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How array size affects the efficiency of constant time delay in systematic instruction for students with intellectual disability

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How Array Size Affects the Efficiency of Constant Time Delay in Systematic Instruction for Students with Intellectual Disability

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Abstract

The purpose of this research study was to determine how three different array sizes affect the efficiency of acquiring target functional words utilizing constant time delay in systematic instruction for students with intellectual disability. The results shown throughout this study can support teachers and administrators to know if adaptations to the array size in which the materials are presented visually during constant time delay instruction yield a more efficient way to teach. The current study utilized an adapted alternating treatment design, replicated across two students, to determine efficiency through trials-to-criterion for functional food and grocery words. The researcher presented array sizes of two, three, and four to each participant in the study. One participant reached mastery to criterion the fastest in an array size of two and the other reached mastery to criterion the fastest in an array size of four. The researcher also assessed each student utilizing what is typically presented to them in their classroom, however, neither participant reached mastery to criterion in this array the fastest. This suggests that we might not be presenting students with the most efficient approach to teaching. Due to the impact that these findings have on the efficient use of instructional time, the implications of this study demonstrate a higher need for research in the presentation of varying array sizes to students with intellectual disability.

Keywords: array, CTD, efficiency, systematic instruction

How Array Size Affects the Efficiency of Constant Time Delay in Systematic Instruction for Students with Intellectual Disability

Introduction

Learning is essential for all students. Necessary skills, such as counting, reading, and writing, promote independence later in life for individuals with disabilities (Akmanoglu & Batu, 2004). Similarly, literacy skills promote independent skills in employment (Coleman, Hurley & Cihak, 2012). The Every Student Succeeds Act (ESSA) currently holds teachers to a high standard to ensure every student receives academic instruction that prepares him or her for post-graduate programs while meeting criteria for overall state-wide assessments (US Department of Education, 2018). Systematic instruction is an evidence-based practice that encompasses a variety of different response prompting procedures, including constant time delay (CTD; Odom & Wolery, 2003). Currently, there is limited evidence on how visual presentation affects direct teaching trials through CTD procedures to students with disabilities. While there is limited research on altering the parameters of CTD procedures to improve instructional efficiency, Miller, Noell, Harris, McIver, and Alvarez (2019) explain how efficiency is central to learning and thus identification of these experimental conditions that lead to efficiency is crucial to investigate. Teachers and administrators would benefit to know if adaptations to the amount of the visual presentation of materials in CTD instruction yield a more efficient way to teach.

Systematic Instruction

Systematic instruction is a teaching method which utilized direct instruction and encompasses instructional sessions and instructional trials (Collins, 2012). Instructional sessions are delivered to the student daily until the student reaches a criterion established by the instructor for the performance of a behavior (Collins, 2012). Systematic instructional procedures require

determining the learning objective, establishing mastery criterion, developing instructional procedures, determining criterion for correct and incorrect responses, and providing performance feedback (e.g., correction trials; Collins, 2012). Systematic instruction includes a variety of prompting procedures such as graduated guidance, most-to-least prompting, system of least prompts procedure (i.e., least to most prompting), time delay, and simultaneous prompting procedures (Collins, 2012).

Time delay is one prompting procedure that is utilized in systematic instruction. Time delay, both progressive and constant, is established as an evidence-based practice for students with moderate to severe disabilities to acquire functional, academic, and various skills (Collins, 2012). In a time delay procedure, the instructor utilizes a controlling prompt, which is the least intrusive prompt required to obtain a correct response. The controlling prompt is then utilized across all teaching trials (Collins, 2012). However, before implementing a time delay procedure, the instructor should ensure that the student has a wait response as defined by the student having the ability to wait until the prompt is delivered if the student does not know the correct answer. When a student has the appropriate waiting skills to receive a prompt, the student is unlikely to respond with an incorrect answer, which results in in errorless learning. CTD may be easier to implement for teachers than other time delay procedures because only two delay intervals are used across sessions, a zero second delay and an *n* second delay (Collins, 2012).

Collins (2012) outlines the steps of implementation as follows:

1. Secure the student's attention.
2. Deliver the task direction.
3. Wait a predetermined set of seconds for the student to respond.
4. Deliver the controlling prompt.

5. Wait the predetermined response interval.

6. Praise correct responses or repeat the prompt for incorrect responses or failures to respond (p. 56-57).

These steps are a basic outline for CTD to ensure that instruction is provided consistently throughout the trials. Data is collected to examine how the student responds. Detailed data demonstrates if the student is correct before the prompt, correct after the prompt, incorrect before the prompt, or incorrect after the prompt. Data is then graphed and decisions about instruction and progress are determined.

Efficiency of CTD procedures can be measured through time, trials, or sessions. Less time, fewer trials, or fewer sessions indicate more efficient instruction. Trials to criterion will be used in this study, similar to Akmanoglu & Batu (2004), to record number of training sessions and number of training trials to mastery.

Array Size

CTD is frequently used to teach receptive language skills. Receptive language is the overall term that can be described by any motor response to another person's spoken instruction (Grow & LeBlanc, 2013). Receptive identification within instruction requires the student to respond to a spoken discriminative stimulus by selecting a requested item or anything where the student engages in a motor response after hearing a demand, such as responding to a direction given by the teacher to draw with a certain color marker (Grow & LeBlanc, 2013). In a receptive language task, the instructor presents a stimulus (e.g., a question or directive) and the student responds by pointing to or handing a written or picture card to the instructor. Receptive identification skills are prerequisites for more advanced learning (Akmanoglu & Batu, 2004). While there is considerable research demonstrating the efficacy of CTD for teaching expressive

skills such as teaching a student to expressively state a word, letter, or number when shown (e.g., Swain, Lane & Gast, 2014; Head, Collins, Schuster, & Ault, 2011; Coleman et al., 2012), fewer research articles demonstrated the use of CTD to teach receptive identification skills (Miller et al., 2019).

When using CTD to teach receptive skills, the size of the instructional array can be minimized or expanded to provide selection options. Collins (2012) outlines how array sizes can be used in CTD procedures, however, Collins does not provide recommendations or rules for array sizes. Fixed arrays (where items are presented in a straight line) can be contrasted with messy arrays, where items are presented in a skewed manner (Sundberg, 2008).

Students with Intellectual Disability

The umbrella term, severe developmental disabilities, can be used to describe individuals with autism, severe intellectual disability, and multiple disabilities (Browder & Spooner, 2011). The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5; American Psychiatric Association, 2013) defines moderate and severe intellectual disability as an IQ score of 70 or lower and limitations in adaptive behavior (i.e.: conceptual, social, and practical skills). Severity (mild, moderate, severe, and profound intellectual disability) can be further identified by assessing the amount and type of interventions needed (Gluck, 2016). Degree can vary with intellectual disability due to the combination of both the individual's IQ and adaptive behaviors (Gluck, 2016). Browder and Spooner (2011) suggest that teachers of students with moderate and severe disabilities should focus on access to all academic educational opportunities as well as support the students to learn functional skills to promote as much independence as possible into adulthood.

Statement of the Problem

When teachers focus on efficiency, instructional time is maximized (Swain et al., 2015). The goal for teaching students with a disability would be to increase the rate of skill acquisition for students to progress towards the general curriculum where peers are learning the state standards without any adaptations. In order to determine the most efficient instructional methods, CTD procedures can be broken down to identify how array size can influence trials to criterion for students.

Purpose of the Study

The current study will investigate how array size impacts the efficiency of skill acquisition as measured by trials to criterion. Specifically, the study seeks to answer the following questions:

1. Does array size affect efficiency of skill acquisition, measured by trials-to-criterion, when using CTD procedures to teach receptive identification skills to students with intellectual disability?
2. Do teachers find the use of CTD procedures to teach functional words efficient and socially valid?

Literature Review

The literature review focuses on the use of CTD for students with intellectual disability. The researcher conducted the literature review using ERIC and PsycNET electronic databases with the following search terms: trials to criterion, skill acquisition, field of, CTD, constant time delay, fixed array, messy array, receptive. This review highlights three main factors that influence the study, including prompting procedures, teaching variables, and array sizes.

The database search yielded 155 studies that discussed CTD prompting procedures. Narrowing the search results with terms including array size, receptive, expressive, and trials-to-

criterion, nine studies were directly relevant to this research study. Out of the nine studies, the researchers reported all the students had a learning disability, ID, autism, or developmental disability. Six out of the nine selected studies focused on acquiring vocabulary words (Gast, Wolery, Morris, Doyle, & Meyers, 1990; Coleman et al., 2012; Henrickson, Rapp, & Ashback, 2015; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Redhair, McCoy, Zucker, Mathur, & Caterino, 2013; Swain et al., 2014). Eight of the nine studies utilized CTD (Gast et al., 1990; Coleman et al., 2012; Henrickson et al., 2015; Gast et al., 1988; Redhair et al., 2013; Swain et al., 2014; Head et al., 2011, Miller et al., 2019). The researcher included one study outside of constant time delay due to the format of looking at receptive identification in an array format (Akmanoglu & Batu, 2004). Of these nine studies, two (Redhair et al., 2013; Akmanoglu & Batu, 2004) examined the target skill (vocabulary word recognition or number recognition) through receptive identification and the remaining eight examined the target skill through expressive identification.

Prompting Procedures

All nine studies compared or used a combination of the following prompting procedures: CTD, simultaneous prompting, or system of least prompts. Gast et al. (1990) conducted a study to determine the effectiveness of using CTD to teach environmental sight words in a group instruction arrangement. Five students, ages eight to twelve years and all diagnosed with moderate ID, participated in the study. All students could match printed words to sample, follow two-step directions, attend to the teacher for 30 minutes, and wait a minimum of four-seconds for the teacher to deliver a prompt. The students had a history of participating in group instruction and attended a self-contained special education classroom in a public elementary school setting. The researchers utilized a multiple probe design across word pairs to evaluate the effectiveness

of CTD procedures on skill acquisition rate. The authors established experimental control between baseline and intervention with each word pair when probe performance remained stable until the introduction of the CTD procedure. Instruction using CTD continued until all students met mastery criteria. This sequence continued until all word pairs were taught. The researchers concluded that CTD was effective and efficient for teaching new skills in a small group format. The researchers also noted that students acquired incidental information (e.g., learning peers' target words, following directions, etc.) during descriptive praise statements given by the teacher. The researchers recommended that future studies investigate improved measures for observational learning in small groups as well as focusing on various instructional procedures in small group settings.

Coleman et al. (2012) conducted a study to evaluate the use of teacher directed and computer-assisted CTD procedures to teach functional sight words to students with moderate ID. Three elementary school students, ages ten to twelve, were selected to participate in the study from the following criteria: receiving a minimum of 25 hours of special education in a self-contained room and having an individualized education program (IEP) goal for functional literacy. The three students also did not have exposure to CTD procedures and fell below a determined accuracy on a pretest of the pre-selected functional words. The authors chose the functional words based on cooking words in recipe cards. The materials also had a corresponding picture which was faded once student met criterion. The researchers used an alternating treatments design to compare the effectiveness of teacher directed CTD versus computer-assisted CTD. Results demonstrated that both interventions were effective in teaching students to read functional cooking words, however, for two of the three students, teacher-directed CTD was more efficient when measured by trials to criterion. The researcher noted that a limitation of the

study included the distracting learning environment. Another limitation noted by the researcher included technological issues with the computer-assisted program. Coleman et al. (2012) recommended that the study be replicated with focus on minimizing the distractions and technology issues. Finally, the researchers recommended repeating the procedure with other functional academic skills and with a larger number of students.

Henrickson et al. (2015) studied the effects of massed versus interspersed trials using a modified CTD procedure for students who engage in problem behavior. The authors measured the number of sessions to criterion, rate of acquisitions (measured in trials), and number trials for academic skill acquisition. Three elementary-aged students, all diagnosed with autism spectrum disorder (ASD) and served in a private day school setting, participated in this study. Two students used receptive identification to tact (i.e., name) objects. The third student had limited vocalizations, communicated by using pictures to request items, and engaged in the study through receptive identification of pictures of objects. Once researchers presented the discriminative stimuli to the student, they recorded a correct response when the student responded within five seconds. Researchers utilized a non-concurrent multiple baseline design to evaluate the performance of students across a modified alternating treatments design that compared interspersed teaching trials and massed teaching trials. Overall, results indicated that while problem behavior stayed consistent in both interventions, between the two teaching strategies, massed teaching trials were more efficient than interspersed teaching trials in acquiring the academic skill. The results confirm prior studies conducted with massed and interspersed teaching trials with rate of acquisition. Authors acknowledge that limitations of this study include recognizing that some reinforcing stimuli might not be preferred once the task

completed, the time constraints for session lengths, as well as using a 3:1 of mastered-to-non-mastered ratio for the selected words.

One study compared CTD procedures to system of least prompts, four studies compared CTD to simultaneous prompting, and one study compared CTD to stimulus fading. Gast et al. (1988) conducted a study to compare the effectiveness and efficiency of CTD procedures and system of least prompts for students to teach food words (i.e., words found in grocery stores) to students with moderate ID. Researchers selected four female students from a self-contained special education program in a public school for this study. The students ranged from eight years to thirteen years of age and all had prior exposure to CTD, but not system of least prompts. The researchers utilized a parallel treatments design to evaluate CTD and the system of least prompts procedure. Specifically, the researchers measured effectiveness and efficiency using sessions through criterion. This study focused on measuring the duration of instruction time, sessions, trials, and assessing generalization of the skills acquired in the intervention. Gast et al. (1988) targeted instruction through an expressive format with the prompt, “what word?” (p. 118). The parallel treatment design taught word pairs during one session using CTD for one word, and system of least prompts for the second word. Results demonstrated that all four students met the set mastery criteria for both conditions to acquire the selected sight words. Students acquired an average of 11.25 words per minute in CTD instruction compared to an average of 16 words per minute in system of least prompts. The researchers noted that incidental learning occurred during trips to grocery stores outside of the study as well as within the classroom with peers. Gast et al. (1988) described this study as unique due to having an all-female cohort. Further research is needed to determine prompt requirements, as well as the generalization outside of the classroom.

Similarly, Head et al. (2011) designed a study to compare CTD with simultaneous prompting to determine the effectiveness and efficiency in acquiring discrete social studies facts for students in high school setting with learning and behavior disorders. Four high school aged students, two diagnosed with a learning disability, one with other health impairment (depression), and one with mild ID, served as students in this study. Head et al. (2011) conducted the study in a secondary resource classroom and focused on teaching the names of state capitals. The authors note that for this study, each student could read the names of all the states and their corresponding state capital. The students however, never received prior instruction using either prompting procedures in the past. The results of the study showed that all four students acquired the state capital names. The results from the study demonstrated that neither prompting procedure yielded a more efficient or effective outcome. Head et al. (2011) compared these findings with similar studies and found comparable mixed results using the CTD and simultaneous prompting for instruction. The authors indicated that the student's history might play a role in which procedure worked for each student. The authors suggested a need for more research pertaining to high school aged individuals with high-incidence disabilities and hypothesizes that individual differences between systematic instruction diminish when students age or are less prominent with high-incidence disabilities. A strength that the researchers articulated included utilizing CTD prompting procedures with a population who can read the printed words. Head et al. (2011) state that CTD is not often researched for students in high school and the literature would benefit to see how different prompting procedures affect students of all abilities.

Redhair et al. (2013) compared CTD to stimulus fading. They evaluated the ability of a four-year old student with autism to identify printed nonsense words. The authors compared

CTD with stimulus fading for ten consonant-vowel-consonant nonsense words in an alternating treatment design utilizing a computer-based format. The researcher assessed the student's receptive identification skills by presenting an array of three stimuli on a touch screen tablet computer. When the teacher showed a printed word on an index card, the student responded with by emitting a vocal response (i.e., expressive identification). The authors selected nonsense words to ensure that the student had not already learned the word. The authors utilized an alternating treatment design to minimize sequencing effects. Redhair et al. (2013) reported that both procedures were equally as effective. However, a limitation that the authors noted included the student engaging in selection bias and choosing the same button location. Due to this selection bias, Redhair et al. (2013) developed the next phase of the study conducted with expressive identification. While both prompting methods were effective in teaching expressive identification of target nonsense words, the student reached mastery in fewer sessions for stimulus fading with an average of 39.69 trials-per-session compared to CTD, yielding an average of 54.31 trials-per-session. Further research is needed to evaluate the potential teaching implications for high frequency words as well as compare to other prompting procedures such as simultaneous prompting.

Swain et al. (2014) also conducted a comparison between CTD procedures and simultaneous prompting procedures. The authors conducted a study to compare efficiency of CTD and systematic prompting. Swain et al. (2014) implemented the intervention during functional sight word instruction. This study measured efficiency through total number of sessions required to meet criterion, percent of training errors, amount of training time, and total number of trials through criterion. Four middle school aged students, one male and three females, participated in this study. Inclusion criteria included: a diagnosis of moderate ID,

receiving services in self-contained classroom, absent less than 10% of school days, imitate a verbal model, wait at least five seconds for a prompt, and sit to attend to stimuli for five minutes. Due to the nature of using nonreversible behaviors, the authors conducted an adapted alternating treatments design across the two comparison conditions. Swain et al. (2014) targeted sight words using expressive statement, "what word?" when prompting (p. 216). Results indicated that CTD procedures resulted in higher efficiency in fewer errors through criterion when compared to simultaneous prompting (SP). The authors also stated that fewer sessions through criterion were needed when compared to simultaneous prompting. Similar to studies conducted comparing prompting procedures, the authors note that prompt efficiency depends on the student and called for more research in this area. Swain et al. (2014) stated that limitations they encountered for the study included only assessing generalization with one target word set.

Next, Akmanoglu and Batu (2004) evaluated simultaneous prompting procedures of receptive identification for students with autism spectrum disorder. For simultaneous prompting procedures, the authors delivered the controlling prompt simultaneously with the stimulus being taught to provide a near errorless learning procedure to teach numeral identification. Akmanoglu and Batu (2004) measured the number of independent responses through probe sessions. Three students diagnosed with a primary disability of autism, aged six to seventeen-years old, participated in the study in Turkey to receptively identify numerals, a novel skill for all. Akmanoglu and Batu (2004) delivered instruction in an array size of three in front of the student for the zero second delay condition as well as throughout the probe assessments. The authors utilized a multiple probe design to assess the effectiveness of simultaneous prompting and replicated across all three students. All three students mastered receptive identification of numbers 1-9. Results indicated the total number of training sessions for all students ranged from

27 sessions to 43 sessions with a mean of 33 sessions. Training time ranged from 35-min. and 34-sec. to 52-min. and 38-sec. with a mean time of 41-min. and 50-sec. The full probe session indicated an increase of total responses from all students from 269 to 360 correct responses throughout the study. The researchers determined that simultaneous prompting is an effective way to teach number identification to students with ASD.

Finally, the Miller et al. (2019) assessed the experimental parameter of instructional set size utilizing constant time delay instruction for three elementary school students receptively acquiring multiplication facts. The authors conducted a study to compare efficiency of varying instructional set sizes. This study measured efficiency through total number of facts mastered per hour, instructional time, and mastery rate. Inclusion criteria included: students accessing the general education classroom, endorsement from teacher who needed extra math supports, as well as not currently receiving special education. Due to the nature of using nonreversible behaviors, the authors conducted a multielement design. Miller et al. provided instruction to the students five minutes once per day and were equally divided between instructional sets of 5 and instructional sets of 20. The researches provided a verbal controlling prompt to ensure errorless learning in the 0-second time condition. Miller et al. (2019) reported that two of the three participants acquired the target facts at a quicker rate in the instructional size set 20 condition relative to the instructional size set 5 condition. Miller et al. (2019) stated that limitations they encountered for the study included only assessing two instructional set sizes and that further research is needed to discover if a smaller or larger target word set size would influence the rate of acquisition.

Receptive Identification

Overall, two of the nine studies assessed receptive identification of functional and academic targets for students with disabilities (Redhair et al., 2013; Akmanoglu and Batu, 2004). Both Redhair et al. (2013) and Akmanoglu and Batu (2004) used an array size of three and asked the student to "point to" or "hand me" from an array. Redhair et al. (2013) utilized receptive identification for functional vocabulary where Akmanoglu and Batu (2004) utilized receptive identification for numeral identification.

Research Gap

There have been many studies that assess the use of CTD to measure trials-of-criterion for students with disabilities (e.g., Swain et al., 2015; Head et al., 2011; Gast et al., 1988). Likewise, there are studies that research receptive identification for students with disabilities in acquiring academic skills (Redhair et al., 2013; Akmanoglu & Batu, 2004). While there is considerable research investigating instructional efficiency, (Miller et al. 2019), no studies specifically evaluated the instructional efficiency of CTD with changes in array size. This gap in literature needs to be filled to ensure that teachers are providing the most effective and efficient instruction.

Significance

The goal of this study is to assess the independent variables of array size in CTD instruction to ensure that students are receiving the best instruction available. With the changing of array size, we can see how these variables affect the dependent variable of trials to criterion for each condition. With pressure to demonstrate skill acquisition and data for individualized education program goals, determining the effects of each independent variable will support teachers in the field. The research for array size will also support future classrooms by determining trials-to-criterion and assessing maintenance and generalization skills.

The research literature demonstrates that there is a significant increase in studies utilizing CTD across the past decade. The progression of systematic instruction that teachers are using is relatively new and educational researchers are developing studies within the past twenty years. Within this research, array size has not been systematically studied which prompts a need for future research.

Method

Participants and Selection Criteria

The target population for the study included school-aged students (ages 7-22) with an educational diagnosis of moderate or severe intellectual disability accessing the adapted curriculum. Both male and female students were considered for the research study as well as students of all ethnicities and socioeconomical statuses. Selection criteria for participation in the study included: (a) participating in the adapted curriculum, (b) having an IEP goal of acquiring vocabulary and or reading instruction, (c) having an educational eligibility of intellectual disability, (d) scoring below 50% accuracy on a researcher-developed pre-assessment for receptive identification of grocery words, (e) ability to respond to a gestural prompt and (f) endorsement to participate from classroom teacher for acquiring vocabulary target words. Exclusion criteria for participation in the study include: (a) prior exposure to the Edmark Fast Food and Grocery Functional Word Series, (b) inability to reach out and touch an index card on a table one foot away, and (c) twenty or more absences prior to the start of the study. The researcher sent home consent forms to all eligible students in the school and obtained written consent from the parents and assent from the students prior to the intervention.

Jerry was a twelve-year-old male middle school participant who had been served in a self-contained special education classroom since the third grade. Jerry satisfied all selection

criteria outlined above for participation in this study. As reported by his individualized educational program (IEP), he scored 2.0 standard deviations below the mean in intellectual functioning with an IQ of 59 according to the Stanford Binet (Roid, 2003). He has scored a composite standard score of 60 on the Vineland II Adaptive Behavior Assessment (Sparrow, Cicchetti, Balla, & Edgar, 2006). Jerry also exhibited delays in visual, motor, and visual perceptual tasks as reported from his IEP.

Tom was a nineteen-year-old male participant who had received special education services since the age of two. Tom satisfied all selection criteria outlined above for participation in this study As reported by his individualized educational program (IEP), Tom was diagnosed with Down Syndrome at birth and global developmental delays at age two. He received services under intellectual disability at the age of five. As mentioned in Tom's IEP, IQ testing was attempted but there was an inability to accrue a true IQ score. On the Wechsler Intelligence Scale V (Wechsler, 2015), he scored 45 for visual and 55 for fluid reasoning. Tom was also assessed with the Adaptive Behavior Assessment Scales II (Harrison & Oakland, 2003) and scored 49% for conceptual, 58% for social, and 48% for practical.

The researcher was a full-time graduate student working towards her Master of Education degree with a behavior specialist concentration. The researcher also was a licensed K-12 adapted curriculum teacher and had over five years of experience working with students with mild to severe disabilities. Three peers in the same concentration as the researcher served as secondary data collectors for the study. Two peers were full-time graduate students working towards their Master of Education degree with a behavior specialist concentration and one was a full-time graduate student working towards her Master of Teaching degree with a behavior specialist concentration.

Setting

The researcher conducted the study at a local public middle and high school that serves students from sixth grade through age twenty-one in the Southeastern United States. Students that were selected for the study were from two different special education classrooms from two different schools (one middle, one high). Both classrooms provided instruction aligned to the adapted curriculum. Each classroom consisted of five to twelve students. A head teacher led instruction and two to four paraprofessionals assisted in each classroom. All phases of the study occurred in a separate room (in the middle school) or table within the classroom (in the high school) with the researcher. The researcher sat next to the student and all other distractor items (e.g., extraneous materials and reinforcers) were placed out of the student's sight. One student and their parent declined to consent to video recording. For the other student, the researcher set up a video camera in the room which was utilized through all segments of the study including baseline and intervention.

Materials

Word cards. Materials used during instruction consisted of grocery/fast food words from the Fast Food and Grocery Edmark Functional Word Series (Pro-ed, 2013a; Pro-ed, 2013b). Each condition utilized a word list consisting of five target words. Each condition had an additional seven words to serve as distractor words in the array. Prior to baseline, the researcher completed two pre-assessments to check for prior knowledge of 120 grocery/fast food words. During the first pre-assessments, the researcher presented picture cards of the food items to account for cultural differences or unfamiliar foods. Next, the researcher presented the corresponding word cards. The researcher did not assess or include any corresponding word card that the student could not identify in the picture pre-assessment. The purpose of the word pre-

assessment was aimed to determine which words the student could not identify correctly. These words then would be included in the word sets. For the picture pre-assessment, the researcher used the laminated colored 5.5 x 4.25-inch picture cards from the Fast Food and Grocery Edmark Functional Word Series (Pro-ed, 2013a; Pro-ed, 2013b). For the word pre-assessment, the researcher printed each word in 48 pt. Times New Roman font on a 3x5 inch blank white index card and laminated the cards.

The researcher pared down the list of words that the student did not respond to correctly to words that the students may see on school lunch menus and within community-based instruction. This is a similar procedure used by Swain et al. (2015). These words are listed in Appendix A. The researcher subdivided the unknown words into syllable count and beginning letter sounds ensuring that each condition set had an equal distribution of words by each characteristic, based on the procedure used by Singleton, Schuster, Morse, and Collins (1999). For double words (e.g., mashed potatoes, french fries), the total syllable count was accounted for (i.e., mashed potatoes yield four syllables with a beginning sound of /m/). The five target words and seven distractor words assigned to each student and each array size is listed in Appendix C. Each student received a unique set of words that counterbalanced for difficulty across the sets for the student.

Data

The researcher utilized a data sheet designed for systematic instruction plans to collect data on all trials within each session (blank copy is listed in Appendix D). The researcher recorded the following data on each data sheet: session number, date, and time-delay prompt. The researcher stored the data in a locked file box housed in the Exceptional Education department. The researcher also transferred the data from hard-copy sheets into Excel

spreadsheets immediately after the session concluded. Students were assigned a number to ensure deidentification on all data sheets. Consent forms were stored in a separate records cabinet behind locked doors in the Exceptional Education department.

Design

The researcher used an adapted alternating treatment design (AATD; Wolery, Gast & Ledford, 2018) replicated across students in the study, similar to Singleton et al. (1999). The researcher measured efficiency in trials to criterion (both as a baseline percentage, and intervention percentage per condition) and total number of sessions to reach criterion (including the final session) for each condition. The researcher used the following labels for the study: "A" represented an array of two, "B" represented an array of three, "C" represented an array of four, and "D" represented the control set which was assessed in an array of three. The experimental conditions include: (a) baseline for word sets A, B, C, and D, (b) intervention with a 0s prompt for word sets A, B, C, (c) intervention with a 3s gestural prompt for word sets A, B, and C. The researcher assessed the intermittent control set (D) every session in baseline, then every third session after the 0-second delay condition.

Within each session (excluding intermittent control sets), the researcher presented 15 trials. The researcher presented the five target words in each array size to the student. Specifically, the researcher presented the words from set A for five trials, set B for five trials, and set C for five trials to yield a total of 15 trials per session. Utilizing a random number generator, the researcher also randomized both the set presentation order (A, B, and C) as well as the words (1-5) in order to minimize the impact of order effects. Specifically, the student could be exposed to the sets in any combination of A, B, and C (including set D during intermittent control sessions). The researcher accounted for percent correct by each array size out of five (i.e.,

a student could earn 0%, 20%, 40%, 60%, 80% or 100% correct). The researcher graphed each array size separately despite all trials being conducted in one session (i.e., one session had three different data points: one for array of two, one for array of three, and one for array of four). During intermittent control sets, the researcher applied the same procedure, but included a final set of five words that were not subject to instruction and were coded as set D.

Procedure

Pre-assessments. The researcher administered the pre-assessments to each student to determine words selected for the study. The researcher implemented the picture assessment, then the word identification assessment. In both pre-assessments, the researcher presented an array of three cards from the Edmark Fast Food and Grocery Word Series set (Pro-ed, 2013a; Pro-ed, 2013b). The researcher obtained the student's attention by stating the student's name and then vocalizing the prompt, "Hand me the picture of…". The researcher delivered reinforcement (i.e., verbal praise) for each trial and overall session stating, "Good job working", "Nice job!", etcetera. The researcher recorded data with a (+) if the student responded correctly, or a (-) if the student responded incorrectly. If the student could not identify a picture, then the corresponding word card was not used in the following assessment or the remainder of the study. The researcher removed these cards to account for cultural differences (e.g., chips as another word for French fries or chips meaning potato chips). Finally, the researcher presented word cards in a fixed array of three. The researcher obtained the student's attention by stating the student's name and then vocalizing the prompt, "Hand me…". The researcher delivered reinforcement (i.e., verbal praise) at the end of the session stating, "Nice job working". The researcher recorded data with a (+) if the student responded correctly, or a (-) if the student responded incorrectly. Replication of the word card procedure occurred twice and selection of words for the study

consisted of words the student missed both times during the word pre-assessment (Coleman et al., 2012). The researcher randomly assigned words once difficulty (i.e., syllable count and beginning letter sounds) was accounted for to each set of words. These assignments are shown in Appendix C.

Preference assessment. The researcher administered a paired stimulus preference assessment to each student at the beginning of the study to establish a hierarchy of preferred items. The student selected one time from a pair of items (e.g.: coloring, Legos, puzzle, etc.) for a six trials. A copy of the paired stimulus preference assessment is listed in Appendix B. The researcher used the results from the assessment in order to provide reinforcement at the conclusion of each session. The researcher provided access to this positive reinforcer to the students due to the length and difficulty of the assessments. Both students chose to work for electronic devices after each session. Based on Jerry's preference assessment, he rotated between a variety of games on a mobile device. Based on Tom's preference assessment he rotated between a variety of video clips on the internet.

Baseline. The researcher obtained the student's attention by stating the student's name and then vocalizing the task direction, "Hand me…" or "Touch…". The researcher did not provide any instructional prompts during the baseline sessions nor provided feedback contingent on either a correct or incorrect response. The researcher delivered neutral, noncontingent verbal praise (e.g., "Thanks for a great job working") at the end of the session. The researcher recorded a (+) if the response was correct or a (-) if the response was incorrect. The researcher presented 20 trials in each baseline session. The researcher presented the target five words in each array size to the student. Each target word was paired with one, two, or three distractor words depending on the specific set. Specifically, the researcher ran the words from set A for five trials,

set B for five trials, set C for five trials, and set D for five trials to yield a total of 20 trials per baseline session. Again, to account for sequencing effects, the researcher ensured that each student received a randomized sequence of sets and word cards within each set. Specifically, the student could have received any combination of the sets A-D (e.g.: A, C, B, D; D, C, B, A; A, D, B, C, etc.). The words were not presented in the same order every time to account for sequencing effects. The researcher continued baseline until the data reflected stable responding, as determined by visual analysis, for a minimum of five sessions for each student.

Intervention. The researcher conducted three 0-second delay sessions for the five words in each array set. The researcher presented the target five words in each array size to the student. Similar to baseline, the researcher presented each target word from set A once (yielding a total of five trials), each target word from set B once (yielding a total of five trials), and each target word from set C once (yielding a total of five trials) to have a total of 15 trials per session. To counterbalance order effects, the researcher alternated randomly between array sizes per each session. For example, student one could receive set A, set B, then set C for the first session and set A, set C and set B for the second session, and so on. For all trials, the researcher administered the following sequence. Secure the learner's attention, state the task direction, immediately deliver controlling prompt (which was a gesture for each student), then record the response. For all the trials, the seven additional words that were assigned to each array size (sets A-D) were used as distractors in the sessions. The researcher showed distractor words with similar beginning sounds in randomized order for each trial. The researcher delivered reinforcement (e.g., verbal praise) for each correct response stating, "You are right! That is the word…". After the three sessions using a 0-second delay, the researcher implemented instruction utilizing a 3-second delay until the student reached mastery criterion of 80% accuracy

independently over four consecutive sessions. Drop back criterion to the 0-second prompting condition included the student scoring a combined accuracy of 40% or below for both after prompt and before prompt over three consecutive sessions. The researcher never needed to implement the drop back criteria throughout the intervention with either participant. Again, the researcher obtained the student's attention stating the student's name and then delivered the task direction, "Hand me…". During each session, the researcher waited the specified time-delay prior to delivering the controlling prompt (i.e.: gestural prompt). The researcher again delivered verbal reinforcement for each correct response stating, "You are right! That is the word…". For any incorrect response, the researcher provided a gestural prompt then implemented an immediate correction trial using a 0-second delay for the next trial. This included the same word set and target word with an immediate gestural prompt after the discriminative stimuli was delivered by the researcher. The researcher did not count correctional trials as part of the five trials per array size. The next trial in the series returned to the CTD 3-second delay condition. The researcher replicated the procedure for all intervention conditions.

The researcher recorded responses in five different ways on the data sheet: 1) correct before the prompt, 2) correct after the prompt, 3) incorrect before the prompt, 4) incorrect after the prompt, and 5) no response from the student. A response was coded as correct before the prompt when the student handed, pointed, or touched the correct word card prior to the controlling prompt being administered. A response was coded as correct after the prompt when the student handed, pointed, or touched (with a finger or whole hand) the word card within five seconds after the delivered prompt. A response was coded as incorrect before the prompt when the student handed, pointed to, or touched an incorrect word before the controlling prompt was given. A response was coded as incorrect after the prompt when the student handed, pointed to,

or touched an incorrect word five seconds after the delivered prompt. A response was coded as no response when the student did not respond within five seconds after the researcher delivered the prompt.

Set A. The researcher presented the words in set A using an array size of two cards. Each word in Set A was presented once in the session. Words were presented in varying order within the session. Utilizing a random online number generator, the order of the sets and words were randomly determined prior to each session and changed within each session. The researcher followed the pre-determined randomized word sequence, placing the target word card in the fixed array of two. This process continued until all five target words were assessed. This array size was assessed until the student met mastery criteria as stated above.

Set B. The researcher presented the words in set B using an array size of three cards. Each word in Set B was presented once in the session. Words were presented in varying order within the session. Utilizing a random online number generator, the order of the sets and words were randomly determined prior to each session and changed within each session. The researcher followed the pre-determined randomized word sequence, placing the target word card in the fixed array of three. This process continued until all five target words were assessed. This array size was assessed until the student met mastery criteria as stated above.

Set C. The researcher presented the words in set C using an array size of four cards. Each word in Set C was presented once in the session. Words were presented in varying order within the session. Utilizing a random online number generator, the order of the sets and words were randomly determined prior to each session and changed within each session. The researcher followed the pre-determined randomized word sequence, placing the target word card in the

fixed array of four. This process continued until all five target words were assessed. This array size was assessed until the student met mastery criteria as stated above.

Set D. The researcher conducted set D as the control set during the beginning of the intervention, every third session, and at the conclusion of the intervention. The researcher ran this condition using a fixed array size of three response cards. Unlike set B words, set D words (also an array of 3) were not taught using CTD, so the researcher anticipated a near zero level on set D words during the intervention. The sequence of target words were randomly determined prior to each session and changed within each session.

Reliability. The researcher and researcher assistants conducted trial-by-trial interobserver agreement (IOA) on the dependent variable (i.e.: student responses) by the following formula (Cooper, Heron & Heward, 2007):

$$\frac{\text{Number of trials (items) agreement}}{\text{Total number of trials (items)}} \times 100 = \text{Trial-by-trial IOA \%}$$

The researcher and research assistant reviewed sessions from video recordings and compared their data sheets and conducted trial-by-trial IOA with the equation stated above. The researcher and research assistant collected IOA data in 30% of all baseline and intervention condition sessions. The minimum acceptable percentage for this study required 80% IOA. If IOA fell below the 80%, the implementor looked at where the discrepancies were and retrained the data collectors and redesigned the data sheet to ensure full understanding.

For Jerry, the researcher and a research assistant collected interobserver agreement (IOA) from the video recordings for four baseline sessions (67% of sessions). Utilizing the formula in the methods section, the researcher calculated that IOA yielded 100% agreement for baseline sessions. The researcher and research assistant collected a total of five (33% of sessions) IOA data points for intervention condition and again calculated the IOA to be 100% agreement.

For Tom, the researcher and a research assistant collected IOA in person, since the participant declined to be video recorded, for five baseline sessions (100% of sessions). Utilizing the formula in the methods section, the researcher calculated that IOA yielded 100% in agreeance for baseline sessions. The researcher and research assistant collected a total of 9 (36% of sessions) IOA data points for intervention phase and again calculated the IOA to be 100% in agreeance.

Procedural fidelity. The researcher was the sole implementor of all conditions through the intervention including the pre-assessment, baseline, and all intervention conditions. The researcher assistant assessed procedural fidelity by reviewing videotaped sessions with a checklist for all steps in administering baseline and intervention sessions in accordance to the methods established in the study. See Appendix D for the procedural fidelity data sheet. Procedural fidelity was assessed in 30% of all baseline and intervention conditions. The researcher reported procedural fidelity as steps implemented correctly. The minimum acceptable percentage for this study required 90% of all steps being implemented correctly. If the procedural fidelity fell below the 90%, the researcher will utilize the procedural fidelity checklist as a visual support for future implementation sessions.

For Jerry, the research assistant conducted procedural fidelity on the researcher's implementation of the intervention for 57% of baseline sessions and 33% of intervention sessions. For Tom, the research assistant conducted procedural fidelity on the researcher's implementation of the intervention for 100% of baseline sessions and 36% of intervention sessions Utilizing the checklist created in appendix E, the researcher calculated procedural fidelity as 100% accuracy for all baseline sessions. Similarly, the researcher utilized the checklist for the intervention phases and again yielded 100% accuracy.

Social validity. The researcher assessed social validity by asking the homeroom teachers to complete a researcher-designed questionnaire. The researcher provided this questionnaire (Appendix E) at the termination of the study. The questionnaire sought to determine how teachers decided on instruction for receptive identification, if the teachers have noticed any changes, or if it would be helpful to know how to set array size.

Ethical Approval

All the procedures performed in this study were in accordance with the ethical standards of the institutional review board by James Madison University. The researcher began implementation after acceptance from the review board.

Informed Consent

The researcher obtained informed consent from legal guardians for all individual participants included in the study. The researcher also obtained child assent for all individual participants included in the study. The researcher requested video recording from both legal guardian and individual participants. One participant declined the use of video recording.

Results

The two research questions that directed this study were (a) does array size affect efficiency of skill acquisition, measured by trials-to-criterion, when using CTD procedures to teach receptive identification skills to students with intellectual disability, and (b) do teachers find the use of CTD procedures to teach functional words efficient and socially valid? This section will describe the results for the dependent measures from this study while also answering the two research questions.

Baseline

Jerry participated in a total of six baseline sessions across three days in addition to the two pre-assessment points. For set A, Jerry had mid-level and variable data with an increasing trend. For set B, Jerry demonstrated a mid-level decreasing trend in data. For set C, Jerry displayed low-level, stable data. For the constant, set D, Jerry showed mid to low-stable data with a decreasing trend. The researcher decided to move to intervention after session eight due to a decreasing trend in data, decreased response effort and the participant engaging in avoidant behaviors (e.g., putting head down on table, picking same card position repeatedly, not looking at cards) during the session.

For Tom, baseline consisted of five sessions across three days of responding in addition to the two pre-assessment points. For set A, Tom had stable, low to mid-level data with decreasing trend. For set B, Tom demonstrated a low stable data. For set C, Tom displayed a low, stable data. For the constant, set D, Tom showed low stable data. The researcher decided to move to intervention with the overall low stable data in all four sets.

Intervention

For Jerry, the researcher implemented 15 total intervention sessions until all word sets were mastered according to criteria. Specifically, Jerry mastered set A (array of 2) in the 15th intervention session (23rd session overall including baseline), mastered set B (array of 3) in the 15th intervention session (23rd session overall including baseline), and mastered set C (array of 4) in the 12th intervention session (20th session overall including baseline). Throughout all the sessions, the researcher did not provide instruction for set D (array of 3) in order to have a constant to compare with the instructional trials. Set D remained below 40% accuracy for all assessed sessions (4 total).

For Tom, the researcher implemented 25 total intervention sessions until all word sets were mastered according to criteria. Specifically, Tom mastered set A (array of 2) in the 15th intervention session (22nd session overall including baseline), mastered set B (array of 3) in the 19th intervention session (26th session overall including baseline), and mastered set C (array of 4) in the 25th intervention session (32nd session overall including baseline). Throughout all the sessions, the researcher did not provide instruction for set D (array of 3) in order to have a constant to compare with the instructional trials. Set D remained below 40% accuracy for all assessed sessions (8 total).

Table 1
Trials and Sessions to Criterion During Intervention for Jerry

Word Set	Trials to Criterion	Total Trials	Sessions to Criterion	Total Sessions
A	75	75	15	15
B	75	75	15	15
C	60	60	12	12
D	Not Applicable	20	Not Applicable	4

Table 2
Trials and Sessions to Criterion During Intervention for Tom

Word Set	Trials to Criterion	Total Trials	Sessions to Criterion	Total Sessions
A	75	105	15	21
B	95	115	19	23
C	125	125	25	25
D	Not Applicable	40	Not Applicable	8

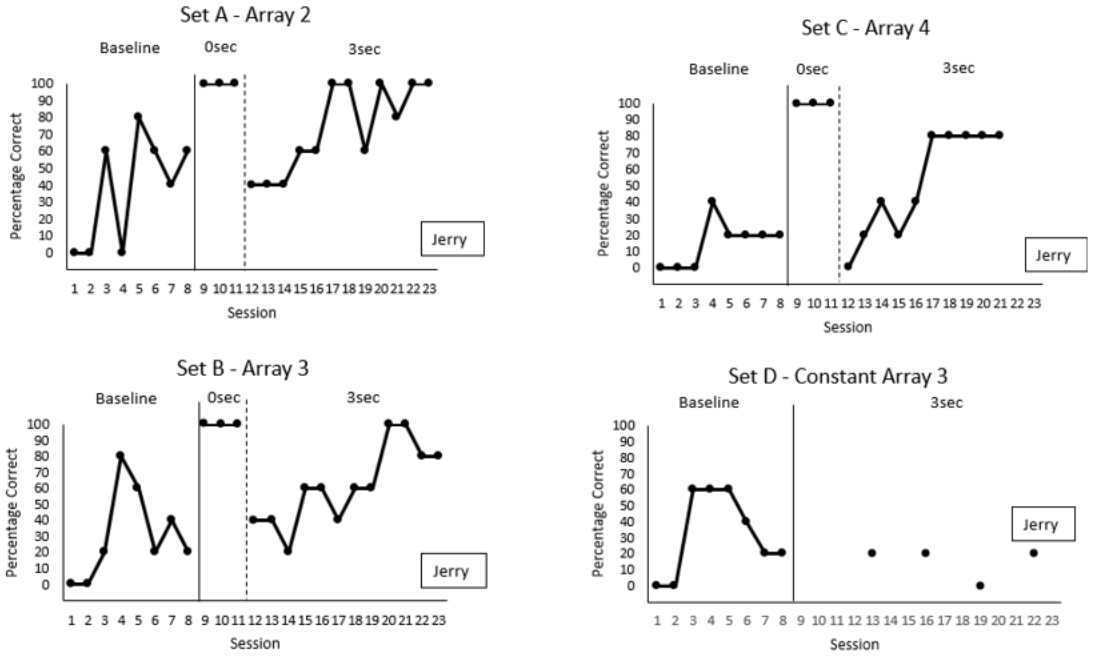

*Figure 1***.** Percentage correct per session for each set of arrays for Jerry

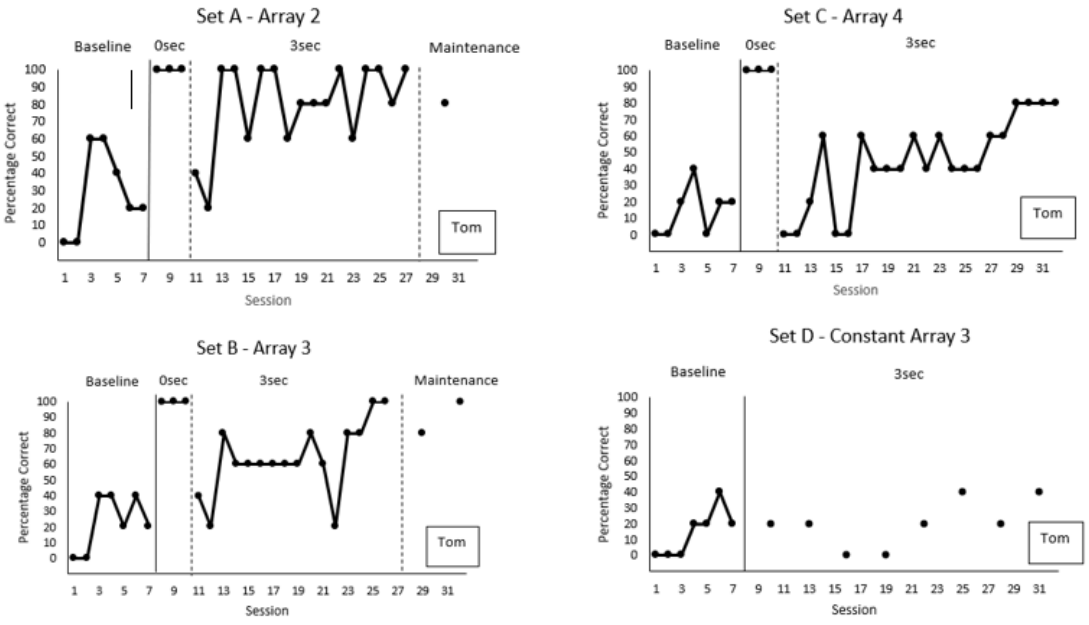

Figure 2. Percentage correct per session for each set of arrays for Tom

Maintenance

The researcher did not include a maintenance goal for the study, however with the varying sessions of mastery, sets that were identified as mastered were assessed for skill maintenance every 3rd session. For Tom, maintenance for Sets A and B was assessed three times. The researcher assessed set A maintenance during the 30th session and assessed set B maintenance during the 29th and 31st session. Due to a procedural error made by the researcher, maintenance should have begun for set A after the 22nd session, instead of after the 27th session. The researcher had no opportunity to assess maintenance sessions for Jerry.

Discussion

Research Questions

For the first question of, does array size affect efficiency of skill acquisition, measured by trials-to-criterion, when using CTD procedures to teach receptive identification skills to students with an intellectual disability, the results demonstrated the following. The percentage correct per session is illustrated by the graph in Figure 1 and Figure 2 and the number of trials until word sets were mastered (i.e., learning efficiency) is presented in Table 1 and Table 2. From the method section, mastery to criterion required four consecutive sessions of 80% or above (which equates to correctly identifying receptively four out of five words per set). Total sessions include all instruction sessions, specifically, for both Jerry and Tom, three sessions in a zero-second prompt condition and then the remaining in the three-second prompt condition. Jerry reached mastery to criterion the fastest with set C words (array of four) with 12 sessions. Tom reached mastery to criterion the fastest under set A (array of two) with a total of 15 sessions. For both Jerry and Tom, set D (constant) remained steady with a low level which indicates that neither participant mastered any of the control set words.

The first participant Jerry mastered Set C (array size of four) first, with 60 trials-to-criterion. The second participant Tom mastered Set A (array size of two) first, with 75 trials-to-criterion. Both participants acquired all fifteen target words in sets A-C. The range for Jerry was 15 trials with variation between the fewest trials in set C (array size of four) and the most trials to criterion with sets A (array size of two) and B (array size of three). The range for Tom was 50 trials with variation between the fewest trials in set A (array size of two) and the most trials to criterion in set C (array size of four).

While Jerry ultimately mastered Set A (array size of two) after session 15, he achieved 80-100% correct in several earlier sessions. However, his performance across earlier sessions was highly variable, with several sessions dropping to 60%, delaying meeting the mastery criterion. For set B, the researcher reports the most stable data with an increasing trend with no significant drops. Finally, for set C, the researcher notes that this set reached mastery criterion the fastest, however, Jerry never reached 100% on Set C. This can be explained by Jerry consistently knowing four out of the five words in the set (specifically selecting the word "sausage" incorrect for session nine through thirteen). Set D, which served as the constant throughout the intervention remained stable at a low level which demonstrates that the student did not acquire these words through teaching the other sets.

Tom first met mastery criteria on Set A (array size of 2), although the data leading to mastery was highly variable. For set B, the researcher reports variability between sessions 20 and 23, but overall an increasing trend in data. Finally, for set C, the researcher notes that this set was the most stable in responding however required more trials overall to reach the set mastery. Set D, which served as the constant throughout the intervention remained stable at a low level which demonstrates that the student did not acquire these words through teaching the other sets.

The second research question was related to the social validity of the intervention. In the questionnaire, Tom's teacher indicated that it would be helpful to know how to set an array size for each student to teach receptive identification as well as indicated that she would be willing to change the presentation of array size to teach receptive identification skills. Further feedback indicated that she usually taught in an array size of four, per request from the school division regarding alternative standardized assessments such as the Virginia Alternative Assessment Program. Jerry's teacher indicated again that it would be helpful to know how to set an array size for each student to teach receptive identification as well as indicated that she would be willing to alternate the presentation of array sizes per student. Jerry's teacher also shared that she often taught receptive identification in an array of three and this is a result of just seeing others teach in an array of three format.

Both participants demonstrated the most stable responding on the array sizes that were used during regular classroom instruction. Jerry's teacher reported that she used an array size of three in her instruction. In this study, he demonstrated the most stability on the array of three. Tom's teacher reported that she used an array size of four in her instruction, and he demonstrated the most stable responding on the set using an array of four. However, it is important to note that neither participant reached mastery criterion quickly on the array sizes that were most familiar to them.

Limitations

The researcher notes four main limitations for this study. The first limitation is the implementation schedule. The researcher implemented the intervention an average of three days a week but also ranged from twice to four times a week. Timing of instructional sessions varied

for both participants and ranged from early morning (first bell after breakfast) to before lunch hour (around 11:30am) or after lunch hour (around 1pm).

A second limitation is the related to the short word lists and repeated trials of the same five words compared to distractor words within the set. With the repeated trials, the five target words were constantly being asked which might have been a prompt to the students of which words to select. While the words were presented randomly against the randomized distractor words, expanding the word lists as well as the distractor words might be an area for further research. This concept parallels the Miller et al. (2019) study discussed in chapter two to determine the most efficient instructional set size.

The third limitation is that the intervention was implemented in different locations for each participant. Jerry's sessions were conducted in the library and Tom's sessions were conducted in the classroom. Other than the recording device, the materials were consistent across both. Jerry's environment stayed consistent with no noise or distractions around the library. However, this was a new environment for Jerry, and he wanted to explore various items in the room. For Tom, sessions took place in his known environment, however, distractions from his peers were present. Similar to this limitation, video recording could have had an impact on Jerry's performance and responding.

Finally, the researcher did not build in maintenance to the intervention, this is a limitation to the study. Long-term maintenance was not assessed within this study due to limited time. Researchers need to demonstrate if the interventions produce socially significant changes that are durable over time by collecting maintenance data. Future studies should also asses generalization in a variety of settings such as grocery stores or food restaurants.

Future Research

An area for future research would be teach the words using a variety of prompting procedures such as constant time delay, progressive time delay, and simultaneous prompting. Then, looking at the rate of skill acquisition with different array sizes through each prompting procedure would provide insight to efficacy. Assessing how different prompting procedures can impact array size is another avenue to assess the efficiency of trials to criterion to mastery.

Future research should also investigate array positioning (e.g., fixed v. messy) and its impact on skill acquisition when combined with changes in array sizes. This can be investigated to determine if there is a correlation with a fixed verses messy array size. Assessing participants on visual perceptual skills would assist in understanding how we acquire knowledge and then further generalize to practical uses (e.g., a menu or grocery index). Implementation of Verbal Behavioral Milestones Assessment and Placement Program (VB-MAPP) to assess visual array scanning ability would be another standardized measurement to compare the data.

Finally, the researcher chose to teach five target words in each set. Five words per set is an arbitrary number and further research should investigate how many target words to teach per set. This again could extend into understanding how large or small instructional set sizes would affect efficiency.

Appendix A

Grocery and Fast Food words from the Edmark Functional Word Series

1. Bread
2. Hamburger
3. Hot dog
4. Crackers
5. Taco
6. Flour
7. Spaghetti
8. beans
9. Noodles
10. Rice
11. Cereal
12. Oatmeal
13. beef
14. Chicken
15. Fish sticks
16. Sausage
17. Steak
18. Bacon
19. Lettuce
20. Tomato
21. Potato
22. Onion
23. Carrots
24. Celery
25. Cucumber
26. pepper
27. Apples
28. Oranges
29. Bananas
30. Grapes
31. Watermelon
32. Peaches
33. Tuna
34. Milk
35. Butter
36. Cheese
37. Eggs
38. Yogurt
39. Coffee
40. Tea
41. Juice
42. Pickles
43. Hot coco mix
44. Kool-Aid
45. Soda
46. Potato Chips
47. Tortilla Chips
48. Popcorn
49. Dip
50. Cookies
51. Ice Cream
52. Brownie Mix
53. Cake Mix
54. Jello
55. Pudding
56. Macaroni and Cheese
57. Pot pie
58. Pizza
59. Chili
60. Chicken Noodle Soup
61. Beef Stew
62. Vegetable Oil
63. Mayonnaise
64. Tomato Soup
65. Sugar
66. Ketchup
67. Salt
68. Pepper
69. Peanut Butter
70. Jam
71. Jelly
72. Salad Dressing
73. Syrup
74. Mustard
75. French Fries
76. Onion Rings
77. Milkshake
78. Chocolate
79. Vanilla
80. Strawberry
81. Sandwich
82. Fish
83. Chicken
84. Nuggets
85. Bacon
86. Cheese
87. Bun
88. Ham
89. Turkey
90. Roast Beef
91. Bologna
92. Iced Tea
93. Baked Potato
94. Salad
95. Sundae
96. Hot Fudge
97. Cone
98. Cookies
99. Pie
100. Pepperoni
101. Salami
102. Olives
103. Mushrooms
104. Garlic Bread
105. Spaghetti
106. Meat Sauce
107. Meatballs
108. Lasagna
109. Coleslaw
110. Fried Chicken
111. Mashed Potatoes
112. Gravy
113. Potato Salad
114. Baked Beans
115. Corn
116. Green Beans
117. Peas
118. Broccoli
119. Biscuit
120. Shrimp

Appendix B

Paired Stimulus Preference Assessment

(4 items)

Item A: _____
Item B: _____
Item C: _____
Item D: _____

Date:

Student:

Trial #	Item selection			
1.	Item	A	Item	B
2.	Item	C	Item	A
3.	Item	A	Item	D
4.	Item	B	Item	C
5.	Item	D	Item	B
6.	Item	C	Item	D

Source: Chazin, K.T. & Ledford, J.R. (2016). Paired stimulus preference assessment. *Evidence-based instructional practices for young children with autism and other disabilities.* Retrieved from http://vkc.mc.vanderbilt.edu/ebip/paired-stimulus

Appendix C

Student 1 (Jerry)

A	B	C	D
1. Beef	1. Cheese	1. Steak	1. Peas
2. Mushrooms	2. Carrots	2. Soda	2. Pepper
3. Bananas	3. Cereal	3. Spaghetti	3. Hamburger
4. Baked Potato	4. Chocolate	4. Sausage	4. Pot Pie
5. Meat Sauce	5. Cake Mix	5. Fish Sticks	5. Tuna
6. Bread	6. Cone	6. Shrimp	6. Taco
7. Mustard	7. Coffee	7. Sugar	7. Tortilla
8. Broccoli	8. Celery	8. Salami	8. Pie
9. Mashed Potatoes	9. Crackers	9. French Fries	9. Pudding
10. Mayonnaise	10. Oranges	10. Fried Chicken	10. Potato chip
11. Baked Potatoes	11. Onion Rings	11. Strawberry	11. Hot Dog
12. Macaroni and Cheese	12. Chicken Noodle Soup	12. Salt	12. Hot Coco Mix

Note. The researcher determined word groupings for each condition after pre-assessment for each student. First 5 words indicate the target words for the array size that were assessed. Words 6-12 in each array size were not assessed and used as distractors through the trials.

Student 2 (Tom)

A	B	C	D
1. Salt	1. Pie	1. Cookie	1. Shrimp
2. Salad	2. Pickles	2. Coffee	2. Sugar
3. Strawberry	3. Potato Chips	3. Chili	3. Fish
4. Meatballs	4. Beans	4. Celery	4. Pudding
5. Milk	5. Broccoli	5. Hot Fudge	5. Popcorn
6. Steak	6. Beef	6. Chicken	6. Flour
7. Soda	7. Bacon	7. Corn	7. Pepperoni
8. Spaghetti	8. Bananas	8. Cereal	8. Pepper
9. Meat Sauce	9. Brownie Mix	9. Chocolate	9. Pot Pie
10. Mustard	10. Potato Salad	10. Hot Dog	10. Sundae
11. Salad Dressing	11. Peanut Butter	11. Hamburger	11. French Chicken
12. Macaroni and Cheese	12. Baked Beans	12. Hot Coco Mix	12. French Fries

Note. The researcher determined word groupings for each condition after pre-assessment for each student. First 5 words indicate the target words for the array size that were assessed. Words 6-12 in each array size were not assessed and used as distractors through the trials.

Appendix D

Data Collection Sheet and IOA Collection Sheet

Student Pseudonym Initials: _____ Date: _____ Session: _____

Set Sequence: _____

Trial Number	Before Prompt	After Prompt	Time Delay	Trail Number	Before Prompt	After Prompt	Time Delay
Trial 1				Trial 11			
Trail 2				Trial 12			
Trial 3				Trial 13			
Trial 4				Trial 14			
Trial 5				Trial 15			
Trial 6				Trial 16			
Trial 7				Trial 17			
Trial 8				Trial 18			
Trial 9				Trial 19			
Trial 10				Trial 20			

Set: ___

Set: ___

Set: ___

Set: ___

Key: (+) correct response, (-) incorrect response; (B) baseline, (0) 0s Delay, (3) 3s Delay

	% Correct before prompt	% Correct after prompt
Set A		
Set B		
Set C		
Set D		

Appendix E

Procedural Fidelity Checklists

Procedural Fidelity Checklist for Preference Assessment

Step 1: Gain student's attention
Step 2: Begin implementing paired stimulus preference assessment with objects (see appendix B)
Step 3: Continue until all options have been presented to student
Step 4: Provide reinforcement to student

Procedural Fidelity Checklist for Baseline

Step 1: Gain student's attention
Step 2: Prepare _____ condition set of words
Step 3: Place _____ word cards in a fixed array in front of student
Step 4: Request first word, stating "Hand me _____"
Step 5: Wait 5 seconds and continue to step 6 if no response.
Step 6: Record students answer on data sheet
Step 7: Shuffle word set cards
Step 8: Repeat steps 3-7 for all words in the session
Step 9: Provide reinforcement to student

Procedural Fidelity Checklist for Intervention Sessions

Step 1: Gain student's attention
Step 2: Prepare ____ set of words
Step 3: Place _____ word cards in a fixed array in front of student
Step 4: Request first word, stating "Hand me _____"
Step 5: Wait ___ seconds for response
Step 6: Provide prompt if student did not answer
    Step 6a: Implement correctional trial (immediately running step 4 with a 0-second delay) if student answers incorrectly
Step 7: Record students answer on data sheet
Step 8 Shuffle word set cards
Step 9: Repeat steps 2-8 for all words in the session
Step 10: Provide reinforcement to student

Appendix F

Teacher Questionnaire

1. I have only used a fixed array of 3 to teach receptive identification skills. (yes/no)
2. It would be helpful to know how to set an array size for each student to teach receptive identification. (yes/no)
3. Have you noticed any changes in student responding post the intervention? (yes/no)
4. I would be willing to change the presentation of array size to teach receptive identification skills. (yes/no)
5. What array size do you currently use to teach receptive sight words? (short answer)
6. How did you determine this array size? (short answer)

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