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USING GRADUATED GUIDANCE TO TEACH IMITATION OF MANUAL SIGNS TO CHILDREN WITH INTELLECTUAL DISABILITIES

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Jacqueline N. Horsman

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Jacqueline N. Horsman, Student

Dr. Justin D. Lane, Major Professor

Dr. Melinda Ault, Director of Graduate Studies

USING GRADUATED GUIDANCE TO TEACH IMITATION OF
MANUAL SIGNS TO CHILDREN WITH INTELLECTUAL DISABILITIES

THESIS

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science in Education in the
College of Education
at the University of Kentucky

By

Jacqueline Horsman

Lexington, Kentucky

Director: Dr. Justin D. Lane, Professor of Special Education

Lexington, Kentucky

2018

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ABSTRACT OF THESIS

USING GRADUATED GUIDANCE TO TEACH IMITATION OF MANUAL SIGNS TO CHILDREN WITH INTELLECTUAL DISABILITIES

The purpose of this study was to test the effects of graduated guidance procedure on teaching imitation of manual signs to students with moderate to severe disabilities. Sessions began with student initiation and were embedded across already established reinforcement routines across the student's day. A multiple baseline across participants design was used to evaluate these effects.

KEYWORDS: Moderate and severe disabilities, imitation, graduated guidance, sign language, student initiated

Jacqueline Horsman

April 13, 2018

USING GRADUATED GUIDANCE TO TEACH IMITATION OF
MANUAL SIGNS TO CHILDREN WITH INTELLECTUAL DISABILITIES

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Section 1: Introduction

Students with developmental delays are likely to display deficits in expressive communication (Office of Special Education Programs, 2004). Early intervention for communicative behaviors often begins with targeting expressive communication, especially functional speech sounds in children. Expressive communication refers to the way in which a person communicates wants, interests, and protests (National Center on Deaf Blindness, 2010) and functional speech refers to a person's ability to communicate these needs through vocalizations (Sigafos, 2016). Students typically begin to develop early communication skills by observing others and imitating their motor (e.g., pointing to an item of interest) and verbal behaviors (e.g., saying, "car" in the presence of a toy car) (Hoff, 2006). As expressive communication becomes more refined, children begin to navigate their environments with more independence (e.g., communicating with peers and novel adults). In contrast, students with developmental delays are less likely to develop age-appropriate communication and may be diagnosed with or considered at-risk for a communication disorder. In addition, challenging behaviors may emerge as alternatives to delayed communication (e.g., physical aggression due to others not understanding wants and interests; Pattison & Robertson, 2016). According to Schindler, Ruoppolo, and Barillari (2010), a communication disorder can be defined as "an impairment in sending and/or receiving a message" during a social exchange (speaker and listener; p. 167). Communication disorders can range from difficulties with articulation or an inability to string sounds into meaningful words. The *Division for Early Childhood of the Council for Exceptional Children* (2014) and the *Center for Excellence and Outcomes in Children and Young People's Services* (2010) emphasize the

importance of targeting all developmental domains, including communication, especially for children with the most significant disabilities.

Imitation of Motor and Verbal Behaviors

Students with developmental delays, who display comorbid communication deficits, can learn communication skills by imitating others motor and verbal behaviors. Because individuals with developmental delays often meet developmental milestones at later dates than same-age peers, implementing evidence- or research-based interventions for imitation *and* communication deficits is of paramount importance. Communication interventions commonly rely on a student's ability to imitate adult models of communicative behaviors. As noted by Ledford and Wolery (2011), "imitation is a primary means through which children learn new skills" and "most children learn to imitate without being taught but some children with disabilities fail to develop or use imitation in the absence of direct instruction" (p. 245). Thus, imitation is a critical skill students need in order to learn new behaviors (Bandura, 1977).

Imitation should be one of the first skills taught to children with disabilities because it builds a platform for learning novel behaviors (Soorya, Arnstein, & Romanczyk, 2003). Thus, teaching non-imitative students to imitate motor and verbal behaviors increases the likelihood of learning new skills via observational learning (absence of intentional instruction from an adult or peer). Observational learning refers to acquiring a new skill or expanding an established response class by watching another person perform that skill. In order for a student to acquire multiple behaviors across their lifespan, they must be able to learn observationally (Bandura, 1977). Multiple studies on

teaching imitation have focused on teaching students with intellectual disability (e.g., Pattison & Robertson 2016) and autism spectrum disorder (ASD) (e.g., Ingersoll & Schreibman, 2006) a variety of behaviors related to object imitation (Ingersoll & Gergans, 2007) and gesture imitation (Ingersoll, Lewis, & Kroman, 2007). Specific procedures used to teach imitation in previous studies include progressive time delay (Venn & Wolery, 1992), system of least prompts (Barton, 2015), and graduated guidance (Gruber & Poulson, 2016).

Augmentative and Alternative Communication

Speech is the most common form of expressive communication during social exchanges with others, but for some children, speech does not develop or is not developed to a level that allows them to adequately deliver a message to another person (Zebron, Mhute, & Musingafi, 2015). Lack of a meaningful communication system increases the likelihood of a student using challenging behaviors to attempt to communicate and, in turn, are likely to lead to the student experiencing social and educational isolation (peer rejection; teachers perceive child as less competent when compared to same-age peers) (Romski & Sevcik, 2005). For these students, professionals recommend the use of augmentative and alternative forms of communication (AAC). Romski and Sevcik (2005) defined AAC as “an intervention that uses manual signs, communication boards with symbols, and computerized devices that speak and incorporate the child’s full communication abilities” (p. 177). In addition, AAC can be further categorized as (a) aided and (b) unaided. Aided communication requires external support, such as speech generating devices (Lancioni et al., 2016), and picture exchange systems (Ivy, Hatton, & Hooper, 2014). Unaided communication includes alternative

modes such as differentiated facial expressions (e.g., smiling, frowning) and manual sign language (Meuris, Maes, & Zink, 2015; Ronski, 2005).

Use of manual signs to share wants and interests with others is a common mode of communication in practice and in the literature (Grove & Walker, 1990; Lane & Brown, 2016). Children with disabilities have successfully been taught to use signs to communicate requests (Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010), share interests with others, and communicate internal states (emotions; e.g., happy; angry) (Ingersoll & Gergans, 2007). In a comparison of sign language and the Picture Exchange System (PECS), results indicated that both modes of communication were equally effective and, as such, decisions should be made based on child preference. In addition, children who use AAC, such as manual signs, may display increased vocalizations (Tincani, 2004).

Specific strategies used to teach children sign language include simultaneous prompting (Palmer, 1999), delayed physical prompts paired with reinforcement (Thompson et al., 2004), and graduated guidance (Kurt, 2011). Simultaneous prompting consists of a probe session (presentation of a discriminative stimulus and an opportunity to respond; functionally similar to delay trials used in procedures such as constant time delay and progressive time delay) followed by an instructional session with a 0-s delay between the antecedent and controlling prompt (adult behavior that shows a student how to be correct and increases the likelihood of a correct response from the student; Palmer, 1999). Delayed physical prompts consists of a controlling prompt with an increasing delay between the antecedent and that prompt (Thompson et al., 2004). This provides time for the behavior to be completed independently before prompting occurs. Graduated

guidance is an evidence-based practice that involves adult-delivered physical prompts that vary based on the student's needs, on a moment-to-moment basis within a session (Demchak, 1989). Intervention sessions typically begin with a full physical prompt that is then systematically removed until an adult can shadow (be proximal or near the student without providing additional physical supports) the student who is independently completing the motions of the task (Collins, 2012; Wolery, Ault, & Doyle, 1992). Graduated guidance has a long-standing history in the special education literature (e.g. Gruber & Poulson, 2016) and studies on communicative motor behaviors (Boutain et al., 2012) and has been used to teach students with disabilities a variety of behaviors, including leisure skills (Gruber & Poulson, 2016), vocational tasks (Gardner, 2015) and self-care behaviors (Sisson, Kilwein, & Van Hasselt 1988).

Purpose of the Study

Developing meaningful expressive communication is critical for all students' social and academic success (Lane & Brown, 2016; Lane, Stanton-Chapman, Jamison, & Phillips, 2007). Students who display delayed imitation are in turn likely to display expressive communication delays. Thus, targeting imitation and an alternative mode of expressive communication in young children is warranted. Given the literature on using graduated guidance to teach new motor behaviors, this study sought to teach children with moderate and severe disabilities how to imitate manual signs using the graduated guidance procedure during typical activities, using child preferred materials.

Section 2: Research Questions

1. Is there a functional relation between graduated guidance and increases in requests for preferred items via imitation of an adult's models for manual signs in children with moderate and severe disabilities?
2. If participants learn to imitate manual signs, will they generalize this behavior to novel stimuli with a novel adult in their classroom?

Section 3: Method

Participants

Students. Four students were recruited for this study. All the students attended a rural elementary school in the southeastern United States and received services in the moderate and severe disabilities (MSD) resource setting for more than 80% of their school day. Inclusion criteria for this study were as follows: (a) qualified for services in the MSD resource setting; (b) did not readily communicate using verbal expression; (c) had an established pool of reinforcers; (d) had the motor abilities to complete a manual sign; (e) tolerated a full physical prompt; and (f) did not imitate motor behaviors. A records review of current psychoeducational evaluation was conducted by the author. Areas examined were motor skills, progress data, and communication functioning.

Devon. Devon was an 8-year-old male who was enrolled in a second-grade classroom. He was previously diagnosed with a developmental delay, but displayed characteristics of ASD (full evaluation considered at time of study). He was serviced under the category of MSD, and spent greater than 80% of his day in the resource setting. He received speech and language services, physical therapy, and occupational therapy. When Devon was four years old he had a standard score of 55 on the *Battelle Developmental Inventory-II* which indicated a significant delay. Devon showed a severe delay in both expressive and receptive communication. He typically babbled to communicate, but his vocalizations were unintelligible and did not form clear approximations of words. Devon was able to use a communication device to express his wants and needs. In addition, Devon was able to sign *music*, *more*, *finished*, and

sometimes would sign *bathroom*. Devon would also make requests by guiding an adult's hand to an item.

Cole. Cole was a 7-year-old male who was enrolled in a second-grade classroom. He was previously diagnosed with ASD. He was serviced under the category of MSD, and spent greater than 80% of his day in the resource setting. He received speech and language services, physical therapy, and occupational therapy. When Cole was four years old he had a standard score of 4 on the *Gillam Autism Rating Scale*. This meant he was “very likely” to have autism. Cole was in the beginning stages of using a communication device. Cole would communicate his wants and needs by bringing someone by the hand to something or through a few learned sign language motions. Cole was able to sign *jump, more, and eat*. Cole would make sounds but they were typically unrelated to the current activity, lacking communicative meaning (e.g., pica pica pee, and oooh).

Sam. Sam was a 10-year-old male who was enrolled in a third-grade classroom. He was previously diagnosed with dwarfism (Kniest Dysplasia), cerebral palsy, vision and hearing impairments, and Periventricular Leukomalacia. He received services under the category of MSD, and spent greater than 80% of his day in the resource setting. He received speech and language services, physical therapy, and occupational therapy. He wore glasses but did not tolerate his hearing aids. It was noted that no adverse impact had been observed due to the absence of his hearing aids. Sam used a wheelchair to move around the building and was able to push himself, but did not always have the motivation to do so. During Sam's last evaluation, they obtained a non-verbal IQ score of a 51, which yielded a classification of *extremely low range*. Sam did not use any manual signs consistently, but would sometimes reach for an adult when he wants to be held. Sam was

in the beginning stages of using a communication device. Sam primarily communicated by crying and or going to the location of what he wanted.

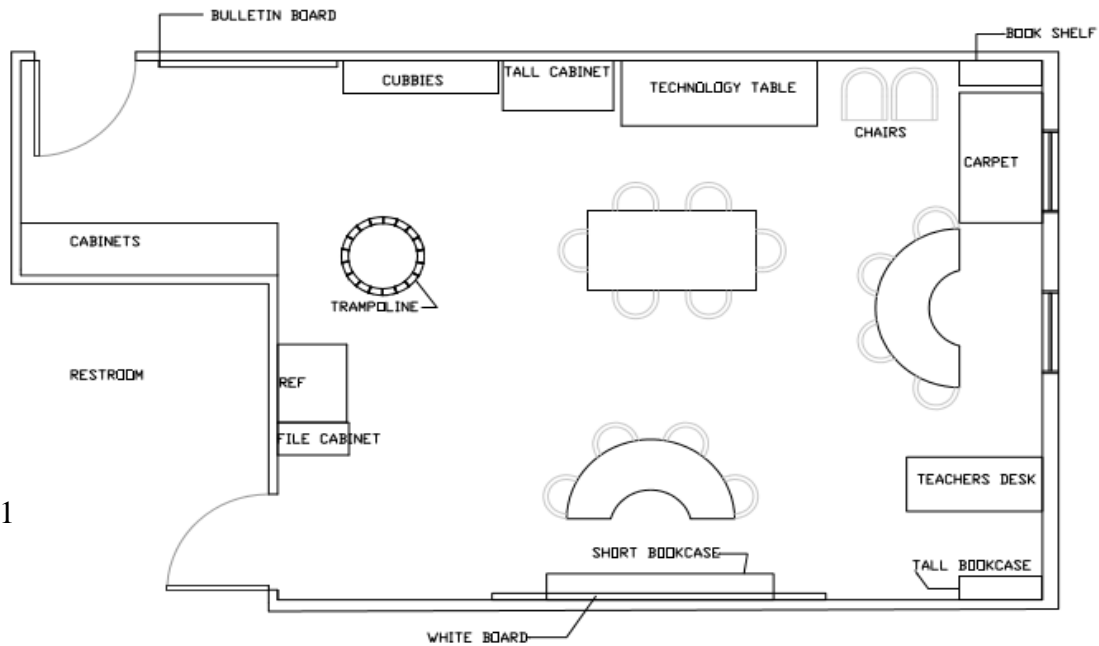
Investigator. The investigator in this study was also the participant's classroom teacher. She was currently in her 4th year of teaching at the participant's school. She had a bachelor's degree in special education, with an emphasis in MSD, and was enrolled in a master's degree program in the same field. Devon and Sam were enrolled in her class for the last 4 years and this was her second year working with Cole.

Instructional Assistant. Inter-observer agreement (IOA) and procedural fidelity data were collected by one of the classroom instructional assistants working in the MSD classroom (four years of experience in this classroom). She previously earned an associate's degree in an unrelated field. She has worked with Sam as his 1:1 aide for 4 years, and has worked with Devon for 3 years and Cole for 1 year.

Instructional Setting and Arrangement

All sessions were conducted in the MSD classroom at the participant's school. The room measured approximately 8 m X 6 m and contained three tables used for small group instruction. See Figure 1 for a diagram of the classroom. All sessions were embedded into already established leisure times during the student's day. Two sessions were conducted per day, with 5 trials conducted per session. During this time, all students would work with an investigator or teaching assistant on their IEP goals in a small group or 1:1 setting. The classroom contained one investigator, four teaching assistants, and nine students. Sessions were conducted in a 1:1 arrangement with the participant and investigator.

Figure 1



Materials/Equipment

The following items were used as reinforcement for imitation of the given manual sign. For the sign for *book* a variety of children books were used: *The Duck Says*, *The Little Mouse*, *The Red Ripe Strawberry and the Big Hungry Bear*, and *The Monster at the End of This Book*. For the student working on the sign for *eat*, potato chips, Goldfish Crackers, and tortilla chips were used. The other materials used were for the student learning to imitate the targeted sign for *toy*. Materials included light up spinning gears, airplane, and a miniature monkey that made animal sounds. Pictures of reinforcement items used in this study can be found in Appendix A.

Dependent Variable and Recording System

Prior to conducting probe and intervention sessions, a screening session was conducted with each participant to ensure they were not able to complete the targeted

manual sign. The preferred item was placed in front of the participant and they were given 5 s to request the item using sign language. The primary dependent variable in this study was independent imitation of a manual sign, following an initiation for the item. *Imitation* was defined as the participant providing an approximation of the same sign language motion as the investigator. *Initiation* was defined as looking, reaching, pointing, touching, or grabbing the preferred item within 5 s of its presentation. A 5 s delay was used between the initiation for the item and the prompt. Each participant had 3-5 items as reinforcers to use for the study. The investigator sent home a parent survey to assist in identifying reinforcers. Then she conducted a paired stimulus preference assessment to evaluate the chosen reinforcers. This consisted of the participants being shown two preferred items to choose between. This continued until every combination of items has been presented. Then toys were ranked from most preferred to least preferred based on student choices.

Devon worked on imitating the sign for "book", Cole worked on imitating the sign for "toy", and Sam worked on imitating the sign for "eat". The sign for book was defined as touching the palms of hands together and then pulling hands in the opposite direction from one another. It was noted in the reinforcer survey that Devon had a preference for books that rhymed. The sign for toy was defined as holding both hands in a fist and twisting them back and forth at the elbow. Cole's parent survey noted that he liked toys with lights and music elements. The sign for eat was defined as touching fingers or any part of the hand to mouth a minimum of two times. Sam's parents indicated that Goldfish Crackers, pretzels, and potato chips as some of his favorite food items. Refer to Appendix B for visual representations of the manual signs (Lau,

Retnasaba, & Parker, 2017). While Appendix B has representations of the signs typically used in American Sign Language, the above approximations of each sign were accepted based on each participant's fine motor abilities.

The investigator collected data during probe, generalization, and maintenance sessions. Each session began with participant initiation of the item either through orienting to the item, reaching, or touching the item. If the participant failed to initiate to the given item, a different item was used until he showed interest. A 5s delay between the adult-model and participant initiation was used. If the participant failed to imitate within this time, then graduated guidance procedure was implemented. Data were collected using a trial-by-trial event recording system in a discrete trial format. Possible responses during probe sessions included: (a) *non-initiation* (E) was recorded if the participant did not initiate an interaction with the given item; (b) an *independent correct response* (I) was recorded if the participant was able to independently imitate the given sign within 5 s of the model; (c) *incorrect response* (-) was recorded if the participant attempted a sign language motion other than the one modeled; (d) a *no response* (NR) if the participant did not make any attempt to make a sign language motion. The four possible responses during intervention and maintenance sessions included: (a) an *independent correct response* (I), which was recorded if the participant was able to independently imitate the given sign within 5 s of the model; (b) *shadowing* (S) was recorded if the participant was able to imitate the sign with the adult shadowing their motion; (c) a *prompted correct response* (P) was recorded if the participant needed a partial physical or full physical prompt to complete the imitation; (d) a *prompted error response* (P-) was recorded if the

participant resisted the physical prompting; (e) a *non-initiation* (NI) if the student did not initiate an interaction with the item. See Appendix C for example data sheet.

General Procedures

This study taught to imitate sign language through the use of graduated guidance procedures. Intervention sessions occurred twice a day, 3-5 days per week. Two sessions with five trials each were conducted daily within the already established reinforcement times for the student. The investigator placed the preferred item in front of the student and waited for the student to initiate in the form of looking, reaching, pointing, or touching the item. Following an initiation, the investigator would then model the given manual sign and wait for the student to imitate the sign for a preferred item. Full physical prompting was the controlling prompt. If the student resisted full physical guidance, the trial ended and did not count toward criterion. Mastery was set to 80% unprompted correct responding on 3 out of 5 sessions. Once the mastery criterion was met, the student entered generalization trials with a novel adult and novel stimuli. Following completion of generalization trials, maintenance probes were conducted two weeks following generalization trials.

Procedures

Probe procedures. During probe sessions, the investigator placed an item on the table in front of the participant in an attempt to gain the student's interest. If he did not initiate within 5 s the trial was terminated and, after a 10 s inter-trial interval (ITI), a different item was presented. During trials and the ITI, the investigator continued interactions with the participant for purposes of paralleling a typical interaction around

materials. Once the student initiated to the item, he was given 5 s to interact with the item (except the student using edibles). Once interest was shown the investigator took the item and provided a general attending cue (e.g. “look” or “eyes on me”). If a general attending response was not obtained, the investigator guided his chin until he made eye contact or oriented toward her face. Once attention was gained the investigator said, “Do this” and immediately provided a model of the target sign. She waited 5 s for an independent response. If he imitated the sign within 5 s, the investigator provided reinforcement in the form of providing access to the item and positive attention (e.g., clapping, smiling, verbal praise). If the student did not imitate the sign within 5 s, they were given the item but without the added positive attention. Probe sessions were conducted for each student throughout the study, and then a minimum of three consecutive probe sessions were completed before each student entered intervention.

Graduated guidance procedures. Instructional sessions were identical to probe sessions, but if the student did not imitate the adult’s model, after 5 s, then a graduated guidance procedure was implemented. This meant a full physical prompt was used and the investigator would make moment-moment decisions on fading (systematically removing) the prompt. Students were given 5 s to imitate the adult before the investigator intervened. If the student made a motion that was incorrect, the investigator would immediately redirect them to form the correct manual sign. This meant the investigator used the controlling prompt of a full-physical prompt to ensure completion of the motor action; the investigator placed her hands over the participant’s hands and guided him in making the manual sign. Once the sign was produced, with or without prompting, the student was provided with a related preferred item (book, snack, toy). This also was

followed with descriptive praise. If the student resisted the full physical prompt (P-) by pulling his hands away from the investigator or making sounds of displeasure, then the trial was terminated and a prompted error was marked on the data sheet. If, following presentation of the preferred item, the student performed the sign language motion then they were immediately granted that item. A shadow response did not occur during this study, all responses were either a partial physical, full physical, or independent response.

Modifications. Due to inconsistent responding during intervention sessions, modifications were made to the procedures for Devon to promote imitation, with consideration of his communication system. To promote increased initiations, a book on iPad replaced the physical books from previous sessions. Then, due to an increase in self-injurious behavior, the decision was made to switch back to a physical book. Following inconsistent responding, probe sessions were conducted to determine if he could imitate a request for the preferred item using his communication device (ProLoQuo2Go on iPad); Devon displayed this behavior during probe sessions and thus additional intervention sessions did not occur.

Generalization. During generalization sessions, the investigator and instructional assistant switched roles to test for generalization across people. The instructional assistant tested the student using novel stimuli to test for generalization across items.

Generalization probes occurred prior to beginning intervention and once a child met the criterion of 80% unprompted correct responding on 3 out of 5 consecutive sessions.

Similar to the intervention sessions, the instructional assistant would wait for the participant to initiate to an item, ensure she had the student's attention, said "Do this", provided a model of the manual sign, waited 5 s for a response, and then provided the

appropriate consequences. A pre- and post-test were also conducted with novel manual signs to assess generalization of imitation. The manual signs assessed included jump, ball, dog, thank you, and Mom. Jump was defined as touching fingers from one hand to the palm of the other hand. Fingers from one hand had to touch the palm of the other hand for a minimum of two touches and had to move in a motion perpendicular to the other hand. Ball was defined as touching the fingertips of one hand to the fingertips of the other hand. Fingertips from one hand had to touch the fingertips of the other hand for a minimum of two touches and had to move in a motion parallel to the other hand. Dog was defined as touching their leg (above the knee) with the palm of one of their hands. The palm of their hand had to touch the leg a minimum of two times and moved in a direction perpendicular to their leg. Thank you was defined as taking one hand to your mouth then moving it in a perpendicular direction away from your mouth. Mom was defined as having an open hand and touching your thumb of that hand to your chin area. The thumb touched for a minimum of two touches and moved in a perpendicular direction to their chin.

Maintenance. Maintenance sessions were conducted with each student once they reached the mastery criterion and sessions were identical to probe sessions. Sessions were conducted at a minimum of once a week for the remainder of the study. Once the third participant met the mastery criterion, all target behaviors were probed for all participants approximately 3 weeks after the final intervention session for participant three.

Experimental Design

A multiple probe design across participants (Gast, Lloyd, & Ledford, 2014) was used to evaluate the effectiveness of the intervention. A multiple probe design across

participants consists of multiple tiers of intervention, with a time-lagged introduction of the intervention across participants (or behaviors or conditions). The multiple probe design controlled for threats to internal validity by collecting probe data in all tiers prior to the start of intervention and periodically once the intervention was introduced in the first tier of the design. Once data were stable across all conditions, the intervention was introduced to the first participant. Experimental control is demonstrated when data remain stable in all untreated tiers and a change in a therapeutic direction is only observed when the intervention is introduced to that tier. For purposes of this study, the intervention was introduced to a subsequent tier when the data path in the intervention condition indicated that participant's unprompted correct responding was at least 50% above pre-intervention levels of responding for three consecutive sessions. Instruction continued until the participant reached the mastery criterion. The mastery criterion was set to 80% unprompted independent responding on 3 out of 5 sessions. This design was appropriate given the primary research question and since the target behavior of imitation was considered a non-reversible behavior. In addition, this design, like many single case experimental designs, was appropriate design to use in an applied setting (Gast & Ledford, 2014). What Works Clearinghouse provides design standards for time-lagged designs: (a) collect pre-intervention data points for at least five sessions prior to introducing the intervention; (b) actively manipulate the independent variable; (c) ensure a minimum of at least three attempts to demonstrate the effectiveness of the intervention, (d) with adequate IOA. In addition, given that multiple probe designs involve intermittent data collection in the pre-intervention condition, data were collected at least once every 8 sessions in the probe condition (Kratochwill, Hitchcock, Horner, Levin, Odom, &

Rindskopf, 2013). Generalization data were collected with a pre- and post-test design; this design is limited to correlational conclusions regarding improvements across testing points.

Reliability

Training. Reliability data were collected by one of the instructional assistants in the resource classroom for at least 20% of sessions in each condition for each participant. Training sessions on interobserver agreement (IOA) and fidelity were conducted in a 1:1 format after the school day ended. The investigator, teaching assistant, and a practice student participated in these trainings. The investigator and the instructional assistant sat on opposite sides of the table with the practice student sitting next to the assistant.

Training and practice sessions occurred prior to starting probe sessions. Practice sessions were conducted with a student from outside the study until acceptable reliability levels were reached. Acceptable levels of reliability were at least 80% or higher. If percentages fell below this level, then the investigator stopped the study and she and the assistant conducted an additional practice session.

Dependent variable reliability. IOA was calculated using the point-by-point method by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 to obtain a reliability score (percent agreement; Gast & Ledford, 2014).

Independent variable reliability. Procedural fidelity data were collected across all conditions. It was assessed by taking the number of observed behaviors and dividing it by the number of planned behaviors and multiplying by 100. A checklist was used to collect this data. The investigator behaviors assessed during probe sessions were

providing an opportunity for the student to initiate to an item, providing an attending cue, gaining a response, saying “Do this”, signing the given motion, and waiting the 5 s delay. The investigator behaviors during intervention sessions were student initiation, ensuring student attention, saying “Do this”, signing the given motion, waiting the five second delay, and providing correct consequences. See Appendices E and F for example dependent and independent reliability data sheets.

Results

This study examined the effectiveness of using graduated guidance procedure to teach imitation of manual sign language to students with MSD. The following six areas were considered when visually analyzing the intervention: (a) level, (b) trend, (c) stability, (d) overlap, (e) consistency of effect, and (f) immediacy of effect (Lane & Gast, 2014; Ledford, Lane, & Severini, 2017; Kratochwill et al., 2013).

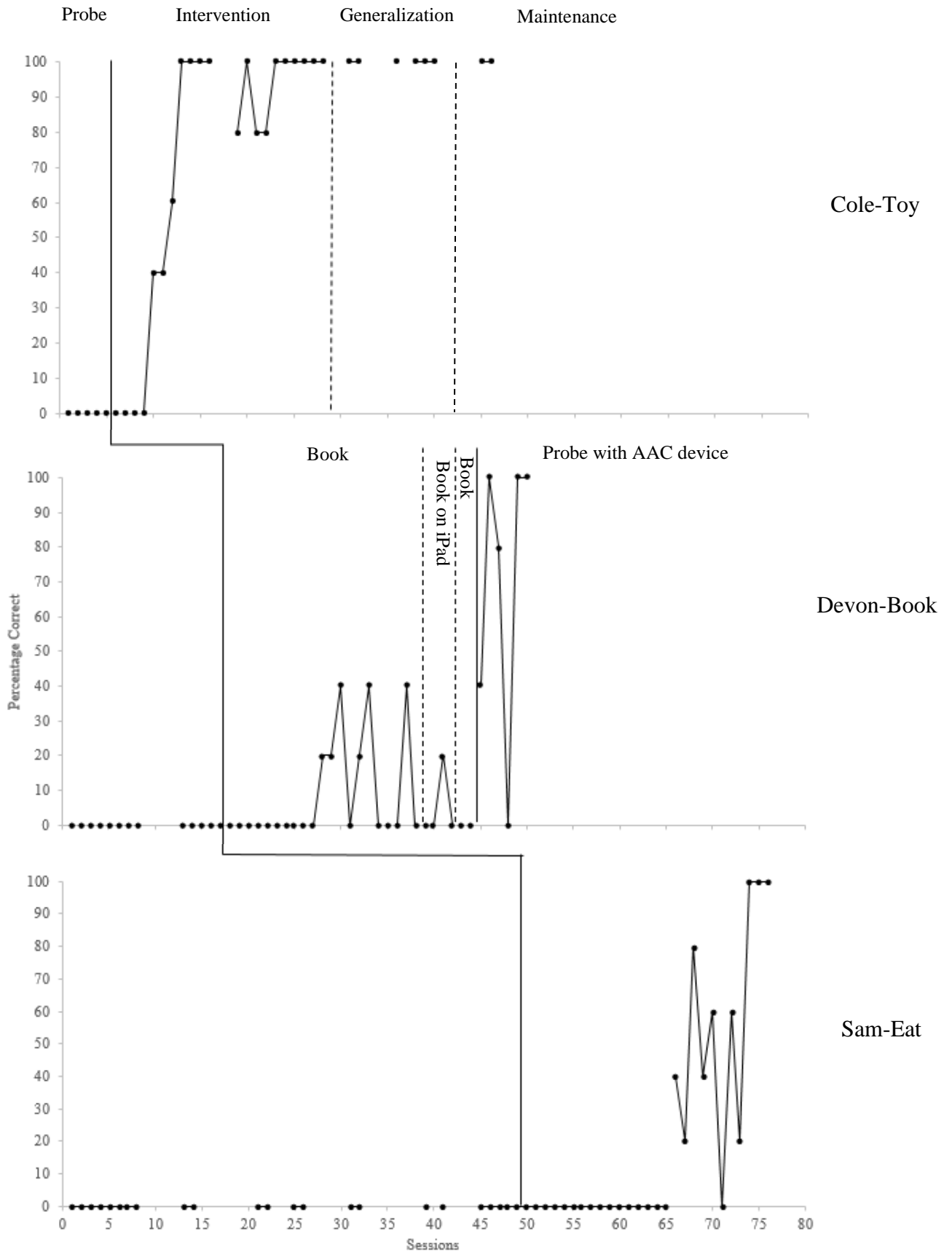


Figure 2

Reliability

IOA and procedural fidelity for Cole’s sessions were collected for 66% of probe sessions and 30% of intervention sessions. IOA was 100% during probe and 100% during intervention sessions. Procedural fidelity was 100% during probe sessions and 99% during intervention sessions. During generalization sessions (Cole) IOA and procedural fidelity were collected for 33% of sessions. IOA averaged 100% and procedural fidelity averaged 100% for all generalization sessions. IOA and procedural fidelity were collected for 100% of maintenance sessions (Cole). IOA and procedural fidelity were both at 100% during maintenance sessions. IOA and procedural fidelity for Devon’s sessions were collected for 33% of probe sessions and 28% of intervention sessions. IOA was 96% during probe sessions and 100% during intervention. Procedural fidelity was 99% during probe sessions and 98% during intervention sessions. IOA and procedural fidelity during Sam’s sessions were collected for 31% of probe sessions. IOA was 90% during probe sessions. Procedural fidelity was 100% during probe sessions. See Figure 3 below.

| Percent of Sessions Collected | | | |
|-------------------------------|------|-------|------|
| Participant: | Cole | Devon | Sam |
| Probe | 66% | 33% | 31% |
| Intervention | 30% | 28% | 38% |
| Generalization | 33% | -- | -- |
| Maintenance | 100% | -- | -- |
| Results-IOA | | | |
| Participant: | Cole | Devon | Sam |
| Probe | 100% | 96% | 90% |
| Intervention | 100% | 100% | 100% |
| Generalization | 100% | -- | -- |
| Maintenance | 100% | -- | -- |

| Results-Procedural Fidelity | | | |
|-----------------------------|------|-------|------|
| Participant: | Cole | Devon | Sam |
| Probe | 100% | 99% | 100% |
| Intervention | 99% | 98% | 99% |
| Generalization | 100% | -- | -- |
| Maintenance | 100% | -- | -- |

Figure 3

Production of Manual Signs

Cole. The targeted manual sign for Cole was “toy” when a preferred toy was present. During probe sessions he displayed zero-celerating trend, and was unable to imitate an adult model for the targeted sign for toy. Upon introduction of the intervention, a delayed response in the target behavior was observed. Following 3 sessions, an accelerating trend (slope or angle) in a therapeutic direction (improving) was observed in the data. The percent of non-overlapping data (PND) was 85%. During intervention, Cole was able to score 100% unprompted correct responding on the 7th intervention session. He was able to master imitation of the target sign for toy on the 9th session. Cole did stay in intervention longer than planned due to a change from graphing days to graphing individual sessions.

Devon. The targeted manual sign for Devon was “book” when a preferred book was present. During probe sessions he displayed zero-celerating trend, and was unable to imitate an adult model for the targeted sign for toy. Upon introduction of the intervention, a delayed response in the target behavior was observed. Devon’s scores ranged from 0-40% independent responding. During intervention sessions 21-24, a book on the iPad was used instead of a traditional text. Due to an increase in self-injurious behavior (SIB) following this change, the iPad was removed and replaced back with the traditional text

for sessions 25 and 26. A second probe condition occurred and data were collected during sessions following the 26th intervention session. These sessions examined if Devon could imitate making a request for a book on the iPad using a single button on ProLoQuo2Go. Devon was able to imitate this on probe (2) sessions 2, 5, and 6. Since an increase in SIB was observed and Devon was able to make the same request using an iPad, intervention was terminated at that time.

Sam. The targeted manual sign for Sam was “eat” when a preferred edible was present. During probe sessions, the data path indicated a zero-celerating trend; Sam was unable to imitate an adult model for the targeted sign for eat. After introducing the intervention, a delayed response in the target behavior was observed. Following 15 intervention sessions, an accelerating trend (slope or angle) in a therapeutic direction (improving) was observed in the data. The percent of non-overlapping data (PND) was 38.5%; PND was influenced by delayed responding after introducing the intervention. Responding was at 100% unprompted correct on the 24th session and displayed mastery of the target sign on the 26th intervention session.

Increases in independent use of manual signs. In addition to imitation of manual signs, given participants had 5 s to initiate to an item, it was possible for participants to independently request a preferred item using a targeted manual sign. Both Cole and Sam were able to master the sign language motion prior to the adult model being provided for them (see Figures 2 and 3). Cole first demonstrated this during session 14 (60% of trials) and during session 20 he was able to make the motion prior to a prompt for 100% of the trials. Cole was able to complete the sign before the prompt for 12 consecutive trials (25-46), including maintenance and generalization sessions. Sam first

demonstrated this during session 67 (20% of trials) and during session 74 he was able to make the motion prior to a prompt for 100% of the trials and continued this for three consecutive trials (74-76). Independent responding prior to an adult model did not occur for Devon.

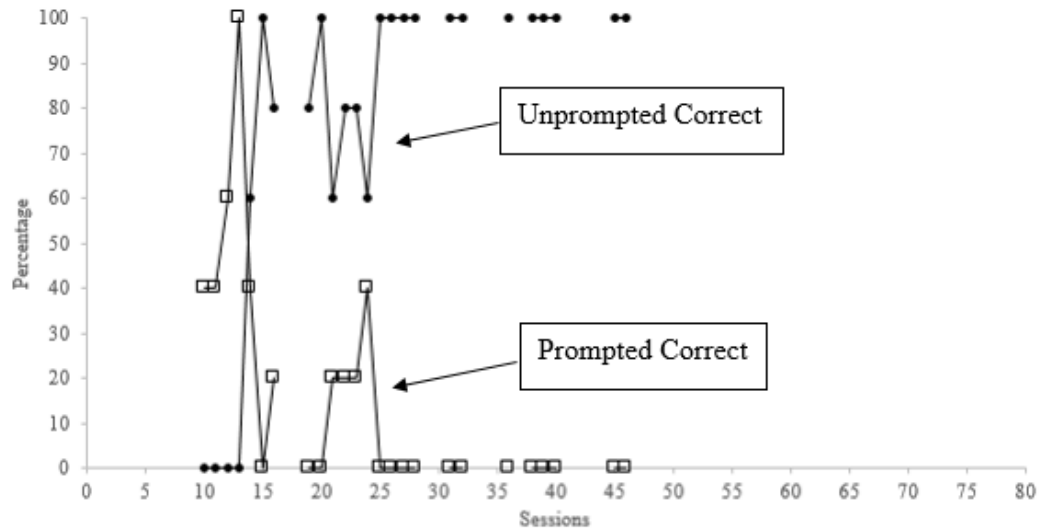


Figure 4

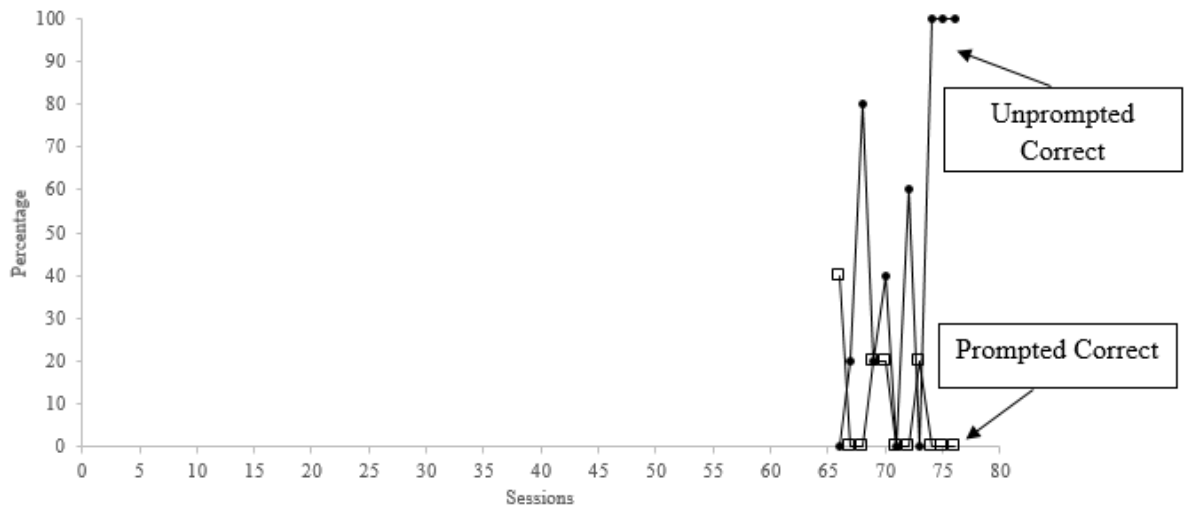


Figure 5

Generalization

A pre-test and post-test were conducted on generalization of imitation to other sign language motions, with the post-test occurring following three consecutive sessions at 100% unprompted correct responding. All participants were unable to imitate the novel manual signs (jump, ball, dog, thank you, Mom) prior to intervention of this study. Following completion of all three tiers, students were then tested on imitation of these signs. None of the students were able to imitate the signs, so generalized imitation was not achieved. Another generalization was conducted using novel stimuli and the investigator and instructional assistant switching roles to assess generalization across a novel person. Cole was able to imitate his target sign of “toy” with 100% unprompted correct responding using a novel toy for six sessions (singing and dancing robot, steering wheel toy, drum).

Discussion

This study evaluated the effects of a graduated guidance procedure to teach students with MSD to imitate manual signs as a form of expressive communication for preferred items. Graduated guidance was an effective strategy to teach imitation of the manual signs for two of three participants. Each trial began by providing a student an opportunity to initiate interest in a preferred item, increasing the likelihood the student would be motivated to imitate an adult's physical model. In addition, two of three participants began to sign independently for the targeted items during intervention sessions and consistently began to use the manual sign within and outside the intervention context. Although a graduated guidance procedure was effective, one participant required multiple modifications, indicating that the procedure may not be an effective option when targeting imitation of manual signs in some students with MSD. These mixed results do not align with previous research that indicated graduated guidance was an effective intervention to teach motor movements to students with ASD (Gruber & Poulson, 2015). It should still be noted that success was seen with two of the three participants and further replication may be needed. In addition, one of the three participants were able to generalize their target sign with novel people and novel stimuli. None of the participants were able to generalize imitation to novel sign language motions.

Limitations

It is important to note limitations of this study. First, Devon did not show success with the given intervention. At the time of the study he was going through changes in medication and displayed increases in self-injurious behavior. These medication changes may have introduced a potential history effect to the study. Thus, the investigator made the decision to discontinue intervention sessions and conducted probe sessions to

determine if Devon could imitate a request on an iPad. Devon was able to imitate the request and, as such, this form of AAC was considered an appropriate alternative to imitating signs. This decision was made for ethical reasons due to an increase in self-injurious behavior during intervention sessions. Also, the iPad was an already established form of communication for this student. A second limitation to note was the student in tier three did not enter generalization (novel item and novel adult) or maintenance sessions. It should be noted that generalization for imitation was limited to a pre- and post-test, therefore interpretations of the data were limited given the design is less rigorous (given the small sample of participants) compared to other designs. Though the study was conducted by the classroom teacher and classroom staff, formal social validity data were not collected. While generalization of a novel adult and novel stimuli were collected following mastery, this information is limited because it was not assessed prior to introducing the intervention. Finally, given a functional relation was not present in the data, the inclusion of an additional participant may have strengthened the findings of this study (*moderate effect* – three effects and one non-effect according to What Works Clearinghouse guidelines; Kratochwill et al., 2013).

Implications

Although the limitations of this study warrant attention, the results of this study provide important information for teachers who work with children with MSD in classrooms. The results of this study support findings that students with MSD can learn to imitate motor actions. Thus, graduated guidance should be considered when selecting an intervention to teach imitation. Teaching students to make requests for preferred items is a starting point for finding an effective communication system. This study was able to

show two basic demonstrations of effect, but failed to meet the standard of three demonstrations of effect at three different points in time. These findings indicate that graduated guidance may be an effective method to teach imitation to students with MSD (diagnosed with an intellectual disability), but, using What Works Clearinghouse guidelines (Kratochwill et al., 2013), this study's findings would be classified as *no effect*. Although that classification would be correct, the results of the intervention for Cole and Sam are promising. Thus, teachers should consider a graduated guidance procedure for students who display similar pre-intervention characteristics to Cole and Sam. In addition, when working with students with MSD, teaching children imitation of a functional manual sign may lead to independent responding after presentation of a preferred stimulus. Including opportunities for independent responding during a trial allows students to independently initiate for a preferred item prior to the adult providing a model (similar to trials in published naturalistic language intervention studies; Lane & Brown, 2016). A variety of communication modes may be appropriate based on each individual student, especially for students who do not consistently respond to an adult model. This study sought to teach imitation though since the participants were not able to generalize this to new motions, they essentially learned how to sign the given sign and not to imitate. Possible new research could examine teaching imitation using a variety of motions. Finally, teachers should be aware of the potential deleterious impact medication changes may have on student performance and behavior and, as such, monitor changes in performance closely during this process (modifying intervention procedures, as needed).

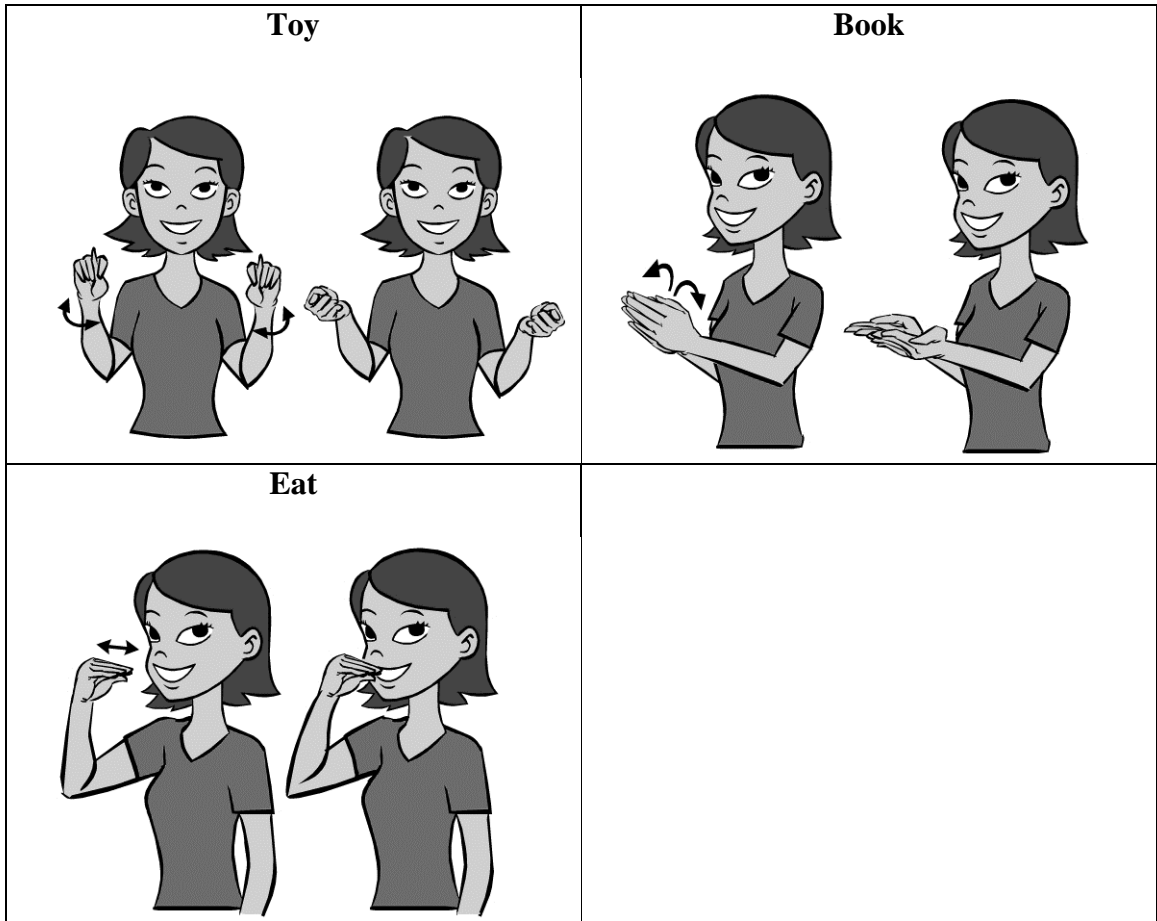
Future Research

Although the results of this study are promising for the MSD population, additional research is required to continue understanding this line of inquiry. Future studies should be conducted with a minimum of four participants to ensure a strong demonstration of effect according to What Works Clearinghouse design standards (Kratochwill et al., 2013) (a minimum of three demonstrations of effect and no non-effects). In addition, future studies could examine these procedures using multiple manual signs; this may increase the likelihood of generalized imitation. A variety of manual signs could be taught, such as signs for other tangibles, edibles, or interactions with preferred people. These procedures may also be effective for students with ASD, multiple disabilities, or any student with severe communication delays. Graduated guidance to teach imitation could be implemented across other settings using appropriate signs for that setting. For example, greetings such as “hello” and “goodbye” could be taught embedded into transition times throughout the day. Other signs to consider would be words that can be used in a variety of contexts such as “more”, “play”, “want”, and “finished”. Future research may want to provide each student a choice for a communication method. Some students may prefer to use an AAC device rather than manual sign language. In order to teach imitation and not just the given motion, future studies should consider teaching a variety of motions during intervention sessions. Generalization was collected following mastery using a novel adult and novel stimuli, but generalization of imitation was assessed through a pre-test post-test. Future research may choose to embed generalization probes within a single case experimental research design.

Appendix A: Reinforcement Items

| Toys | Books | Edibles |
|---|---|---|
|  |  |  |
|  |  |  |
|  |  |  |

Appendix B: Sign Language Motions



Pictures from babysignlanguage.com

Appendix C: Data Sheet-Baseline

Imitation of Manual Sign Language Intervention Data Sheet

| | | | | | |
|------------------|-------------|---------------|-------------------------|------------|----|
| Student: | | | Manual Sign: | | |
| Date: | | | Date: | | |
| | AM | PM | | AM | PM |
| 1 | | | 1 | | |
| 2 | | | 2 | | |
| 3 | | | 3 | | |
| 4 | | | 4 | | |
| 5 | | | 5 | | |
| Total % | | | | | |
| I | | | I | | |
| S | | | S | | |
| P | | | P | | |
| P- | | | P- | | |
| E | | | E | | |
| Date: | | | Date: | | |
| | AM | PM | | AM | PM |
| 1 | | | 1 | | |
| 2 | | | 2 | | |
| 3 | | | 3 | | |
| 4 | | | 4 | | |
| 5 | | | 5 | | |
| Total % | | | | | |
| I | | | I | | |
| S | | | S | | |
| P | | | P | | |
| P- | | | P- | | |
| E | | | E | | |
| I Independent | S Shadow | P Prompted | P- Prompted Error | E Error | |

Appendix D: Data Sheet-Intervention

Imitation of Manual Sign Language Baseline Data Sheet

| | | | | | |
|------------------|----------------|----|-------------------|------------|----|
| Student: | | | Manual Sign: | | |
| Date: | | | Date: | | |
| | AM | PM | | AM | PM |
| 1 | | | 1 | | |
| 2 | | | 2 | | |
| 3 | | | 3 | | |
| 4 | | | 4 | | |
| 5 | | | 5 | | |
| Total % | | | | | |
| I | | | I | | |
| - | | | - | | |
| NR | | | NR | | |
| E | | | E | | |
| Date: | | | Date: | | |
| | AM | PM | | AM | PM |
| 1 | | | 1 | | |
| 2 | | | 2 | | |
| 3 | | | 3 | | |
| 4 | | | 4 | | |
| 5 | | | 5 | | |
| Total % | | | | | |
| I | | | I | | |
| - | | | - | | |
| NR | | | NR | | |
| E | | | E | | |
| I Independent | - Incorrect | | NR No Response | E Error | |

Appendix E: Dependent and Independent Variable Reliability-Baseline

| | | | |
|---|----------|----------|----------|
| Date: | | | |
| Observer: | | | |
| Baseline | | | |
| 1. Place item on table | | | |
| 2. 5 second delay | | | |
| Student initiation? | Yes No | Yes No | Yes No |
| 3. Allow student 5 seconds of interaction | | | |
| 4. Pull item away | | | |
| 5. Gain student attention | | | |
| 6. "Do this" | | | |
| 7. Model Given Sign | | | |
| 8. 5 second delay | | | |
| Student Response | I - NR E | I - NR E | I - NR E |
| | I - NR E | I - NR E | I - NR E |
| | I - NR E | I - NR E | I - NR E |
| | I - NR E | I - NR E | I - NR E |
| | I - NR E | I - NR E | I - NR E |
| 9. Deliver appropriate Consequences | | | |
| Total % | | | |
| I | | | |
| - | | | |
| NR | | | |
| E | | | |
| DV Reliability % out of 5 | | | |
| IV Reliability % out of 9 | | | |

DV: 1: 20% 2: 40% 3: 60% 4: 80% 5: 100%
 IV: 1: 11% 2: 22% 3: 33% 4: 44% 5: 55%
 6: 66% 7: 77% 8: 88% 9: 100%

**Appendix F: Dependent and Independent Variable Reliability-
Intervention/Generalization/Maintenance**

| | | | |
|---|------------|------------|------------|
| Date: | | | |
| Observer: | | | |
| Baseline | | | |
| 1. Place item on table | | | |
| 2. 5 second delay | | | |
| Student initiation? | Yes No | Yes No | Yes No |
| 3. Allow student 5 seconds of interaction | | | |
| 4. Pull item away | | | |
| 5. Gain student attention | | | |
| 6. "Do this" | | | |
| 7. Model Given Sign | | | |
| 8. 5 second delay | | | |
| Student Response | I E S P P- | I E S P P- | I E S P P- |
| | I E S P P- | I E S P P- | I E S P P- |
| | I E S P P- | I E S P P- | I E S P P- |
| | I E S P P- | I E S P P- | I E S P P- |
| | I E S P P- | I E S P P- | I E S P P- |
| 9. Deliver appropriate Consequences | | | |
| Total % | | | |
| I | | | |
| E | | | |
| S | | | |
| P | | | |
| P- | | | |
| DV Reliability % out of 5 | | | |
| IV Reliability % out of 9 | | | |

DV: 1: 20% 2: 40% 3: 60% 4: 80% 5: 100%
 IV: 1: 11% 2: 22% 3: 33% 4: 44% 5: 55%
 6: 66% 7: 77% 8: 88% 9: 100%

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