trend in independent spoon use. Following implementation of GG during snack, generalization data were collected during lunch approximately once per week, or every 4 instructional days, until Day 23. After Day 23, Dallas went through a period of frequent absences from school, during which lunch sessions were held less frequently. Generalization data were collected during dinner approximately once every 2-3 weeks until Day 31. Because Dallas had not reached mastery criterion in the primary instructional setting and his data continued to be highly variable, lunch sessions were discontinued after Day 43 and dinner sessions after Day 31, until the last week of instruction.

Data comparisons for generalization were made to the highest level of independence achieved in the same setting prior to Day 7. No immediate improvements in spoon use at the step or trial level were observed. During lunch: (a) on Day 15, Dallas showed improved independence with the *scoop, raise the spoon,* and *take a bite;* (b) on Day 19, he also showed improvement with *lower spoon*; and (c) on Day 23, he showed improved independence with all steps of spoon use. Between Days 15 and 23, Dallas also showed improved independence at the trial level. Improvements at the step and trial level were subsequently lost until the last week of data collection when Dallas regained minimal improvements with *scoop, raise spoon,* and *take a bite*. During dinner on Days 20 and 31, Dallas showed improvements with all steps and at the trial level. Data collected during the last week showed independence had regressed to baseline levels.

Finn. Before GG was introduced with Finn in the primary instructional setting on Day 17, data at lunch for *lower spoon* were slightly variable, and slight improvements for *raise spoon* and *take a bite* were observed. During dinner a small accelerating trend for *put spoon in bowl* and *lower spoon* was observed. Data at the trial level and for other steps of spoon use at lunch

and dinner were stable. Following implementation of GG during snack, generalization data were collected during lunch approximately every 1-2 weeks, and only three times during dinner, until Day 38. Because Finn had not reached mastery criterion in the primary instructional setting and his data were highly variable, generalization sessions were discontinued after Day 38. In the last week of instruction, generalization data were collected during lunch for one session.

Data comparisons for generalization were made to the highest level of independence achieved in the same setting prior to Day 17. During lunch, immediate and ongoing improvements were observed for *put spoon in bowl* and *lower spoon*; however data for these two steps were variable prior to Day 17. Immediate improvements were not observed for other steps or trial level data during lunch. After Day 31, additional improvements were observed for *scoop, raise spoon,* and *take a bite*, as well as overall independent spoon use at the trial level. For dinner, improvement with *raise spoon* and *take bite* was observed during Day 17 and 30. Improvement with the *scoop* was only observed during Day 30. On Day 38, *scoop, raise spoon,* and *take a bite* returned to zero levels. During dinner, Finn's data for *put spoon in bowl* and *lower spoon* showed a positive trend prior to Day 17 that stabilized until Day 38 when he showed improved independence again.

Reliability

Procedural fidelity. Procedural fidelity data were collected for 100% of sessions for all participants across all conditions and settings. Mean fidelity scores, across all behaviors and sessions, for Dallas were 97.5% (95-100%), 97.8% (94.7-100%), 97.6% (95.7-99.6%), and 97.5% (95-100%) for baseline, intervention, lunch, and dinner, respectively. Mean fidelity scores for Finn were 98.4% (96.8-100%), 98.1% (91.3-100%), 98.3 (96.1-100%), and 98.3 (96.8-100%) for the baseline, intervention, lunch, and dinner, respectively. For the same four conditions and

settings, mean fidelity scores for Preston were 99.6% (98.6-100%), 97.9% (95-100%), 99.6% (95-100%), and 99.6% (97.9-100%).

Fidelity was 100% for all sessions, across all conditions and settings, for all participants for the following behaviors: (a) bowl with food positioned in front of student at table's edge, (b) student oriented to spoon (touch cue/physical guidance if student already has spoon in hand), and (c) student encouraged to feed himself with or without prompts. The following behaviors only dropped below 100% infrequently: (a) 5s time delay provided from beginning of trial for student to demonstrate skill with or without prompts (95%, 1 session), (b) physical contact maintained if student resisted step with prompting (95%, 1 session), (c) student was not blocked from bringing spoon to mouth (95%, 3 sessions), (d) correct behavior was not blocked (90%, 1 session; 80%, 1 session), (e) prompting level decreased from previous trial only if student did not resist action with prompt on previous trial (95%, 4 sessions; 90%, 2 sessions; 88%, 1 session), and (f) attempts to finger feed or self injure were immediately blocked (95 %, 3 sessions; 90%, 3 sessions; 85%, 2 sessions). Other behaviors for which the mean fidelity score was above 90% for each condition, setting, and participant, included: (a) prompting level increased from previous trial only if student had an error on current or previous trial, was about to make an error, or paused during current or previous trial (mean range: 94.9-100)%); (b) student oriented to spoon in the bowl (or spoon was already in bowl) and given five second time delay to demonstrate skill from scoop with or without prompts (91.7-100%); and (c) contingent praise provided if student completed all steps without error (92-100%).

Two behaviors were implemented with relatively poor fidelity. Fidelity with which necessary physical and/or verbal guidance was provided to assist a student to complete the trial without error was only relevant under intervention conditions. During intervention in the primary

instructional setting, mean fidelity for this behavior was 88.4% (60-100%), 88.4% (53.8-100%), and 80.1% (53-100%) for Dallas, Finn, and Preston, respectively. Fidelity with which encouragement was provided if a student completed some but not all steps without error was highly variable throughout all conditions, setting, and participants. For Dallas, mean fidelity for this behavior was 76.7% (50-100%), 92.5% (70-100%), 71.9% (45-100%), and 74.3% (36.8-100%) for baseline, intervention, lunch, and dinner, respectively. For Finn, mean fidelity for this behavior was 82.7% (60-100%), 94.8% (70-100%), 79% (55-100%), 84.3% (55.6-100%) for baseline, intervention, lunch, and dinner, respectively. For Preston mean fidelity for providing encouragement was 98% (80-100%), 96.1% (89-100%), 96% (80-100%), and 98.8% (80-100%) for baseline, intervention, lunch, and dinner, respectively. For Finn and Dallas, fidelity with which the interventionist provided encouragement was lower under baseline and generalization conditions, in which errors were more frequent.

Interrater reliability. Interrater reliability data were collected for procedural fidelity and the dependent variable for at least 33% (range: 33-60%) of sessions for all participants across all conditions and settings. Also, second observer data for the dependent variable were graphed and displayed in Figures 1-4. Mean reliability for the dependent variable at the step level for Dallas was 95.9% (91.7-100%), 92.5% (70.8-100%), 84.2% (75-93.3%), and 88.5% (85-94.4%) for baseline, intervention, lunch, and dinner, respectively. For trial level data, mean reliability was 100%, 91.89% (60-100%), 97.5% (90-100%), and 98.3% (95-100%), respectively. Mean reliability scores at the step level for Finn were 84.2% (75-94.4%), 92.4% (82.5-98%), 92.2% (90-96.7%), and 92.3% (91.2-93.3%) for the baseline, intervention, lunch, and dinner, respectively. For trial level data, mean reliability for Finn was 100% for baseline, lunch, and dinner; and 87.7% (71.4-100%) for intervention. Mean reliability scores at the step level for

Preston were 99.2% (98.3-100%), 93% (87.5-100%), 97.9% (96.7-100%), and 97.8% (96.7-98.3%) for baseline, lunch, and dinner, respectively. For trial level data, reliability scores were 100% for baseline, lunch, and dinner, and 92.8% (84.2-100%) for intervention.

Social Validity

Social validity data were collected from parent(s) and the classroom teacher of each student. In addition, the occupational therapist working with Finn and Preston completed just one social validity form after viewing videos for both children. For Dallas and Preston, parents filled out one form after viewing the videos together. For Finn, only the mother completed social validity; however, generalization sessions were held in the father's home. In total, 9 adults completed 7 questionnaires for social validity. Participants answered the greater majority of questions with positive regard for the procedures and outcomes. Results are displayed in Table 5.

Table 5
Results of Social Validity Questionnaire

	Respondents by Student						
	Dallas		Finn		Preston		Finn & Preston
Social Validity Questions	Parents	Teacher	Mother	Teacher	Parents	Teacher	OT
1. In general, do you think the procedures shown in the video would be effective to teach spoon use to children with blindness and additional disabilities?	2	2	2	2	2	1	2
2. In general, do you think the procedures shown in the video would be effective to teach other types of functional skills to children with blindness and additional disabilities?	2	2	2	2	2	1	2
3. With training, do you think you could easily implement these procedures with accuracy?	1	2	2	2	2	1	2
4. Without training, do you think you could easily implement these procedures with accuracy?	0	-1	-1	1	2	0	NA
5. Would you be interested in receiving training to learn how to implement these procedures?	2	NA	2	1	2	1	NA
6. In your opinion, do you think that these procedures were necessary to teach spoon use to your child?	2	1	2	0	2	1	2
7. In your opinion, do you think that the procedures were or would be enough to teach spoon use to your child?	2	1	2	1	2	0	2
8. Is there anything about the procedures that you don't like or would do differently? If yes, please explain.	No	Yes	No	No	No	No	Yes

Note. Responses were converted to a numerical scale: strongly disagree (-2), disagree (-1), neutral (0), agree (1), strongly agree (2). NA = not applicable. Shading indicates neutral and negative responses.

Only 2 participants, both professionals, expressed they would do anything differently. Dallas's classroom teacher indicated she might include additional steps or skills as instructional targets such as maintaining optimal positioning of the elbow or other elements of correct bite that would require consultation with related services. The occupational therapist critiqued the orientation of the scooper lip of the child's bowl in 1 of the 5 videos viewed. Those same two professionals answered not applicable for questions regarding perceived need for training and verbally indicated they were already trained in the procedure. In summary, (a) 8 of 9 participants strongly agreed to questions about efficacy of the procedures, (b) all participants agreed or strongly agreed they could implement the procedures easily with training, (c) two participants agreed or strongly agreed they could implement procedures without training, (d) all participants expressed interest in receiving training (except those indicating they already had training), (e) all but one teacher thought the procedures were necessary for the student to learn spoon use, and (f) all but one teacher thought the procedures alone would be enough to teach spoon use.

CHAPTER IV

DISCUSSION

Of the research literature on response prompting strategies, few studies have used GG to teach students with disabilities. A small fraction of previously published studies targeted eating skills or included participants with VI. Only two other studies were found that published results of using systematic prompting procedures (CTD or SLP) to teach spoon use to students with blindness (Collins et al., 1991; Sisson & Dixon, 1986a). This study was the first in depth analysis of graduated guidance to teach spoon use to children with blindness.

Although none of the students reached mastery criteria, all three students showed some improvement at the step level (as illustrated in Figure 1 by darker shading for steps in intervention as compared to baseline). Only two students improved independence at the trial level. Because students did not reach mastery with spoon use during snack, instruction was not implemented at lunch or dinner. Generalization data collected during lunch and dinner showed limited improvement for only two students across settings. Instruction continued until the end of the school year; therefore, maintenance of learning could not be assessed. In this section, results are discussed in terms of (a) efficacy of the intervention to teach spoon use, (b) generalization of learning, (c) implications for practice, and (d) limitations and future research needs. Comparisons will be made to similar published studies where appropriate, especially Collins et al. (1991) because the procedures, measurement system, and data reporting were similar to this study.

Efficacy of Graduated Guidance

The primary research question for this study concerned the efficacy of GG to teach spoon use. As described in the design section of this manuscript, changes in step level data would demonstrate experimental control, and demonstration of experimental control would be necessary but not sufficient to infer efficacy of graduated guidance. Students would also need to reach a pre-determined mastery criterion to establish efficacy of the intervention. Furthermore, according to Horner et al. (2005), determination of a functional relation in single case design may be compromised if the following are true: (a) long latency between introduction of an independent variable and change in the dependent variable was observed, (b) changes in mean levels of behavior between baseline to intervention were small, and (c) trends in behavioral change were unpredictable. Results will be summarized for step level data, trial level data, and overall variability to determine whether a functional relation was demonstrated.

Step level data. Increases in independent spoon use at the step level were observed for three students after introducing GG. As predicted, changes occurred after a period of latency due to the provision of manual guidance. Students showed improvement with later steps of the task analysis first, not surprisingly, because the interventionist faded prompts beginning with the last step. For Dallas, improvements above baseline levels were first observed on the 3rd instructional day for the following steps: *put spoon in bowl, take a bite*, and *lower spoon*. For Finn, improvements above baseline levels were observed for *raise spoon* and *take a bite* on the 5th instructional day, after 4 days of full physical guidance. For Preston, improvements were observed for *put spoon in bowl* by the 5th instructional day, after 4 days of full physical guidance. A comparable number of sessions, but fewer trials, of full physical guidance were

provided to the student with blindness in Collins et al. (1991; 5 sessions or 50 trials) as for students in the present study (4-5 sessions or 80-100 trials).

Trial level data. A positive change in trend of independent spoon use at the trial level was apparent for two students. However, no students met mastery criteria. Additionally, trial level data for Dallas and Finn frequently returned to zero levels throughout intervention. For Dallas, after trial data first exceeded baseline levels on Day 24 (15th instructional day), independence dropped to 0% on 7 of 29 instructional days. For Finn, after trial data first exceeded baseline levels on Day 26 (9th instructional day), independence dropped to 0% on 5 out of 29 instructional days. We cannot know whether additional instructional time or more intensive instruction across multiple settings would have been sufficient to get students to mastery with spoon use.

Comparison to Collins et al. (1991). Collins et al. (1991) used a different systematic prompting procedure (CTD) and unfortunately did not publish trial level data. However, they did report that both students in their study reached mastery, set at 90% independent and accurate trials for at least one session, within 31 or 34 sessions for a student with low vision and a student with blindness, respectively. After reaching this criterion, researchers thinned reinforcement after each step to once per trial. The student with blindness reached mastery on the new thinned reinforcement schedule (the same schedule implemented throughout the course of the present study) after 29 more sessions (63 total instructional sessions). The student with low vision completed 8 sessions (39 total instructional sessions) on the new reinforcement schedule, but did not reach mastery criterion before the end of the school year. It appears that throughout the course of the study, student performance was highly variable and neither student maintained mastery criterion for consecutive sessions. The lack of data reporting at the trial level limits

comparison with the present study; however, only one student (Dallas) in the present study reached 90% independent and accurate trials for a single session (27th instructional session). Students in the present study participated in fewer instructional sessions (n = 30-46) than the student with blindness in Collins et al. (n = 63).

Variability. For Dallas and Finn, who improved spoon use at the trial level in this study, spoon use was highly variable throughout the study. Several factors may have contributed to this variability. First, variability in the foods used across sessions probably contributed to variability of performance. However, it is important to note that accuracy varied for the same food items, so this factor does not account for all of the variability. Second, history effects may have been caused by snow days, seasonal allergies, and developmental or medical factors described earlier. Third, low muscle tone and tactile sensitivity may have been factors interfering with students acquiring independence with utensils at mealtime, which GG did not address. Fourth, variability may be explained by student learning characteristics and/or GG may not be sufficiently strong to produce long-term effects. That is, after students learned to independently perform a step of spoon use and prompts were faded for a length of time, learning was not well-maintained. Fifth, a possibility, supported by the interventionist's subjective observations, is that students became averse to prolonged periods of physical prompting, which over time may have had a punishing effect on accurate spoon use. Sixth, high rates of error were observed. The occurrence of errors is considered an inefficient way to learn and is incompatible with the definition of GG. Likewise, students' participation in highly controlled generalization sessions with the interventionist may have been confusing for students while instruction was ongoing in the primary setting. Generalization sessions provided opportunities for error and may have contributed to the variability in student data throughout the study.

Finally, motivation to use a spoon may have been a factor in student variability. Especially, Dallas and Finn had several years to adopt maladaptive mealtime habits, such as finger feeding. Perhaps variability in the data is a reflection of the process of adaptation to higher expectations imposed by the interventionist. Inconsistent expectations to use a spoon across mealtimes at school and at home throughout the course of the study likely affected students' motivation as well. This explanation is supported by findings from an early study in which a young girl with disabilities did not respond to prompting instruction for spoon use until finger feeding was blocked (O'Brien et al., 1972). The student quickly abandoned spoon use after the study ended. Albin (1977) completely interrupted students' ability to finger feed by controlling the type of food provided across all mealtimes throughout the course of intervention. Finger foods were systematically reintroduced to students only after utensil use was mastered. In the current study, Dallas' parents indicated at the end of the study that they had purposely prepared finger foods for their son for convenience sake so that Dallas could be independent. They indicated a desire to set new expectations for his behavior to build on the momentum gained by participating in this study, but they also acknowledged that it would require a dramatic shift in the mealtime culture of their home.

Determination of a functional relation. GG appears to have had a positive impact on three students' independent spoon use. After introducing GG, within 1-3 sessions after the interventionist began to fade physical guidance, behavioral change was observed for one or more steps above baseline levels for all three students. However, the gradual increase in independent spoon use at the trial level for only two students also suggests limited effectiveness of the procedure to teach students to achieve mastery criteria. Additionally, latency and ongoing

behavioral variability detract from evidence of a functional relation between the independent and dependent variables. Therefore, the results of this study provide weak evidence of a functional relation between GG and independent spoon use for children with MDVI.

The objective results of this study suggest GG may be beneficial but not sufficient to teach independent spoon use to students with MDVI to mastery levels. Subjectively, seven of the nine adults who were familiar with the child participants and completed social validity questionnaires expressed that the procedures were necessary and effective to teach spoon use to this group of children. Additionally, one teacher indicated the procedures were effective but perhaps unnecessary (indicated by a neutral response). Preston's teacher indicated the procedures were necessary but perhaps would not be enough to teach him independent spoon use.

Generalization of Learning

Generalization of learning was examined by intermittent probing of spoon use under baseline conditions at school during either breakfast or lunch and at home for each child. Only two of three students generalized spoon use to lunch and/or dinner. Dallas and Finn showed little improvement at the step and trial level at lunch, Dallas showed similar limited improvement at dinner sessions after GG was implemented in the primary instructional setting. Finn showed limited improvement at the step level during dinner sessions. Both students' generalization data were highly variable. Dallas demonstrated a greater degree of generalization to both settings than Finn. Finn's generalization to additional settings was minimal except in the last week of data collection during a single lunch session. Preston did not generalize spoon use at either the step or trial level. Students who improved independence with all steps of spoon use showed generalization to additional settings without direct instruction (i.e., Dallas and Finn). The student

who did not reach independence with every step, did not generalize learning to additional settings (i.e., Preston).

For Dallas, independent spoon use at the trial level during lunch and dinner sessions without instruction exceeded performance during snack sessions with instruction. This finding makes sense because Dallas received prompts for at least part of each trial during snack sessions until Session 19 (13th instructional day). If any prompts were given (verbal or physical) at any point during a bite, the trial was coded as prompted. However, while Dallas was being heavily prompted during snack; during lunch and dinner, he was given the opportunity to demonstrate independent spoon use. Higher levels of independent spoon use in generalization sessions than during snack may suggest that the interventionist provided too much prompting during snack. However, as the interventionist faded her support during snack, errors increased. Interestingly, once independent spoon use at the trial level began to improve during snack, performance declined at both the step and trial level in generalization sessions. This finding supports the previously discussed hypothesis that without instruction, learning is not well-maintained. Maintenance data from a student who achieved mastery criteria in Collins et al. (1991), showed a quick decline in skill, which manifest within two sessions. In this case, generalized learning followed the same data pattern observed in the primary instructional setting. That is, initial gains in independent spoon use were largely lost by the end of the study.

Previous research revealed the importance of programming for generalization and maintenance (e.g., O'Brien et al., 1972). One popular strategy to promote generalization of learned skills is to use multiple exemplars of materials during instruction. However, this type of programming may also lead to high variability in student behavior and necessitate additional instructional time. Unfortunately, variability and long periods of instruction are antithetical to

detecting change due to treatment in single case research. In the present study, it is unclear the extent to which the use of multiple food exemplars contributed to variability in independent and accurate spoon use.

Implications for Practice

The purpose of conducting this study was to identify an instructional method to help students achieve greater independence at mealtime. Two approaches to help students achieve greater independence are to (a) provide instructional support to teach specific mealtime skills, or (b) arrange the environment to meet students at their current skill level. Descriptive assessments completed before experimental sessions began showed student behavior was highly variable across different settings and support persons present; suggesting that the type and level of support and expectations for student behavior have a strong impact on the performance of the student. Overall, low levels of prompting and reinforcement may mean that adults had low expectations for students in this study to use utensils. However, to reiterate, levels of prompting and reinforcement varied significantly across settings and support, which suggests that expectations likely varied as well. The youngest student in the study received the most instructional support during observations.

These findings may not surprise professionals who work with children with MDVI. Consistent and ongoing support is typically required for long periods of time, and incremental improvements in behavior provide little reinforcement to sustain long-term treatment for students with the most intensive support needs. That is, the length of time it takes for students to master skills and the variability of behavior can impede teacher and parent motivation to continue teaching a skill. Expectations may worsen over time as students get older. The results of this study suggest that older students can still benefit from GG, specifically to develop skill in

spoon use; however, teachers and parents should be prepared to provide intensive instruction and expect variability. Understanding the nature of working with children with significant needs and taking data with sensitive measures capable of detecting progress may be key to sustainability. Teachers are faced with the challenge of setting realistic goals that reflect high-standards for students. This challenge is compounded by a lack of intervention research that could help parents and professionals understand patterns in skill acquisition for this group of learners and help guide intervention decisions.

Systematic prompting, specifically GG, can support development of spoon use. Whether additional modes of instruction or adaptations are necessary remains to be answered by future research. The results of this study suggest additional instructional support may be necessary to address factors such as motivation, muscle tone, and tactile sensitivity. Additionally, errorless learning strategies, such as GG, may be more difficult to implement with fidelity when working with children with the most complex and intensive support needs. Even if procedures are implemented with high fidelity, collaboration with other professionals and parents may be necessary so that expectations are communicated across settings. The conduct of this study in the home, despite that GG was never implemented in the home, seemed to support parent buy in. Parents in this study expressed strong approval of the procedures and goals for this study, a desire to set higher expectations for their children, and strong interest in training to implement the procedures at home. Parents seemed to especially respond to seeing their child's improvement documented on video.

Training. All adult participants in this study who had not already received training, expressed interest in receiving training. Additionally, three adult participants also expressed confidence in being able to implement procedures without training after having viewed video of

GG implemented with their child or student. However, results from a previous study indicated that even with training and ongoing feedback, a majority of direct care staff implemented physical guidance procedures with poor fidelity (Ulicny et al., 1985). Poor fidelity may be explained by (a) misunderstanding of how to implement procedures correctly, (b) lack of motivation to implement procedures, (c) disbelief in the benefits of this type of instruction, (d) personal conflict with the researcher(s) or trainer, or (e) lack of resources to implement procedures in authentic settings. This list is not comprehensive but is meant to acknowledge the myriad factors that challenge accurate and consistent ongoing implementation of systematic instruction. The results of the present study indicate that motivation to implement systematic instruction and disbelief of the benefits of systematic instruction may not be significant challenges. Administrators and researchers should carefully consider all the challenges to implementation.

Limitations and Future Research

The results of this study provide weak evidence of a functional relation between GG and the development of independent spoon use in children with MDVI. GG may therefore be beneficial but not sufficient to teach independent spoon use to this group of learners. However, the results of this study need to be considered in light of a few limitations that demonstrate the preliminary and exploratory nature of this study.

First, the low-incidence nature of visual impairments and the heterogeneity of this small group of learners present a significant challenge to conducting experimental research from which causality might be inferred. Single case design was used for this study to demonstrate experimental control with a small number of participants. However, even three participants who met the inclusion criteria and were accessible to the researcher proved difficult to find.

Therefore, a greater degree of variability among participants was accepted than was originally planned. If possible, future research should impose greater control for age and current skill level. Factors affecting motivation to use a spoon, such as expectations for the student to use utensils, need to be carefully considered either to address in the course of intervention or to define in inclusion/exclusion criteria.

Second, an accurate estimate of students' independent spoon use and the nature of supports provided in authentic settings were limited by the measurement system. Specifically, the descriptive assessment did not measure independent utensil use for an entire bite, only whether prompting and utensil use occurred within the same interval. It is possible that an adult may have loaded the spoon, and the student independently raised the spoon to take a bite. It is also possible that a bite may have occurred over two intervals and prompting only occurred during one of the intervals; therefore, utensil use was prompted for part of the bite and the student received credit for independent utensil use for the same bite.

Third, the effect of graduated guidance may have been undermined by the prolonged exposure to baseline conditions in which students made numerous errors and to generalization sessions in which errors frequently occurred. The researcher shortened baseline sessions to limit the allowance of errors. For future studies, researchers should consider ways to implement more intensive instruction across multiple settings. This approach would increase instruction while also decreasing opportunities for errors. Additional interventionists may need to be trained to implement procedures with high fidelity, which poses an additional challenge, especially with implementation of GG, which leads to the fourth limitation.

Fourth, GG is not well described in the extant literature and is by nature fluid, making it difficult to define parameters for rigorous and consistent implementation. Additionally, it is unclear how independent, blind observers can be equipped to collect procedural fidelity objectively. GG is systematic in the sense that there are rules for implementation; however, it is not predictable because interventionists are required to differentially respond to various student behaviors that are often hard to predict. Likewise, scoring of some procedural fidelity items for this study required observers to make seemingly impossible judgments of student behavior, such as whether students resisted correct behavior with prompts or were about to make an error. Because these judgments were based on subtle cues from the student, it was difficult to determine if the interventionist implemented the procedure with fidelity. Additionally, while the interventionist aimed to prevent error, errors were not completely unavoidable. The literature on GG does not define an acceptable amount of error. More research is needed to develop an objective measure for documenting treatment integrity of GG and to examine the extent to which interventionists can be trained to implement GG with high fidelity.

Fifth, the occurrence or non-occurrence of several variables that may have affected student behavior, were not documented. These include but may not be limited to implementation or provision of (a) verbal corrective feedback, (b) adapted materials, (c) optimal positioning of scooper lip, (d) optimal student positioning, (e) preferred food items, (f) choice offerings, (g) water or juice, (h) responses to repetitive behavior, and (i) additional instruction for other behaviors (e.g., “head up”). Additionally, verbal descriptions and verbal prompts were not distinguished for purposes of this study. The procedural differences between these interventionist behaviors are not described in the literature, but may have important implications for student learning.

Conclusion

This study was conducted to analyze GG to teach a specific mealtime skill (i.e., spoon use) to a small group of learners (i.e., students with MDVI whose lack of utensil use at mealtime was primarily thought to be a result of a skill deficit) to increase independence at mealtime. Independence is important for all persons to control their own pace of food consumption, and has important implications for health and quality of life. Spoon use is just one of several skills necessary to achieve full independence at mealtime. There are also ways to arrange the environment so that spoon use is unnecessary, such as providing only finger foods. However, there are many foods and many environments for which spoon use is desirable and possibly mandatory. For persons with VI to independently enjoy a full range of foods in a way that is efficient and socially acceptable, spoon use is an important learned skill.

This study adds to the very small body of research to teach spoon use to students with MDVI (Collins et al., 1991; Sisson & Dixon, 1986a). Sufficient high-quality research has been published to suggest systematic response prompting procedures are highly effective to teach new skill acquisition to persons with blindness (Ivy & Hatton, 2014). However, this is the first study to examine the effect of GG to teach mealtime skills to children with MDVI. Results suggest GG is beneficial to improve child behavior, but may not be sufficient to teach students to full independence with spoon use. It is unclear whether more intensive instruction would have led to greater independence. An empirical analysis is needed to explain how specific student characteristics and ecological factors affect independence at mealtime. Such an analysis could provide direction for future intervention research.

APPENDIX

Data Collection Forms

Descriptive Assessment Data Collection Form

Date: _____
Participant ID: _____
Data Collector: _____
Time start: _____
Time stop: _____

Support person's relationship to student: _____
Location: _____
Food item: _____

X | check the following boxes if the behavior occurred in the interval for 10s prior to the time listed in the leftmost column

Interval	Access to food	Physical prompt	Verbal prompt	Utensil use	Touch food	Finger feed	Food spill	R+	Adult Fed
10s									
20s									
30s									
40s									
50s									
1m									
1m 10s									
1m 20s									
1m 30s									
1m 40s									
1m 50s									
2m									
2m 10s									
2m 20s									
2m 30s									
2m 40s									
2m 50s									
3m									
Et cetera									

Primary Dependent Variable Data Collection Form

FILE NAME: _____

Interventionist: _____ Weight eaten: _____ Start weight of food: _____ Date coded: _____

Coder: _____ Weight spilled: _____ Food item: _____ Date entered in DB: _____

Time: W – contact for whole step | PP – contact for part of step

Form/Intensity: P – full physical | V – verbal | T – touch cue

Location: H – hand | W – wrist | F – forearm | E – elbow | S - shoulder

Accuracy: N – no response | E – error | I – independent

R – resists | U – no resistance | P – pause | O – no opportunity

Steps	1	2	3	4	5	6	7	8	9	10	Total 1-10
Start of trial:											
Pre-step: Hand on bowl	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
1. Hold spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
2. Put spoon in bowl	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
3. Scoop food	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
4. Raise spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
5. Take a bite	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
6. Lower spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	
Mark + if trial was correct with prompts (steps 1-6):											
Mark + if trial was correct <u>without</u> prompts (steps 1-6):											

Steps	11	12	13	14	15	16	17	18	19	20	Total 11-20	Total 1-20
Start of trial:												
Pre-step: Hand on bowl	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
1. Hold spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
2. Put spoon in bowl	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
3. Scoop food	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
4. Raise spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
5. Take a bite	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
6. Lower spoon	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I	R U P O / W PP P V T H W F E S / N E I		
Mark + if trial was correct with prompts (steps 1-6):												
Mark + if trial was correct <u>without</u> prompts (steps 1-6):												

Total # of Correct Prompted Trials: _____
Total # of Trials: _____
Percent Correct Prompted trials: _____

Total # of Correct Unprompted Trials: _____
Total # of Trials: _____
Percent Correct Unprompted trials:_____

Procedural Fidelity Data Collection Form

Procedural Fidelity Data Collection Form

FILE NAME: _____ Coder: _____ Date coded: _____

Response Key: + occurred or did not occur as planned | - did not occur | BO = black out

Steps: **Behaviors**	1	2	3	4	5	6	7	8	9	10	Total
1. Bowl sitting at edge of table, food is in bowl											
2. Orient student to spoon (touch cue/physical guidance if student already has spoon in hand).											
3. Encourage student to feed himself with or without prompts											
4. 5s time delay from beginning of trial for student to demonstrate skill with or without prompts											
5. Necessary physical and/or verbal guidance to assist student to complete trial without errors (**BO** if no prompts)											
6. If student resists step with prompting, physical contact is maintained (**BO** if student does not resist or performs step independently)											
7. If prompting level decreased from previous trial, student did not resist action with prompt on previous trial (**BO** prompt level was not decreased)											
8. If prompting level increased from previous trial, student had an error on current or previous trial, was about to make an error, or pauses during current or previous trial (**BO** if prompt level was not increased)											
9. Student is oriented to spoon in the bowl (or spoon is already in bowl) given 5s time delay to demonstrate skill from scoop with or without prompts											
10. Student is not blocked from bringing spoon to mouth (**BO** if student does not bring spoon to mouth)											
11. If student tries to finger feed or self injure, response is immediately blocked (**BO** if no finger feed or self injure)											
12. If student completes all steps without error, provide praise; if student does not complete these steps without error, do not praise											
13. If student performs some but not all of steps without error, provide encouragement; if student does not complete any steps, do not provide encouragement (**BO** if student completes all steps)											
14. Correct behavior is not blocked											

Response Key: + occurred or did not occur as planned | - did not occur | BO = black out

Steps: **Behaviors**	11	12	13	14	15	16	17	18	19	20	Total	For PI only
1. Bowl sitting at edge of table, food is in bowl												
2. Orient student to spoon (touch cue/physical guidance if student already has spoon in hand).												
3. Encourage student to feed himself with or without prompts												
4. 5s time delay from beginning of trial for student to demonstrate skill with or without prompts												
5. Necessary physical and/or verbal guidance to assist student to complete trial without errors (**BO** if no prompts)												
6. If student resists step with prompting, physical contact is maintained (**BO** if student does not resist or performs step independently)												
7. If prompting level decreased from previous trial, student did not resist action with prompt on previous trial (**BO** prompt level was not decreased)												
8. If prompting level increased from previous trial, student had an error on current or previous trial, was about to make an error, or pauses during current or previous trial (**BO** if prompt level was not increased)												
9. Student is oriented to spoon in the bowl (or spoon is already in bowl) given 5s time delay to demonstrate skill from scoop with or without prompts												
10. Student is not blocked from bringing spoon to mouth (**BO** if student does not bring spoon to mouth)												
11. If student tries to finger feed or self injure, response is immediately blocked (**BO** if no finger feed or self injure)												
12. If student completes all steps without error, provide praise; if student does not complete these steps without error, do not praise												
13. If student performs some but not all of steps without error, provide encouragement; if student does not complete any steps, do not provide encouragement (**BO** if student completes all steps)												
14. Correct behavior is not blocked												

TOTAL PERCENT FIDELITY (for PI use only): _____

Date entered in to database: _____

Parent Interview

Date: _____
Participant ID: _____
Relation to Participant: _____
Completed by: _____

1. Does your child have any allergies to food? Please list.

_____
_____

2. Is your child sensitive to certain textures? Please list.

_____

3. Does your child have repetitive behaviors? Please describe.

_____

4. How do you communicate with your child during mealtimes? What messages?

_____

5. How does your child communicate with you during mealtimes? What messages?

_____

6. Why do you think it is a challenge for your child to feed himself/herself?

_____

7. What have you tried in the past to teach your child to feed himself/herself? What have others tried? Why do you think those methods did not work?

_____

8. How would you characterize the type of support during mealtimes you have provided to your child this school year?

_____

9. What type of seating equipment or positioning techniques are optimal for your child during mealtime?

_____

10. What type of feeding equipment is optimal for your child during mealtime?

_____

11. What foods does your child eat with a spoon?

_____

Teacher/Therapist Interview

Date: _____
Participant ID: _____
Relation to Participant: _____
Completed by: _____

1. Does the student have any allergies to food? Please list.

_____

2. Is the student sensitive to certain textures? Please list.

_____

3. Does the student have repetitive behaviors? Please describe.

_____

4. How do you communicate with the student during mealtimes? What messages?

_____

5. How does the student communicate with you during mealtimes? What messages?

_____

6. Why do you think it is a challenge for this student to feed himself/herself?

_____

7. What have you tried in the past to teach this student to feed himself/herself? What have others tried? Why do you think those methods did not work?

_____

8. How would you characterize the type of support during mealtimes you have provided to this student this school year?

_____

9. What type of seating equipment or positioning techniques are optimal for this student during mealtime?

_____

10. What type of feeding equipment is optimal for this student during mealtime?

_____

11. What foods does this student eat with a spoon?

_____

Record Review Data Collection Form

Date: _____ Participant ID: _____ Age: _____
Gender: _____ Ethnicity: _____
Completed by: _____

Primary Visual Condition:
_____

☐ Form Perception

☐ Light Perception

☐ No Light Perception

☐ Congenital Onset

☐ Adventitious Onset – Age of Onset: _____

☐ Vision is Stable

☐ Vision is Unstable

Hearing:
☐ Hearing aids ☐ Hearing within normal limits

_____

Other Conditions:

Preferences:
_____

Medical Alerts:
☐ Allergies: _____

☐ Seizures (signs and triggers):_____

☐ Shunt: _____

☐ Food restrictions: _____

☐ Other: _____

Scales of Independent Behavior – Revised
Date administered: _____
Results: _____

Oregon Project
Date administered: _____
Results: _____

Social Validity Questionnaire

Date: _____
Participant ID: _____
Relation to Participant: _____
Completed by: _____

Today, I would like to tell you about the intervention I have been using with your child/student in detail and show you videos of me teaching your child. I used a procedure called graduated guidance. First, I'd like to give you a little bit of background on graduated guidance. Then, I'll show you three videos, each 2 minutes long: one from the 1st or 2nd time I used graduated guidance with your son/student, one approximately half way between the beginning and end of the study, and one recent video. After I have shown you the videos, I would like for you to complete a questionnaire to give me your impressions of graduated guidance and of your participation in this study. If you have any questions about graduated guidance or if anything is unclear, please ask.

After you have completed the questionnaire, I will show you your child's/student's data and answer any other questions you have.

Background: Graduated guidance is a systematic prompting procedure. I used physical guidance in the form of hand-over-hand and guidance at the wrist, forearm, elbow, or shoulder. I also used verbal prompts. Over time, I systematically decreased the level of assistance I provided. However, I always tried to provide as much assistance as needed to prevent errors. If errors were made, it was my fault for not providing the level of assistance necessary. In addition to prompts, I gave students feedback and/or praise after each bite, to communicate my expectations and encourage good spoon-use.

Directions: After watching the video, please circle the statement that best describes your opinion related to each question.

1. In general, do you think the procedures shown in the video would be effective to teach spoon use to children with blindness and additional disabilities?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. In general, do you think the procedures shown in the video would be effective to teach other types of functional skills to children with blindness and additional disabilities?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. With training, do you think you could easily implement these procedures with accuracy?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. Without training, do you think you could easily implement these procedures with accuracy?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. Would you be interested in receiving training to learn how to implement these procedures?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. In your opinion, do you think that these procedures were necessary to teach spoon use to your child?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. In your opinion, do you think that the procedures were or would be enough to teach spoon use to your child?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. Is there anything about the procedures that you don't like or would do differently? If yes, please explain.

Yes No

_____

_____

REFERENCES

Albin, J. B. (1977). Some variables influencing the maintenance of acquired self-feeding behavior in profoundly retarded children. *Mental Retardation, 15*(5), 49-52.

Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour, 49*, 227-265.

Anderson, S., Boigon, S., Davis, K., deWaard, C. (2007). *The Oregon project for visually impaired and blind preschool children*. Medford, OR: Southern Oregon Education Service District.

Ando, H., Yoshimura, I., & Wakabayashi, S. (1980). Effects of age on adaptive behavior levels and academic skill levels in autistic and mentally retarded children. *Journal of Autism and Developmental Disorders, 10*, 173-184.

Ayres, K., & Gast, D. L. (2010). Dependent measures and measurement procedures. In D. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 129-165). New York, NY: Routledge.

Azrin, H. N., & Armstrong, M. P. (1973). The "mini-meal"--A method for teaching eating skills to the profoundly retarded. *Mental Retardation, 11*(1), 9-13.

Ball, S. L., Panter, S. G., Redley, M., Proctor, C. A., Byrne, K., Clare, I. C. H., & Holland, A. J. (2012). The extent and nature of need for mealtime support among adults with intellectual disabilities. *Journal of Intellectual Disability Research, 56*, 382-401.

Berkowitz, S., Sherry, P. J., & Davis, B. A. (1971). Teaching self-feeding skills to profound retardates using reinforcement and fading procedures. *Behavior Therapy, 2*, 62-67.

Bigelow, A. (1995). The effect of blindness on the early development of the self. In P. Rochat (Ed.), *The self in infancy: Theory and research* (Vol. 112, pp. 327-347). Amsterdam: Elsevier.

Bledsoe, R., Myles, B. S., & Simpson, R. L. (2003). Use of a social story intervention to improve mealtime skills of an adolescent with Asperger syndrome. *Autism, 7*, 289-295.

Brambring, M. (2007). Divergent development of manual skills in children who are blind or sighted. *Journal of Visual Impairment & Blindness, 101*, 212-225.

Browder, D. Ahlgrim-Delzell, L., Spooner, F., Mims, P. J., & Baker, J. N. (2009). Using time delay to teach literacy to students with severe developmental disabilities. *Exceptional Children*, 75, 343-364.

Bruce, S., & Muhammad, Z. (2009). The development of object permanence in children with intellectual disability, physical disability, autism, and blindness. *Journal of Disability, Development and Education, 56*, 229-246.

Bruininks, R. H., Woodcock, R. W., Weatherman, R. F., & Hill, B. K. (1996). *Scales of independent behavior – revised: Manual.* Boston, MA: Riverside Publishing Company.

Collins, B. C., Gast, D. L., Wolery, M., Holcombe, A., & Leatherby, J. G. (1991). Using constant time delay to teach self-feeding to young students with severe/profound handicaps: Evidence of limited effectiveness. *Journal of Developmental and Physical Disabilities, 3*, 157-179.

Connolly, K., & Dalgleish, M. (1989). The emergence of a tool-using skill in infancy. *Developmental Psychology, 25*, 894-912.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied Behavior Analysis* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Demchak, M. (1990). Response prompting and fading methods: A review. *American Journal on Mental Retardation, 94,* 603-615.

Dogoe, M., & Banda, D. R. (2009). Review of recent research using constant time delay to teach chained tasks to persons with developmental disabilities. *Education and Training in Developmental Disabilities, 44,* 177-186.

Doyle, P. M., Wolery, M., Halle, J., & Gast, D. L. (1988). System of least prompts: A review of procedural parameters. *Journal of the Association for Persons with Severe Handicaps, 13*, 28-40.

Erin, J. N. (2003). Educating students with visual impairments (ERIC EC Digest #E653). *The ERIC Clearinghouse on Disabilities and Gifted Education.* Retrieved from http://www.hoagiesgifted.org/eric/e653.html

Ferrell, K. A. (2006). Evidence-based practices for students with visual disabilities. *Communication Disorders Quarterly, 28*, 42-48.

Fraiberg, S. (1977). *Insights from the blind: Comparative studies on blind and sighted infants.* New York, NY: Basic Books.

Gast, D. L., & Hammond, D. (2010). Withdrawal and reversal designs. In D. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pg. 234-275). New York, NY: Routledge.

Gast, D. L., & Ledford, J. (2010). Multiple baseline and multiple probe designs. In D. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pg. 276-328). New York, NY: Routledge.

Gee, K., Graham, N., Sailor, W., & Goetz, L. (1995). Use of integrated, general education, and community settings as primary contexts for skill instruction for students with severe, multiple disabilities. *Behavior Modification, 19,* 33-58.

Grisham-Brown, J., Schuster, J. W., Hemmeter, M. L., & Collins, B. C. (2000). Using an embedding strategy to teach preschoolers with significant disabilities. *Journal of Behavioral Education, 10,* 139-162.

Groves, I. D., & Caroccio, D. F. (1971). A self-feeding program for the severely and profoundly Retarded. *Mental Retardation, 9*(3), 10-12.

Handen, B. L., & Zane, T. (1987). Delayed Prompting: A Review of Procedural Variations and Results. *Research in Developmental Disabilities, 8,* 307-330.

Hatton, D. D., Bailey, D. B., Burchinal, M. R., & Ferrell, K. A. (1997). Developmental growth curves of preschool children with vision impairments. *Child Development, 68,* 788-806.

Hatton, D. D., Ivy, S. E., Boyer, C. (2013). Severe visual impairments in infants and toddlers in the United States. *Journal of Visual Impairment & Blindness,* 107, 325-337.

Hodges, E. A., Johnson, S. L., Hughes, S. O., Hopkinson, J. M., Butte, N. F., & Fisher, J. O. (2013). Development of the responsiveness to child feeding cues scale. *Appetite, 65,* 210-219.

Horner, R. & Baer, D. (1978). Multiple probe technique: A variation of the multiple baseline. *Journal of Applied Behavior Analysis, 11,* 189-196.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71,* 165-179.

Ivy, S. E., & Hatton, D. D. Teaching skill acquisition to individuals with blindness: A systematic review of response prompting procedures. *International Review of Research in Developmental Disabilities.* Manuscript in preparation.

Ivy, S. E., Lather, A., & Hatton, D. D., & Wehby, J. *Teaching self-management of eating skills to students with visual impairments.* Manuscript in preparation.

Kang, S., O'Reilly, M., Lancioni, G., Falcomata, T. S., Sigafoos, J., & Xu, Z. (2013). Comparison of the predictive validity and consistency among preference assessment procedures: A review of the literature. *Research in Developmental Disabilities, 34*, 1125-1133.

Ledford, J. R., Lane, J. D., Elam, K. L., & Wolery, M. (2012). Using response-prompting procedures during small-group direct instruction: Outcomes and procedural variations. *American Journal on Intellectual and Developmental Disabilities, 117,* 413-434.

Leibowitz, J. M., & Holcer, P. (1974). Building and maintaining self-feeding skills in a retarded child. *American Journal of Occupational Therapy, 28*, 545-548.

Luiselli, J. K. (1993). Training self-feeding skills in children who are deaf and blind. *Behavior Modification, 17*, 457-473.

Luiselli, J. K. (1988). Behavioral feeding intervention with deaf-blind, multihandicapped children. *Child & Family Behavior Therapy, 10*(4), 49-61.

Miller, H. R., Patton, M. E., & Henton, K. R. (1971). Behavior modification in a profoundly retarded child: A case report. *Behavior Therapy, 2*, 375-384.

Neitzel, J., & Wolery, M. (2009). Steps for implementation: Graduated guidance. Chapel Hill, NC: The National Professional Development Center on Autism Spectrum Disorders, FPG Child Development Institute, The University of North Carolina.

Nelson, G. L., Cone, J. D., & Hanson, C. R. (1975). Training correct utensil use in retarded children: Modeling vs. physical guidance. *American Journal of Mental Deficiency, 80,* 114-122.

O'Brien, F., Bugle, C., & Azrin, N. H. (1972). Training and maintaining a retarded child's proper eating. *Journal of Applied Behavior Analysis, 5,* 67-72.

Parker, A. T., Davidson, R., & Banda, D. R. (2007). Emerging evidence in single-subject research in the field of deaf-blindness. *Journal of Visual Impairment & Blindness, 101,* 690-700.

Parker, A. T., & Pogrund, R. L. (2009). A review of research on the literacy of students with visual impairments and additional disabilities. *Journal of Visual Impairment & Blindness, 103,* 635-648.

Piazza, C. C., Anderson, C., & Fisher, W. (1993). Teaching self-feeding skills to patients with rett syndrome. *Developmental Medicine and Child Neurology, 35,* 991-996.

Preisler, G. M. (1991a). Blind Infant-sighted mother interaction during the first year. *International Journal of Rehabilitation Research, 14,* 231-234.

Preisler, G. M. (1991b). Early patterns of interaction between blind infants and their sighted mothers. *Child: Care, Health and Development, 17,* 65-90.

Preisler, G., M. (1993). A descriptive study of blind children in nurseries with sighted children. *Child: Care, Health and Development, 19,* 295-315.

Rogers, S., & Puchalski, C. (1988). Development of object permanence in visually impaired infants. *Journal of Visual Impairment & Blindness, 82,* 137-142.

Rowland, C. (1984). Preverbal communication of blind infants and their mothers. *Journal of Visual Impairment & Blindness, 78,* 297-302.

Schulze, P. A., Harwood, R. L., & Schoelmerich, A. (2001). Feeding practices and expectations among middle-class Anglo and Puerto Rican mothers of 12-month-old infants. *Journal of Cross-Cultural Psychology, 32*, 397-406.

Schuster, J. W., Morse, T. E., Ault, M. J., Doyle, P. M., Crawford, M. R., & Wolery, M. (1998). Constant time delay with chained tasks: A review of the literature. *Education and Treatment of Children, 21,* 74-106.

Sisson, L. A., & Dixon, M. J. (1986a). Improving mealtime behaviors of a multihandicapped child using behavior therapy techniques. *Journal of Visual Impairment & Blindness, 80,* 855-858.

Sisson, L. A., & Dixon, M. J. (1986b). Improving mealtime behaviors through token reinforcement: A study with mentally retarded behaviorally disordered children. *Behavior Modification, 10,* 333-354.

Song, A. Y., & Gandhi, R. (1974). An analysis of behavior during the acquisition and maintenance phases of self-spoon feeding skills of profound retardates. *Mental Retardation, 12*(1), 9-13.

Sonksen, P., Levitt, S., & Kitzinger, M. (1984). Identification of constraints acting on motor development in young visually disabled children and principles of remediation. *Child: Care, Health and Development, 10,* 273-286.

Spencer, R. A., Head, D. N., Van Dusen Pysh, M., & Chalfant, J. C. (1997). Response patterns of children with visual impairments on measures of internalized self-responsibility. *RE:view: Rehabilitation and Education for Blindness and Visual Impairment, 29,* 121-127.

Taras, M. E., Matson, J. L., & Felps, J. N. (1993). Using independence training teach independent living skills to children and young men with visual impairments. *Behavior Modification, 17,* 189-208.

Thompson, R. J. (1977). Applied behavior analysis in the treatment of mealtime tantrums and delay in self feeding in a multi-handicapped child. *Journal of Clinical Child Psychology, 6*(3), 52-54.

Ulicny, G. R., Thompson, S. K., Favell, J. E., & Thompson, M. S. (1985). The active assessment of educability: A case study. *Journal of the Association for Persons with Severe Handicaps, 10,* 111-114.

U.S. Department of Commerce, Economics and Statistics Administration U.S. Census Bureau. (2011). *School-aged children with disabilities in U.S. metropolitan statistical Areas: 2010 American community survey Briefs.*

Walker, G. (2008). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders, 38,* 261-275.

Warren, D. H., & Hatton, D. D. (2003). Cognitive development in children with visual impairments. In S. J. Segalowitz & I. Rapin (Eds.), *Handbook of Neuropsychology* (2nd edition, Vol. 8, Part II, pp. 439-458). New York, NY: Elsevier.

Waugh, R. E., Alberto, P. A., & Fredrick, L. D. (2011). Simultaneous prompting: An instructional strategy for skill acquisition. *Education and Training in Autism and Developmental Disabilities, 46,* 528-543.

Wolery, M., & Gast, D. L. (1984). Effective and efficient procedures for the transfer of stimulus control. *Topics in Early Childhood Special Education, 4*(3), 52–77.

Wolery, M., & Gast, D. L. (2000). Classroom research for young children with disabilities: Assumptions that guided the conduct of research. *Topics in Early Childhood Special Education*, *20*(1), 49–55.

Wolery, M., Holcombe, A., Cybriwsky, C., Doyle, P. M., Schuster, J. W., Ault, M. J., & Gast, D. L. (1992). Contant time delay with discrete responses: A review of effectiveness and demographic, procedural, and methodological parameters. *Research in Developmental Disabilities, 13,* 239-266.

Yoder, P. & Symons, F. (2010). *Observational measurement of Behavior*. New York, NY: Springer.