The Effects of Computer-Based Phrase Reading Interventions on Word Reading in Postsecondary Students with Disabilities

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DEDICATION

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ABSTRACT

Post-secondary students with intellectual and developmental disability have an increased presence on college and university campuses nationwide. Given the academic rigor required to succeed in college courses, students with Intellectual and Developmental Disability need support and explicit instruction to target specific skill deficits. This dissertation includes four-chapters. Chapter One is an overview of post-secondary education programs, reading challenges experienced by post-secondary students with disabilities, and whole-word reading interventions. Chapter Two describes a study in which a computer-based phrase reading intervention was used to increase course related vocabulary acquisition. Chapter Three describes a study in which a computer-based phrase reading intervention was used to compare two methods of teaching words in phrases on generalization. Chapter Four discusses the effects, limitations, and implications of using a computer-based reading intervention to enhance whole-word and phrase acquisition and generalization.

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CHAPTER ONE

Review of the Literature: Postsecondary Programs for Students with Intellectual and Developmental Disability and Whole-Word Interventions

Postsecondary Programs for Students with Intellectual and Developmental Disability

Some people may not expect to see individuals with intellectual and developmental disabilities (IDD) taking classes at postsecondary institutions. These expectations can hinder student success and well-being and increase barriers that contribute to educational disparities among students with IDD (Kleinert, 2012). Changes made to the Individuals with Disabilities Education Act (IDEA) in 2004, ensured postsecondary access to individuals with disabilities (Individuals with Disabilities Education Act, 2004). Those who pursued higher education were provided support through the Higher Education Opportunities Act of 2008, which includes financial supports and access to Transitional Programs for Students with Intellectual Disability (TPSID; Higher Education Opportunity Act, 2008). TPSID programs have become increasingly popular and are enhanced in their capacities to support individuals with disabilities (Think College, 2021). Programs such as these exist to provide support for students with disabilities in reaching their independence and vocational goals (Kleinert, 2012).

TPSID programs housed within college and university settings allow students with disabilities to access supports that can help them meet social, independence, and vocational goals in an inclusive and enriching environment (Folk et al., 2012). Although there is variation among programs, many of them provide a similar range of supports. The awarded credential varies by program but may range from a vocational certificate awarded by the program to a university degree (Kleinert, 2012). Most students obtain a certificate awarded by the TPSID program (Grigal et al., 2019).

Students enrolled in TPSID programs generally take undergraduate courses, obtain job skills by working at an internship, and work towards independent living by living away from home in typical student housing including dorms and apartments (Burgin, 2017). Prior to their

first semester, students along with their family members and other stakeholders, meet with program staff members to share their short- and long-term goals, and to develop action plans for their time in the program (Folk et al., 2012). The inclusive model that most TPSID programs follow is designed to ensure that students take classes with peers, and engage with their instructors, their peers, and their academic work.

Students enrolled in these postsecondary programs often require extensive academic support. These supports include accommodations and modifications in their academic courses. Additionally, students are supported by peers who serve as mentors to assist them in daily planning, getting from place to place, and completing homework and assignments (Burgin et al., 2017). In programs that afford students the opportunity to audit undergraduate courses, these courses are often modified in an idiosyncratic way that meet the individualized learning and vocational goals of each student (Kleinert et al., 2012).

While the student's workload may be paired down (e.g., fewer courses and fewer course requirements), the students are enrolled in courses that students without IDD take. While they might not receive grades, the material requires students to read complex course specific words. To access the academic content, the students enrolled in TPSID programs read the same material and learn the same vocabulary terms as traditional students. When considering the learning difficulties that students with IDD have, creative approaches to help students engage with and access the curriculum are required. Furthermore, researchers suggest a positive relationship between academic achievement and student engagement amongst college students (Lei et al., 2018).

Student Engagement

Student engagement can be defined as active involvement in learning and academic tasks (Lei et al., 2018). This can include student participation, cognitive effort, sense of belonging, level of interest, and other emotions surrounding student attitudes towards learning (Finn, 1989; Fredricks et al., 2004). An engagement model developed by Finn (1989), depicts engagement as a cycle that relies on student ability to perform successfully. In this model, ability impacts participation, which may increase academic success and in turn, enhance sense of belonging. When students feel more confident in their knowledge and in their abilities, student engagement increases (Finn, 1989).

Whole-word Interventions

Reading deficits can have an adverse effect on academic progress and achievement across content areas (Daniel et al., 2006) and has led to a growing interest towards research relating to programming and interventions that may help to increase reading achievement in all populations, but specifically in school age students (Vellutino et al., 2006). Most of the research has focused on students in primary school, as this is where much of the foundational reading skills are developed, and where gaps in these skills quickly become apparent. Basic reading skills, such as letter recognition and decoding, provide the basis for automatic word recognition (Golinkoff & Rosinski, 1976; Lovett et al., 2000), reading fluency (Samuels & Flor, 1997), and comprehension (Rasinski, 2004) skills to emerge. These skills are then used throughout the remainder of a student's education for purposes of gaining knowledge (Burns et al., 2004; Fuchs et al., 2001). Because of this reliance on reading to learn, students with reading deficits can have difficulty learning content across subject area (Daniel et al., 2006). These reading skill deficits are

especially apparent in students with intellectual and developmental disabilities (IDD; Daly et al., 2015).

Targeted interventions are used in schools nationwide to help improve student outcomes in reading. Much of the targeted instruction is designed to teach basic reading skills, including accurate and automatic recognition of high-frequency words (Ehri, 2005). Even with these and other individualized and targeted interventions in place, students with IDD continue to demonstrate difficulties acquiring necessary basic reading skills (Browder et al., 2006). A potential reason for this lack of skill development is that students are not learning fast enough (Skinner, 2008). Techniques used to teach these skills must provide adequate learning trials while still remaining time sensitive (Skinner et al., 1996).

Whole-word reading is the process of reading whole words from memory, without having to sound out individual phonemes (Ehri, 1987). After much practice, advanced and efficient readers can recognize most words by sight (Ehri, 2005). This ability increases reading accuracy and speed, and leads to better comprehension (Krasa & Bell, 2021). To increase generalizability and decrease reliance on memory, researchers suggest teaching students with IDD both high frequency and functional words that are encountered in the students' environment (Alberto et al., 2013)

Traditional Drill and Incremental Rehearsal

Previous researchers have used traditional flashcard interventions to increase whole-word acquisition (January et al., 2017; Joseph & Nist, 2006; Joseph et al., 2012; Lozy & Donaldson, 2019; Nist & Joseph, 2008). The traditional drill includes the presentation of unknown words. This method requires the instructor to present and model each unknown word to the students, then allow an appropriate response time for the student to respond with the correct word.

Following this response, immediate corrective feedback is provided by the instructor. These instructional trials may be repeated by the instructor as many times as desired to aid in the students learning (Joseph & Nist, 2006; Joseph et al., 2012; Nist & Joseph, 2008).

Incremental rehearsal is another popular flashcard method, which requires more instructional time than the traditional drill. Similar to the traditional drill, words are presented and modeled to students. The primary difference is that instead of only unknown words being presented, the instructor presents nine known words and one unknown word. After an unknown word is presented nine times it is considered known and a new unknown word is added (Tucker, 1988 as cited in Klingbeil et al., 2019).

Both flashcard methods have their strengths and limitations. The traditional drill is more efficient as it only presents unknown words (Joseph et al., 2012), while the incremental rehearsal method provides more opportunities to respond (Burns, 2007). Due to the unique process of incremental rehearsal, only a limited number of new words can be introduced during each session. To address this concern, Kupzyk and colleagues (2011), developed a method that combines components from both incremental rehearsal and traditional drill methods. Other researchers also expressed concerns that the transition criteria should be contingent upon the student demonstrating mastery of the words rather than a predetermined criterion (January et al., 2017).

Strategic Incremental Rehearsal

In this method, consistent with incremental rehearsal, unknown words are intermixed with familiar words. As the student successfully recognizes words, new unknown words are introduced. Instead of the automatic removal of a word after a set number of practices, words are removed as students demonstrate mastery of the word. Once a word is removed, it may be

reintroduced to assess maintenance (Kupzyk et al., 2011). This combined method was found to be slightly more effective and efficient in teaching whole-words to early elementary students than incremental rehearsal (January et al., 2017). Other researchers demonstrated that the strategic incremental rehearsal method and the traditional drill were equally effective in teaching early reading skills (Lozy & Donaldson, 2019).

Computer-Based Interventions

Research supports the effectiveness of the previous approaches; however, more researchers have also investigated the effects of similar flashcard word reading interventions delivered via technology (e.g., computers, tablets). These computer-based reading interventions, discussed in the following chapter, may provide a more efficient strategy to delivering word reading interventions (Skinner et al., 1996; Yaw et al., 2014).

Purpose of the Study

The current literature lacks sufficient research on interventions for postsecondary students with IDD. An abundant body of research on reading interventions for primary and secondary students exists, as well as interventions for students who are in general education. A smaller yet increasing amount of research is emerging with intervention supports for students receiving special education services. This dissertation seeks to add to the body of research addressing interventions for postsecondary students who have IDD and are enrolled in a non-degree seeking transitional program. Computer-based reading programs have been shown to be effective for increasing word acquisition in students with disabilities including elementary through post-secondary students (Aspiranti & Hilton-Prillhart, 2021; Cazzell et al., 2016, 2017, 2020; Hilton-Prillhart et al., 2011; Yaw et al., 2011, 2012, 2014). The goal of this dissertation is to extend previous research by evaluating the effects of computer-based reading interventions to

post-secondary students with IDD. Specifically, rather than targeting whole-words or high frequency words, our goal was to determine if these interventions would help students to read words specific to their college courses.

The following chapter contains an evaluation of the effectiveness of a computer-based phrase reading intervention on the acquisition of unknown course-specific words. The third chapter is an extension of the first study and details a comparison between methods of phrase teaching on students' ability to read unknown words across phrases. Theoretical and applied implications, along with directions for future research are discussed in the final chapter.

CHAPTER TWO

Study I: The Effects of a Computer-Based Phrase Reading Intervention on Word Reading in Postsecondary Students with Disabilities

Abstract

The effects of a computer-based reading intervention on whole word reading in three post-secondary students with intellectual and/or developmental disability was evaluated using a multiple baseline across tasks (i.e., word sets) design. Target words were selected based on each student's elective undergraduate social science course. During this stimulus-response-stimulus response intervention, the computer presented target words embedded within short phrases and the student had 3s to read the phrase before a recording of the phrase was played. The student then repeated the phrase and the computer screen provide a new word and the next trial began. During assessment, students read target words in isolation. These words had to be read correctly within 3s across two consecutive assessments to be considered acquired. Visual analysis of the repeated measures graphs suggests nine demonstrations of a treatment effect. The current results showed that learning to read content-specific words when they were embedded in phrases resulted in generalization (i.e., taught students to read the words in isolation). Discussion focuses on implications, limitations, and future research.

Keywords: computer phrase reading intervention, post-secondary student with disability, content-specific words, learning trials

Computer-Based Phrase Reading Interventions

While phonemic approaches to teaching reading are supported by extensive research, there are instances when teaching students to read whole words may be beneficial (Browder & Spooner, 2011; Ehri, 2005). For example, students with reading deficits who have failed to develop phonemic skills despite receiving years of general, remedial, and special education services may benefit from whole word instruction targeting high frequency words (Browder et al., 2006; Cazzell et al., 2017: Cazzell et al., 2020; Yaw et al., 2014). Also, students with reading deficits may benefit from learning content-specific words found in secondary and college classes (Cazzell et al., 2016).

Students with disabilities enrolled in post-secondary education programs often take elective courses with all other college students (Grigal et al., 2019). When these students have reading skill deficits, they may struggle with content-specific words (e.g., amygdala) that are found in text and instructional materials, such as PowerPoint presentations (Wright et al., 2021). Being able to read these content-specific words may enhance their learning, engagement, and confidence as they participate in these courses.

Computer-based reading interventions have been used to enhance reading performance (Aspiranti & Hilton-Prillhart, 2021; Cazzell et al., 2016, 2017, 2020; Hilton-Prillhart et al., 2011; Yaw et al., 2011, 2012, 2014). Many computer-based reading researchers have applied stimulus-response-stimulus-response (S-R-S-R) learning trials to enhance word or phrase reading. These interventions were designed to model traditional flashcard instruction. A stimulus (in this case a word/phrase on the screen), is followed by an interval for the student to respond by reading the word/phrase (i.e., response interval). After that interval, a second stimulus is delivered when an audio recording of the word/phrase is played. This second stimulus is followed by another

response interval for the student to repeat the word or phrase before another word is presented on the screen, initiating the next S-R-S-R trial.

These computer-based interventions have many advantages over traditional flashcard instruction (Cazzell et al., 2016, 2017, 2020; Yaw et al., 2011, 2014). The interventions allow idiosyncratic words or phrases to be targeted. Also, the interventions are generally brief, requiring only 2-4 min of student time (Yaw et al., 2011). Finally, because they are computer-based, teachers are not required to deliver interventions to students individually.

Researchers have demonstrated the effectiveness of traditional and computer-based flashcard interventions on whole-word acquisition. These interventions have been used to increase word reading automaticity (e.g., accurate reading within 3s) in students who are receiving tiered reading intervention services (Hilton-Prillhart et al., 2011), students with learning disabilities (Kim et al., 2017), as well as individuals with intellectual and/or developmental disability (Cazzell et al., 2016, 2017, 2020; Yaw et al., 2011, 2012). Cazzell et al., (2016), examined the effects of a computer-based flashcard reading intervention on the acquisition of health-related words in three students enrolled in a post-secondary education program for students with intellectual disability. Each of these students was taking an elective in the College of Nursing and words were selected from course textbooks. Researchers found that the intervention was effective in increasing word reading across all participants.

While Cazzell and colleagues' (2016) results supported the use of the computer-based intervention, maintenance data produced inconsistent results. This limitation of whole word reading interventions has been noted by other researchers (Alberto et al., 2010; Begeny et al., 2006). Another concern with teaching words in isolation is generalization. After reviewing the research on students with intellectual disability, Browder et al., (2006) concluded that there is

evidence supporting the teaching of whole words; however, whole word instruction has not been demonstrated to foster strong generalization in students with intellectual disability. Results from a Martin-Chang et al., (2007) study supported this conclusion as they found that words taught in isolation were often not read accurately when embedded in text.

To address maintenance and generalization concerns, researchers have focused on teaching words embedded in phrases (Alberto et al., 2010; Begeny et al., 2006; Cates & Rhymer, 2006). Archer and Bryant (2001) taught students to read unknown words embedded in sentences or in isolation using S-R-S flashcard trials. Dahl (1974) taught students words in context and words in isolation. Students who learned words in context demonstrated greater accuracy and comprehension when reading text than those who learned words in isolation. Alberto et al. (2013) showed that teaching meaningful phrases increased generalized reading to real world text and elected reading materials. After reviewing the literature, Alberto et al., (2010) concluded that repeated and targeted phrase practice may enhance students' ability to read words in context, reading fluency, and reading comprehension.

Researchers have begun to investigate tablet-based interventions to enhance phrase-reading in elementary students with and without intellectual disability (Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022). These interventions were similar to the S-R-S-R whole word interventions provided via computers (e.g., Hilton-Prillhart et al., 2011; Cazzell et al., 2016). Results indicated that phrases were quickly acquired and that students were able to maintain previously acquired phrases. Although phrases were rapidly acquired in both studies, researchers were unable to determine whether students were correctly identifying individual targeted words included in each phrase, or if students used already known words embedded in phrases and phrase memorization to read targeted words. Thus, students may be learning to read

words embedded in specific phrases but struggle to read those words when they are presented in a different context (e.g., in isolation or when embedded in other phrases or text).

Purpose of the Present Study

It is possible that learning to read words in phrases may not teach students to read words in isolation without any context cues (Aspiranti et al., 2022). In the present study we evaluated the effectiveness of a computer-based phrase-reading (CPR) intervention in post-secondary students with intellectual and/or developmental disability. Our primary goal was to determine if S-R-S-R phrase-reading learning trials would allow the students to read words in isolation (i.e., generalization), without the aid of the surrounding stimuli (i.e., other words in phrase).

Method

Participants and Setting

Participants included three students who were enrolled in a post-secondary education program for students with intellectual and/or developmental disability at a university in the southeastern United States (see Table 1; all tables and figures are included in Appendix A). Two of the participants self-identified as female, one participant self-identified as male. All participants were between 20-22 years old and identified as Caucasian. All three participants received special education services in high school. Student reading levels ranged from third through ninth grade. Participant data were de-identified and pseudonyms are used in the reporting of this study. Research procedures were conducted in a small section of a room that was designated for study space during a brief segment of each student's daily study session period or break period.

Materials

Target words were gathered from the glossary section of each student's respective social science course textbook (see Appendix B). The researcher created the stimuli used during assessments by printing each word in black Times New Roman 20-point font on a 3x5, unlined index card. Words were present with all lowercase letters. Step-by-step instructions from Hopkins et al. (2011) were used to help design the computer phrase reading (CPR) intervention with Microsoft PowerPoint. For the intervention, the target words were included in brief two- or three-word phrases. The computerized stimuli were presented in lowercase, black, 48 point, Times New Roman font. Participants were allowed to personalize their intervention stimuli by changing the background wallpaper to a desired theme that was approved by the researcher.

Dependent Variables and Data Collection

Word acquisition was the dependent variable. For a word to be considered acquired, students were required to correctly read the word within 3s across two consecutive assessments. Students were assessed on all 21 words during pre-testing/baseline and each day the intervention was applied. These 21 words were divided into three sets (Sets A, B, and C) of 7 words, and the computer-based intervention targeted only one set of words at a time. After a student acquired five or more words from a set, the intervention was halted for that word set and applied to the next word set. Consequently, maintenance data for Set A and B words were collected after the intervention was moved to the next set of words. No maintenance data were collected for Set C words. An experimenter-constructed social validity form was completed by each participant after the study was completed.

Experimental Design

For each student, a multiple baseline across tasks (i.e., three-word sets) design was used

to evaluate the effects of the computer-based reading intervention on word acquisition (Kazdin, 2011). This design was appropriate because maintenance of acquired words was anticipated as these words were included in the materials that students used for their elective classes. Phase changes were applied after participants acquired five or more of the seven words from a set.

General Procedures

After University approval was provided and informed consent and assent were obtained, pretesting assessments were used to identify an idiosyncratic pool of 21 unknown words for each participant. Pre-test session data were also used for baseline data for two reasons. Repeatedly asking students to read unknown words without any instruction could cause negative side effects and hinder learning (Cuvo, 1979; Horner & Baer, 1978). Also, students were enrolled in their elective courses and using pre-testing data for baseline allowed us to advance students to the intervention sooner.

After collecting five pre-test/baseline data points, a researcher randomly selected 21 unknown words for each student which were randomly assigned to each of the three-word sets with seven words per set. For each unknown word, researchers then developed brief two- to three- word phrases to be presented during the intervention and computer-based S-R-S-R interventions were constructed for each set of seven word-phrases (see Appendix B). Next, students were trained on how to implement the CPR intervention. After training, the intervention phase began. During each session, participants were first assessed across all 21 target words. Following the assessment, participants completed the computer-based phrase reading intervention which targeted one of the three sets of words. Thus, assessment typically occurred at least 23.5 hour after there last intervention.

Pretest Assessments and Baseline Phase

Participants were assessed on 100 words that were obtained from the glossary section of each of their social science course textbooks. All words were printed in lowercase, black, Times New Roman font, on unlined 3 x 5 index cards. Before each of the pretesting sessions, students were instructed to read the words presented on the flashcards to the best of their ability. They were informed that after 3s, they would be presented with the next word, and asked if they had any questions before beginning. Participants were pretested across five consecutive school days. Each day words were presented in random order and no feedback was given to participants during this assessment. Any words read correctly on any session were excluded from the intervention phase. From the remaining unknown words, 21 words were randomly selected for each student and randomly assigned to three sets each containing 7 words.

Intervention Development

Before the intervention phase began, the experimenter wrote one brief (two-three words) phrases for each word and developed the computer-based phrase reading intervention (see Appendix B). During the intervention phase, each phrase-reading learning trial consisted of a stimulus-response-stimulus-response (S-R-S-R) sequence. The first stimulus was the phrase appearing on the computer screen. The student had 3s to read the phrase before the second stimuli, a recording of the phrase being read, was presented. The student then had 3s to repeat the phrase while the phrase remained on the screen. After this second 3s response interval the next word was presented on the screen, beginning the next trial. After the first seven trials (one trial per phrase), these procedures were repeated two more times. Each time, the seven trials were presented in random order. Thus, the intervention was constructed so that students received a total of 21 S-R-S-R trials, 3 trials per word-phrase.

Intervention Training

Before the intervention was installed, students were trained on the CPR intervention. Using pretesting data, the experimenter selected two known (i.e., correct over last three pretesting assessment) and two unknown words (i.e., never correct) that were not included in the intervention. Brief phrases were developed along with a CPR intervention which only contained phrases for these four words. Instructions used in a previous study (Cazzell et al., 2020) were adapted to fit the current study design and are included below:

> *When you are ready, press the spacebar to see your first phrase. When the phrase appears, attempt to read the phrase to the best of your ability within 3s. Then, wait to hear the phrase being read aloud to you. Once you hear the phrase, repeat the phrase out loud. The program will transition to the next phrase automatically. You will repeat this procedure for every phrase. Do you have any questions?*

Following training, each student was asked to practice using the intervention three times. All participants demonstrated the ability to use the intervention over all three practice sessions.

Intervention Implementation

Immediately after participant training, implementation of the intervention began, starting with the first set of seven words (i.e., Set A words) for each student. Each session began with an assessment of all 21 unknown words presented in a randomized order. Words that were correctly identified by the participant within 3s were scored as correct. After the assessment, the CPR intervention was applied, and the 21 S-R-S-R trials were delivered via the computer. Sessions were conducted during consecutive school days, and only skipped in the event of participant absence. A word was considered acquired after it was read correctly within 3s across two consecutive assessments. With the exception of Set C words, once participants acquired five or

more of the seven words, we stopped applying the intervention to that word set and began applying the intervention for the next set of words.

Procedural Integrity and Interobserver Agreement

A second researcher independently observed and recorded procedural integrity data and words read correctly within 3s during assessments. These data were collected for each student across 20% of pretest/baseline assessments and 22% of treatment-phase assessments. An adapted version of the procedural integrity checklist developed by Cazzell et al. (2020) served as a protocol for the lead researcher and was used by a second researcher to record procedural integrity data (see Appendix C). Procedural integrity was 100% for all sessions. Interobserver agreement was calculated by dividing the number of agreements on words read correctly within 3s by the number of agreements plus the number of disagreements, then multiplying by 100. Average interobserver agreement across sessions was 98%. During baseline assessments, average interobserver agreement was 99% with a range of 98-100%. During intervention assessments, average interobserver agreement was 97% with a range of 86-100%.

After experimental procedures were completed, each participant completed an acceptability questionnaire (see Appendix D) that contained five Likert-type scale items (strongly disagree = 1, strongly agree = 5). A researcher administered the questionnaire individually by reading each item aloud as the student followed along. The researchers responded to any questions and provided clarification when needed.

Results

Figures 1-3 present the number of words acquired for Maggie, Megan, and Caleb across baseline, intervention, and maintenance phases for all three sets of words. As pre-testing data were used for baseline, baseline data were zero across the first five baseline sessions

for all students and word sets. Because a word was not considered acquired until it was read correctly across two consecutive assessment sessions, it was rare to see any increases in words acquired following the first intervention session.

Maggie

Figure 1 shows that Maggie began to acquire Set A words following the second intervention session and showed a rapid increase in words acquired following intervention sessions four and five. Then word acquisition during the intervention phase slowed. During the maintenance phase, Maggie continued to acquire unknown Set A words when the intervention was no longer applied to Set A. Maintenance data were stable at seven words until a word was lost and Maggie fluctuated between six and seven Set A words acquired for the remainder of the maintenance phase.

Baseline data for Set B words were stable at zero until just before the implementation of the intervention, when Maggie acquired one word. Upon implementation of the intervention, there was an immediate increase in the number of words acquired. The acquired Set B word on the first day following the first intervention phase session indicates Maggie read the word correctly on the final baseline session. There is an increasing trend in Set B words acquired during the intervention phase. Upon initiation of the maintenance phase, Maggie acquired one more Set B word, which remained stable for three sessions. Over the next three maintenance sessions Maggie reverted to reading five Set B word correctly within 3s. Data collected over the final two maintenance sessions indicated that Maggie acquired all seven Set B words.

No Set C words were acquired during baseline. After the intervention was implemented, there was an increasing trend in words acquired which decelerated as Maggie acquired more words. As this was the last word set, intervention continued after Maggie met criteria. Data show

that Maggie acquired all seven Set C words in eight sessions. The final data collection points indicated Maggie acquired all 21 words.

Megan

Figure 2 displays the number of words acquired by Megan across phases. Baseline data for Set A words were stable at zero. Upon implementation of the intervention, Megan began to acquire words following three intervention sessions, followed by increasing trend, which started gradual and accelerated before transitioning to the maintenance phase. During the first maintenance phase, there was an immediate increase in word acquisition. This was followed by an unstable trend for the remainder of the Set A maintenance phase as Megan fluctuated between six and seven words acquired.

Baseline data for Set B words remained at zero before the implementation of the intervention. No immediate growth in word acquisition was seen. Following five intervention sessions, an increasing trend was observed as Megan acquired additional Set B words across three sessions until meeting the five-word criteria. No additional Set B words were acquired during the maintenance phase.

Baseline data for Word Set C were stable at zero until just before the implementation of the intervention when Megan acquired two words. One of the acquired Set C words was lost immediately after the intervention was applied to this word set. After three intervention sessions a stead increasing trend in words acquired continue until the study ceased. The final data collection points indicated that Megan acquired 17 of the 21 words.

Caleb

Figure 3 shows the number of words acquired by Caleb. Baseline data for Set A words remained stable at zero. Over the first three sessions Caleb acquired one word. His learning

increased more rapidly after that as he acquired six additional words over the final two intervention sessions. All Set A words were maintained after the intervention was applied to subsequent word sets.

Baseline data for Set B words were stable at zero until the final baseline phase when Caleb acquired two words. After the intervention was applied, there was a delay, followed by an increasing trend in Set B words acquired. During the maintenance phase, Caleb continued to acquire Set B words until reaching the maximum of seven words. He maintained this performance over the final three maintenance sessions.

During the baseline phase for Set C words, Caleb acquired one word (on the eighth session), then lost this word and re-acquired it on the final two baseline sessions. Upon implementation of the intervention, an immediate increase was observed, which was followed by a steady increasing trend until data collection was completed. The final data collection points indicate Caleb acquired all 21 words.

Learning Speed to Criterion

Table 2 provides descriptive statistics for the average number of sessions required to reach criterion (i.e., five words acquired), the average number of words acquired during these sessions, and the average number of cumulative instructional seconds each student spent to acquire a word during these sessions to criteria. Each session lasted 210s. To reduce the impact of ceiling effects as students approached the maximum possible words they could learn (i.e., seven words), learning speed data were collected only for the sessions required to reach criteria (i.e., sessions needed to acquire five words). These data show that Caleb acquired a word about every three min (172.96s per word) of time spent engaged in the CPR intervention.

Maggie required about four min to acquire each word, and Megan required about six min to acquire a word.

Student Acceptability

Each participant completed a five-item acceptability questionnaire (see Appendix D). All items were rated on a scale from 1 (strongly disagree) to 5 (strongly agree). All responses were positive, with small variability in responses across participants. The average response was 4.33 for the item "The computer-based reading intervention was easy to use". The average rating was 4.00 for the items "I would like to continue using a computer-based reading intervention" and "Others in my class would like the computer-based reading intervention." For the items "I like using the computer-based reading intervention," and "The computer-based reading intervention helped me learn new words" the average response was a 3.67.

Discussion

The purpose of the present study was to evaluate the effectiveness of a CPR intervention in post-secondary students with intellectual and/or developmental disability. Specifically, we evaluated whether words taught in phrases would increase students' ability to read unknown content-specific words in isolation. Across each word set, after the intervention was applied, all three students showed an increase in word acquisition. In most instances these increases were immediate. Thus, our multiple baseline data provided nine demonstrations of a treatment effect (Kazdin, 2011). Additionally, after the intervention ceased for both Sets A and B, data indicated that students maintained their ability to read the words in isolation.

The current results are consistent with previous findings of researchers who have evaluated computer-based interventions to teach words or phrases (Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022; Cazzell et al., 2016, 2017, 2020). Our findings extend this research

by demonstrating that teaching words in phrases enhanced students' ability to read words in isolation, without the surrounding text or context cues. These results suggest that students were not learning to read or memorize phrases (Aspiranti et al., 2022); rather, they were learning to read the words within the phrases.

Limitations and Future Research

While the current data provide strong evidence supporting the intervention's effectiveness, there were instances of students acquiring words during baseline. Before the intervention was applied, Maggie acquired one Set B word, Megan acquired two Set C words, and Caleb acquired two Set B words and one Set C word. Words learned prior to the intervention did not coincide with the application of the intervention to another word set. Also, maintenance data showed that acquired words were maintained and that students continued to acquire words after the intervention was applied to another word set. Future researchers may want to determine if the repeated assessments and/or exposure to words during their college class may have caused students to acquire additional words (Cazzell et al., 2016; Skinner & Shapiro, 1989; Yaw et al., 2012). Regardless, the increase in words acquired during baseline and maintenance phases suggest that not all increases in words acquired were not caused solely by the intervention.

The data provided in Table 2 show differences in learning speed across students. These learning speed scores were correlated with student reading level. Caleb, who was reading at a ninth-grade level, learned one word for just under every 3 min spent engaged in the phrase-reading intervention. Maggie, who was reading at a sixth-grade level, learned a word about every 4 min of intervention to acquire a word and Megan, who was reading at a third-grade level, learned a word in just under 6 min. While these data suggest that the intervention caused more

rapid learning in stronger readers, because our sample size small additional studies are needed before drawing such a conclusion.

Teaching words in isolation may not allow students to read the words when they are embedded in text, a generalization problem (Alberto et al., 2010; Begeny et al., 2006; Browder et al., 2006; Martin-Chang et al., 2007). Thus, researchers began teaching words in phrases (Alberto et al., 2013; Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022). We found evidence for generalization in the other direction as teaching words in phrases allowed our participants to read words in isolation. These results suggest that our instructional procedure allowed students to read the target words when they were separated from the other words in the instructional stimuli (i.e., the other words in the phrases). While this suggests that teaching words in phrases did result in generalization, researchers should determine if using computer-based phrase reading interventions teaches students to read words when they are embedded in other phrases or longer text (Alberto et al., 2013).

We developed phrases to target just one unknown word. As student with disabilities benefit from interventions which cause more learning in the same amount of time, researchers should determine if students can learn more words in a similar amount of time when phrases contain multiple unknown words (Skinner, 2008). We targeted words specific to students' elective college courses to enhance students' success and confidence in these college courses; however, these outcomes were not measured. Researchers should investigate the effects of similar interventions on these and other outcomes (e.g., participation and engagement in courses, acceptability of the courses, interest in course content, content learning).

These findings have limited external validity. Researchers should conduct similar studies with larger numbers of students, across settings (e.g., middle and high school students), across

words (e.g., high frequency irregular words), and across phrases (e.g., more meaningful phrases). Additionally, researchers should evaluate the effects of similar interventions on reading fluency and comprehension (Alberto et al., 2010; Browder et al., 2006). The students in this study read at the third through ninth grade level. Additionally, studies should include students with weaker reading skills. Furthermore, researchers could conduct similar studies with elementary students receiving remedial reading services students with learning disabilities.

Conclusion

The number of students with disabilities enrolling in post-secondary education programs continues to grow (Grigal et al., 2019). Allowing these students to select elective courses that align with their interests is likely to enhance their engagement in these courses. However, these students are more likely to have reading skills deficits than their peers, and these deficits make it difficult for these students to read printed content (e.g., text, PowerPoint presentations). While teaching students how to read content-specific words prior to the class may not overcome all the obstacles these students face, it may enhance their confidence and engagement when taking classes with their peers.

CHAPTER THREE

Study II: Evaluating and Comparing Phrase-Reading Instruction on Generalized Reading in Adult Students with Intellectual Disability

Abstract

We designed this study to extend the research on computer-based phrase reading interventions. Adapted alternating treatments designs were used to evaluate and compare two computer-based phrase reading interventions that were applied across four postsecondary students with intellectual and/or developmental disability. Each intervention session targeted eight words from each student's elective college class and included three stimulus-response-stimulus-response learning trials which required students to read brief phrases which contained unknown target words. During the single-phrase intervention, for each targeted word, three learning trials including the same phrase were presented. During the multi-phrase intervention, three different phrases per word were presented. Our dependent variables included each students' ability to read target words embedded in generalization phrases and their ability to read the entire generalization phrases. Results indicated that both interventions were effective in enhancing students' ability to read words embedded in generalization phrases and the ability to read entire generalization phrases. Across all four students, data showed that the multi-phrase intervention results in more rapid learning during the early stages of the study. Discussion focuses on limitations of the current study including ceiling effects and future research designed to evaluate phrase reading interventions.

Keywords: computer flashcard reading, whole-word instruction, phrase reading, fixed response intervals, intellectual disability

Phrase Reading Instructional Methods and Generalization

Basic reading skills, such as decoding and phonemic awareness skills, are often the building blocks to developing functional reading skills (Ehri, 2005). While some students with intellectual and developmental disability (IDD) can learn and apply these skills (Waugh et al., 2009), others who struggle with phonemic awareness and decoding skills may benefit from drill-based whole word reading instruction (Browder et al., 2006). Researchers have used computer delivered stimulus-response-stimulus-response (S-R-S-R) trials to enhance whole word reading in students with IDD (Cazzell et al., 2015, 2016, 2017; Wright et al., 2021; Yaw et al., 2012, 2014). With these interventions, a word is presented on the computer screen (first stimulus) and students are given an interval (e.g., 1s - 5s) to respond. This first response interval ends when a recording of the word being read is played (the second stimulus), which if followed by the second response interval. Students are instructed to attempt to read the word during each response interval.

Whole word reading interventions focus on repetition and memorization, rather than enhancing students' understanding of and ability to apply phonological processes (Alberto et al., 2010). Although this method of instruction is effective for teaching individual words, a primary concern with this method is generalization (Alberto et al., 2013; Yaw et al., 2014). Specifically, students may not be able to read words acquired in isolation when they are embedded in text (Browder et al., 2006; Martin-Chang et al., 2007). Additionally, when words are individually taught, it may limit the number of words learned (Alberto et al., 2010). Thus, researchers have begun teaching words embedded in connected text (e.g., Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022; Wilson et al., 2023).

Reading connected text or phrases, which are a minimum of two words that convey meaning, is the prelude to skillful reading (Adams, 1990; Duffy, 2014). In functional reading instruction, the goal is to increase student level of independence across areas, which includes the classroom and other settings. Students with IDD need to be able to read and comprehend connected text in various forms (Browder et al., 2006). Thus, the ability to read connected text may be particularly important when teaching functional reading to students with IDD who struggle with developing and applying phonological processes (Alberto et al., 2013).

One approach for teaching connected text involves presenting brief multi-word phrases using technology driven S-R-S-R trials (e.g., Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022). These interventions are similar to the whole word reading interventions (e.g., Wright et al., 2021) except multi-word phrases, as opposed to isolated words, serve as stimuli and students attempt to read entire phrases during response intervals. Across two studies, researchers found that these technology-driven (i.e., electronic tablets) phrase-based interventions resulted in rapid phrase learning across students, including students with IDD (Aspiranti & Hilton-Prillhart, 2021; Aspiranti et al., 2022). Although students learned to read entire phrases, researchers were unable to distinguish between phrase memorization and individual word reading which limited their ability to determine whether students were able to read acquired words in isolation or in other connected text.

Working with post-secondary students with IDD, Wilson et al., (2023) evaluated the effects of a computer-delivered phrase reading intervention on students' ability to read unknown words when they were presented in isolation. Results showed evidence of generalization as learning to read unknown words when they were embedded in phrases allowed students to read those words when they were presented in isolation. These results suggest that students were not

merely memorizing phrases; rather, they were acquiring the ability to read words embedded with the phrases.

Generalization: Training Multiple Exemplars

Generalization may require the application of instructional strategies designed to enhance generalization (Baer et al., 1968). Stokes and Baer (1977) identify procedures designed to enhance generalization, including training sufficient exemplars. Training sufficient exemplars entails training a desired outcome using various examples until the target behavior or outcome can be generalized to novel situations or settings (Stokes & Baer, 1977). While researchers have demonstrated that training exemplars resulted in generalization, the question became what is considered sufficient for generalization (Stokes & Baer, 1977). To measure the number of exemplars that are required for generalization, one exemplar must be trained until mastery and then generalization is assessed. Additional exemplars are sequentially added until generalization occurs (White et al., 1998). Elfevik et al. (2016) sought to determine what is "sufficient" by teaching students with IDD to generalize past tense verbs to other contexts. Experimenters measured the number of verbs necessary to train before generalization to a new phrase occurred. Their findings indicated that the number of exemplars deemed to be "sufficient" was idiosyncratic, with some students needing more exemplars before generalization occurred than other students.

While training sufficient exemplars may reduce the over-teaching of unnecessary exemplars (Eldevik et al., 2016), it also requires frequent assessment for generalization and adjustments to treatment dose based on assessment results (Anderson & Spradlin, 1980; Cates et al., 2003). Training more than one example at a time, through a technique termed training multiple exemplars, was suggested to increase the efficiency of generalization training (White et

al., 1998). For example, Hupp (1986) compared two training conditions on the generalization of object labels in students with IDD. In one condition she trained a set of three exemplars, and in the other condition she trained a set of five. Overall, no significant differences in generalization were found between the two conditions; however, most students generalized more objects under the five-exemplar training condition (Hupp, 1986).

Alberto and colleagues (2010) used word cards to teach students with IDD to read whole words and multi-word phrases. Students were first taught individual nouns, verbs, adjectives, and prepositions. Next, they combined these words and taught students to read brief phrases. Generalization was assessed by measuring the students' ability to read phrases containing words previously taught in story books or environmental settings. Results demonstrated that students taught words in isolation and brief phrases can read those words when presented in other connected text (i.e., generalization). The primary limitation associated with this study is that students were taught words in isolation and in brief phrases before assessing for generalization. Thus, researchers could not determine if teaching only phrases allowed students to learn words when they were presented in other phrases or connected text.

Purpose of Present Study

Researchers have shown that technology driven phrase-based learning trials can be used to allow students with IDD to acquire and maintain the ability to read words in isolation and whole phrases (Aspiranti et al., 2022; Wilson et al., 2023). However, researchers have not evaluated whether phrase-based instruction allows students with disability to read these words when they were embedded in other phases (i.e., generalized effects of phrase-based instruction). The current study was designed to address this limitation.

Specifically, we used adapted alternating treatments designs to evaluate and compare the effects of two computer-based S-R-S-R phrase reading interventions on students' with IDD ability to read target words when they were presented in different phrases (i.e., generalization phrases) and on their ability to read entire generalization phrases. One intervention presented each targeted unknown word in a single phrase (i.e., one phrase, three trials per session) and the other presented each targeted word in multiple phrases (i.e., three different phrases, one trial each per session). As Wilson et al., (2023) showed that students learned to read words in isolation when they were taught in single phrases, we hypothesized that both interventions would enhance student ability to read words when they were embedded in generalization phrases. Based on previous research on teaching multiple exemplars, we posited that the multi-phase intervention would be more effective than the single-phrase intervention in enhancing students' ability to read words embedded in generalization phrases and their ability to read entire generalization phrases.

Method

Participants and Setting

The current study was conducted at a post-secondary education program for students with IDD at a large research university in the southeastern part of the United States. Participants included four students who were enrolled in elected social science audit courses (see Table 3). All participants were between the ages of 18-24 years old. Two of the participants self-identified as female, two self-identified as male. Two participants identify as African American, two identify as Caucasian. Disability classification and reading levels varied among participants (see Table 3). Reading levels ranged from third through tenth grade. All participants received special education services in high school and met eligibility criteria for the post-secondary education program. Participant data were de-identified and pseudonyms were used in the reporting of the

study. Research procedures were conducted on a computer within the designated program study space, during a brief period of each participant's daily study session or break period. Participants worked with graduate research assistants who had experience and training working with the target population.

Materials

The computer-based phrase-reading intervention was delivered using Microsoft PowerPoint©, designed with step-by-step instructions provided by Hopkins et al. (2011). Target words were gathered from the glossary section of each student's respective social science course textbook. Phrases were generated using an online phrase generator (Ahrefs, n.d.) and a hand search of represented phrases in each textbook. Words paired with the target words on assessment phrases were commonly used words that participants were predicted to be able to correctly read given their reading level. Stratified random assignment was used to create three lists of unknown words with each list containing the same number of words by syllabi (e.g., each list contained the same number of three syllabi words). See Appendix E for words and phrases.

Flashcard stimuli used for generalization assessments were created by printing each phrase in black Times New Roman 30-point font, on a 3 x 5, unlined index card (see Appendix F). Phrases were typed in all lowercase letters. For the intervention phases, computerized stimuli were typed in black, 48 point, Times New Roman font. During the intervention, target words were underlined. On the assessment cards, no words were underlined. Participants were permitted to personalize their intervention stimuli by changing the slide background to a theme approved by the researcher; however, none elected to do so.

Dependent and Independent Variables

The dependent variables included the number of target words read correctly when embedded in generalization phrases and the number of generalization phrases read correctly (see Appendix F). A word was considered correct when it was read correctly within the context of the generalization phrase during assessment within 3s. To receive credit for correctly reading a generalization phrase, each word in the phrase must be correctly read within 3s. Students were assessed on three different generalization phrases for each of the target words, resulting in 24 generalization phrases assessed for each treatment condition. For each assessment, the 24 phrases were presented in random order. The independent variables are the two different phrase learning instructional methods delivered via the computer. During the single-phrase intervention, each word was presented in the same phrases over three different learning trials. During the multi-phrase intervention, each word was presented in three different phrases, and each phrase differed from the generalization phrases. Under each treatment, the intervention targeted eight course related whole words.

Experimental Design

An adapted alternating treatments design (Sindelar et al., 1985) was used to evaluate and compare the effects of the computer-based phrase reading intervention on generalized word and phrase reading. The order of the two interventions (single-phrase and multi-phrase) was alternated across sessions. Each intervention was immediately followed by an assessment in which students were asked to read each of the 24 generalization phrases. An additional list of unknown words in phrases was assessed each day to allow for a clearer demonstration of treatment effects (Sindelar et al., 1985). This additional assessment was randomly assigned to occur before, between, or after the two treatment interventions and assessments.

Procedures

After obtaining University approval, informed consent, and assent, pretesting measures were used to obtain an idiosyncratic list of unknown words for each participant. While phrases were being developed and the interventions were created, students were taught how to use the intervention using an example target word and phrase. Once training was completed, the intervention was introduced.

Pretesting

To obtain the list of unknown words, a pool of approximately 100 words was assessed across three pretesting sessions prior to the start of the intervention. Words were obtained from the glossary and key word sections of each participant's social science textbook. Words were assessed using 3 x 5 unlined index cards. Prior to each pretest session, students were instructed to read the word presented on each flashcard to the best of their ability within 3s. The list of words was assessed in random order during each session and no feedback was provided. Any words that were correctly read were excluded from the intervention phase. A word bank was created with the remaining unknown words and categorized by number of syllables. From this word bank, 24 target words were selected and stratified by syllable before being randomly assigned to each condition.

Interventions

Prior to the start of the intervention, the experimenter wrote three different phrases for each of the eight unknown words that were randomly assigned to the multi-phrase condition (see Appendix E). During each session, 24 S-R-S-R trials were applied. During the first eight trials, each target word was presented embedded in a phrase. During the next eight trials, each word was embedded in a different phrase; and in the final eight trials, each word was embedded in a

phrase that differed from the first two phrases. Thus, during each multi-phrase session, each phrase was presented in one learning trial and each unknown word presented in three learning trials. Each time the eight phrases were presented, they were presented in random order.

For the eight unknown words that were randomly assigned to the single-phrase condition (see Appendix E), the experimenter wrote one phrase per word. Twenty-four S-R-S-R trials were conducted, three for each phrase. The eight phrases, one per word, were presented and then presented two more times. During each session, each phrase and each word was repeated three times. Each time the eight phrases were presented, they were presented in random order.

During the intervention phase, under both conditions, each phrase-reading trial consisted of a stimulus-response-stimulus-response (S-R-S-R) trial. The first stimulus was the phrase appearing on the screen. This was followed by a 3s response interval for the students to respond, and then the second stimulus was presented; an audio recording was played of the phrase being read. Students were instructed to try to read the phrase out loud before the audio recording played it. Following the second stimulus, there was another 3s response interval and students were instructed to read the phrase again during this interval. Following this second 3s response interval, a new trial began when another phrase appeared on the screen. Under both intervention conditions, the students received a total of 24 S-R-S-R trials.

Assessments

Immediately following each intervention session, students were assessed on generalization phrases. For each target word, three phrases which differed from the treatment phrases (24 total phrases) but contained to target word were assessed. Target words that were read correctly within the 3s were scored as correct. Also, phrases that were read correctly within

3s were scored as correct. Finally, students were also assessed on a set of no-treatment phrases each session. This set included three phrases for each unknown word that was not targeted.

Procedural Integrity and Interobserver Agreement

A procedural checklist was used by the lead researcher to ensure that the interventions were conducted with fidelity (see Appendix G). A second researcher recorded treatment integrity and scored phrases and target words read correctly within 3s during assessments across 33% of pretest assessments and 40% of treatment condition assessments. Procedural integrity was 100% for all sessions. To collect interobserver agreement, two researchers independently scored the number of phrases read correctly and the number of target words read correctly within 3s for each student during assessments. Interobserver agreement was calculated by dividing the number of agreements on words and phrases read correctly within 3s by the total number of trials scored by both observers, then multiplied by 100. The average interobserver agreement across all sessions was 94%. During pretesting, average interobserver agreement was 93% with a range of 88-96%. During intervention assessments, average interobserver agreement for phrases correctly read was 95.2% with a range of 92-100%, while the average for words read correctly was 95% with a range of 90-100%.

Student Acceptability

Social validity was obtained by collecting student responses to Likert-type scale items regarding their thoughts about the intervention (see Appendix D). Items ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). This measure was administered to students individually by graduate research assistants. Each student was read the instructions and asked if they wanted the items to be read aloud to them. Three of the four students elected to have the items read aloud by the research assistants as they followed along and circled their own answers. One student chose

to read the items themself but required assistance circling their responses due to restricted mobility.

Results

Figures 4-11 present the number of target words correctly read within generalization phrases and the number of generalization phrases read correctly by Abel, Troy, Rachel, and Isabelle, respectively. The data series for each condition were compared using visual analysis of trend, slope, variability, and immediacy of response to treatment. Comparisons of each intervention series to the no-treatment series was used to evaluate the effectiveness of each intervention. To evaluate relative effectiveness of the interventions, the two-treatment series were compared.

Abel

Figure 4 depicts the number of target words Abel correctly read when embedded in generalization phrases and Figure 5 displays the number of generalization phrases read correctly. The two figures are similar. On the fourth session, Abel read three no-treatment words correct and their phrases correct, but no other increase occurred on the two no-treatment series before or after this session. For both the single-phrase and multi-phrase words and phrases series, an increasing trend is followed by a deceleration in words (Figure 4) and phrases (Figure 5) read correctly. Abel showed more immediate growth in multi-phrase words and phrases read correctly relative to single-phrase words and phrases. However, for both dependent variables, following the fourth intervention session an abrupt and large increase in words and phrases read correctly occurred for the single phrase condition. At the end of the study, Abel correctly read 20 words and phrases correctly under the multi-phrase intervention, 18 target words and phrases correctly under the single-phrase intervention, and three no-treatment words and phrases.

Abel consistently read more words and phrases correctly under the two treatment conditions, relative to the no-treatment condition. This suggest that the two interventions allowed Abel to read target words when they were embedded in generalization phrases and increased his ability to read generalization phrases. When comparing the two interventions, the multi-phrase intervention caused more rapid improvements, but as the study progressed the single-phrase condition accelerated and there were few differences by the end of the study.

Troy

Figure 6 depicts the number of target words Troy correctly read when embedded in generalization phrases and Figure 7 displays the number of generalization phrases read correctly. Again, the two figures display similar patterns. Troy showed an immediate increase in response to the multi-phrase condition, which began to decelerate following intervention sessions three through five. However, this deceleration was followed by an abrupt increase after the fifth session, which then leveled off as Troy started reading over 90% of the multi-phrase words and phrases correctly. Troy showed no immediate increase in no-treatment words or phrases read correctly. As the study progressed, Troy steadily increased his single phrase words and phrases read correctly over sessions two through five. However, following the fifth session, this increasing trend stopped, and Troy showed no more increases in single phrase words or phrase read correctly over the final five sessions.

At the end of the intervention, for the multi-phrase intervention, Troy correctly read 24 words and 23 phrases correctly. For the single-phrase intervention, he read 16 words and 15 phrases correctly. Although Troy read seven no-treatment words and phrases following the seventh intervention session, he did not maintain these words and phrases. Thus, for the no-treatment conditions he read five words and four phrases correctly on the last session.

Comparing the two-intervention series with the no-treatment series suggest that both interventions were effective in increasing Troy's generalized reading. Although no intervention series indicated stable growth, Troy's word and phrase reading accuracy was superior under the multi-phrase intervention.

Rachel

Figure 8 depicts the number of target words Rachel correctly read when embedded in generalization phrases and Figure 9 displays the number of generalization phrases read correctly. Again, the two figures are similar. Rachel began reading no-treatment words and phrases on the third session and showed an increasing trend followed by a decreasing trend for both words and phrases read correctly. Rachel showed an immediate increase in multi-phrase and single-phrase words and phrases read correctly. For both series there was an increasing trend in words and phrases read correctly until Rachel read all 24 words and phrases correctly. During the first four sessions Rachel's increases on multi-phrase words and phrases were much more rapid that her increases on single-phrase words and phrases. Rachel read all 24 multi-phrase words and phrases correctly following the fourth intervention session. However, for the single-phrase condition, it took Rachel eight sessions to read all 24 words correctly and nine sessions to read all 24 phrases correctly.

Rachel's data provides another demonstration that both treatments were more effective than the no-treatment condition. Further, while Rachel's learning was immediate under both conditions, she experienced more rapid learning under the multi-phrase intervention. This indicates that the multi-phrase condition resulted in stronger words and phrase reading generalization.

Isabelle

Figure 10 depicts the number of target words Isabelle correctly read when embedded in generalization phrases and Figure 11 displays the number of generalization phrases read correctly. These two figures depict similar patterns. Isabelle showed no immediate increase in no-treatment words or phrases read correctly and did not read any no-treatment words or phrases correctly until the sixth session. Across the final five sessions she read between two and seven no-treatment words and phrases correctly with no clear trends.

Isabelle showed an immediate increase in words and phrases read following the application of both interventions. For the multi-phrase intervention, there was a stable increase in words and phrases read correctly across the first four sessions. Across the final six sessions, Isabelle showed no further increases in multi-phrase words or phrases read correctly. For the single-phrase intervention Isabelle showed a steady increase in words and phrases read correctly over the first four sessions followed by a sharp increase on the sixth session. Her performance was then variable until she showed an increasing trend in single phrase words and phrases read correctly over the final two sessions.

On the last session, Isabelle read seven no-treatment words and phrases correctly, 17 multi-phrase words and phrases correctly, and 21 single-phrase words and phrases correctly. Isabelle was the only student who read more single-phrase words and phrases read correctly on the final session. However, her relative effectiveness data over the first four sessions was similar to all other students and showed that the multi-phrase intervention results in more rapid learning.

Summary

Limited differences in the number of assessment phrases read correctly and the number of target words read correctly were observed. This suggests that students may have already

acquired the ability to read the non-target words in the generalization phrase. Although all students did increase phrase and target word reading under the no-treatment condition, learning was greater for the treatment conditions. For two students, learning at the end of the study was similar across the single and multi-phrase conditions. By the end of the study Troy learned more words and phrases under the multi-phrase intervention, while Isabelle learned more under the single-phrase intervention. However, early in the study (i.e., sessions one through three to five), all students, including Isabelle demonstrated more rapid learning under the multi-phrase condition.

Student Acceptability

Participants were asked to complete a questionnaire (see Appendix D) designed to assess intervention acceptability. Five items were rated on a scale from 1 (strongly disagree) to 5 (strongly agree), addressing the following: how much they liked the intervention, whether they would like to continue using the intervention, whether the intervention was easy to use, whether the intervention helped them learn new words, and how others in their class might perceive the intervention. The average acceptability rating for the intervention was 4.75. The average response for continued use was 4.50. The average rating for ease of use was 3.75. Participants gave an average rating of 4.75 when asked if the intervention helped them to learn new words, and an average rating of 3.50 in response to their classmates' perception of the intervention.

Discussion

One purpose of the current study was to determine if computer-based phrase reading interventions could increase students' ability to read target words when they were embedded in different phrases. Across participants, both instructional methods (multi-phrase and single-phrase) allowed students to read more target words embedded in generalization phrases and more

generalization phrases correctly than the no-treatment condition. Additionally, these increases were more immediate than the increase in no-treatment words and phrases. These finding suggest that both phrase reading interventions fostered generalization to other phrases.

Pervious researchers have expressed concern that whole-phrase instruction may cause students to memorize phrases but have limited impact on students' ability to read words when they are embedded in other phrases or connected text (Alberto et al., 2010; Aspiranti et al., 2022; Martin-Chang et al., 2007). Our results showed that even when a single phrase was taught, students were able to read words from the instructional phrase when the target words were presented in other phrases (i.e., generalization phrases). These results support the findings of Wilson et al., (2023) who showed that phrase reading instruction allowed students to read words when they were presented in isolation (i.e., generalization from phrases to isolation). Also, these results support researchers who have suggested that teaching words embedded in phrases may enhance generalization by allowing students to read words when embedded in other connected text (Alberto et al., 2013; Aspiranti et al., 2022).

We compared the two instructional methods for teaching target words in phrases and evaluated their effectiveness in promoting generalization to other phrases. Across all students, we initially found more rapid increases in generalization under the multiple phrase condition. However, as the study progressed and students were exposed to more learning trials (e.g., larger dose), these differences were mitigated. These results are consistent with previous researchers who found that generalization can occur when training single and multiple exemplars; however, multiple exemplar training may yield higher levels of generalization (Anderson & Spradlin, 1980; Hupp, 1986). Regardless, because relative effectiveness conclusions changed as the study

progressed, additional studies are needed before concluding that the multi-phrase intervention results in more rapid learning.

Limitations and Future Research

All students experienced an immediate response to the multi-phrase intervention and rapid initial growth. For most students, as the study progressed the single-phrase condition showed more rapid generalization than the multi-phrase intervention. Thus, by the end of the study the interventions appear to be similarly effective. However, it is difficult to draw relative effectiveness conclusions, because the small number of words and phrases included in each intervention may have introduced ceiling effects that limited our ability to detect differences as the study progressed. Specifically, because students learned more rapidly under the multi-phrase intervention, as the study progressed, they had fewer multi-phrase condition words and phrases to learn, relative to single-phrase words and phrases. Thus, students' learning rate under the multi-phrase condition may have decelerated relative to their learning under the single-phrase intervention because of the differential impact of these ceiling effects.

To address limitations caused by uncontrolled ceiling effects, researchers could use a flow list procedure in which new words and phrases are added upon mastery of previously targeted words and phrases (Hubbert et al., 2000; McLaughlin et al., 1991; Yaw et al., 2014). Flow list procedures may mitigate ceiling effects and allow for a clearer indication of differences between the two treatments across the entire alternating treatments phase. As we found that the single phrase intervention required a greater number of sessions to produce similar levels of generalization, researchers should also conduct dose and dose schedule studies evaluating single and multi-phrase interventions (Duhon et al., 2022).

Alberto et al. (2010) suggested that phrase training may allow students to simultaneously learn multiple words; thus, it may allow for more rapid word learning than whole word instruction. While we pre-tested to identify unknown target words, we did not pre-test to determine each student's ability to read other words used in both instructional and assessment phrases. Future researchers should conduct studies where all words are pre-tested in order to determine if phrase training allows students to learn multiple words (Alberto et al., 2010). Additionally, they should compare whole word with phrase training instruction to determine which procedure results in the most rapid word learning.

Across students, similar results occurred across phrases and words read correctly, which suggests that researchers may have been successful in selecting other words in generalization phrases (i.e., those words not targeted) that students had already acquired the ability to read. Students may have already acquired non-target words in the generalization phrases; however, it is possible that learning to read target words enhanced students' ability to read non-targeted words (Browder et al., 2006; Ehri, 2005). If future researchers assess and manipulate students' ability to read all non-targeted words embedded in generalization phrase, they may be able to determine if learning unknown target words in phrases allowed students to more easily learn other words in phrases.

While both interventions resulted in greater increases in generalized word and phrase reading than the no-treatment condition, all students showed increases in no-treatment words and phrases. Research should investigate plausible causal mechanisms that may account for these increases. For example, testing effects (Skinner & Shapiro, 1989), history effects or learning outside experimental conditions (e.g., being exposed to these words in their courses), or

interaction effects (e.g., interaction of assessments and exposure during courses) may account for those increases (Wright et al., 2021).

Researchers should address other limitations associated with the current study. Although we found generalization of the target word from learned phrase to generalization phrases, generalization may have been aided by the limited number of additional words presented with phrases. Because word meaning was being taught in their college classes, we did not address comprehension. While target words were stratified based on number of syllables, we did not determine readability levels for any words or phrases. To address these limitations, future researchers may consider increasing connected text length (e.g., sentences, paragraphs, pages), using readability formulas to equate phrases across conditions (Alberto et al., 2010), and assessing for reading comprehension and reading comprehension rate on longer passages (Neddenriep et al., 2007). Maintenance data should also be collected in future studies, in order to determine whether words are being maintained post-intervention.

This study was conducted with four participants from a postsecondary education program and two of these students had reading achievement scores above the eighth-grade level. Additional studies are needed that target younger developing readers, including students with more severe reading skills deficits, especially phonological deficits. Also, studies should be conducted with students who have different learning problems including specific learning disability in reading, dyslexia, attention problems, and students receiving remedial reading services, to determine if phrase-training interventions may be effective procedures designed to mitigate, prevent, or remedy reading skills deficits in developing readers.

Conclusion

The ability to read learned words in various contexts (i.e., generalization) is necessary for developing functional reading skills (Duffy, 2014). Developing generalized reading skills in students with IDD can increase student access to knowledge and their ability to function across environments (Alberto et al., 2013). In the college setting, being able to read course-specific words across context may help post-secondary students with IDD experience greater success in the classroom and enhance students' ability and willingness to engage with course materials, ask questions during class, and participate in class discussion. Thus, being able to read content relevant words may foster a greater sense of belonging (Wright et al., 2021). Building reading skills may also increase independence and vocational skills in students with IDD, which is a core component of most TPSID program models. While our study did not address these variables, our current findings support future research designed to evaluate the effects of phrase-training interventions in post-secondary students with disabilities.

CHAPTER FOUR

A General Discussion: Computer-based Reading Programs on Word Acquisition and Generalization in Postsecondary Education Students with Intellectual and Developmental Disabilities.

Computer-based Reading Programs on Word Acquisition and Generalization

The purpose of this dissertation was to evaluate a computer-based phrase reading intervention and its effects on word learning and generalization among post-secondary students with IDD. Both studies, conducted with students who are auditing university courses, were designed to increase students' ability to read course-related words when they were presented in a context that differed from the training context (i.e., generalization). The first study, described in Chapter II, was designed to evaluate whether teaching students words embedded in phrases would enhance their ability to read the same words in isolation. Results from our multiple baseline across word lists designs indicated that all three students showed an increase in their ability to read words in isolation across three-word lists, resulting in nine demonstrations of a treatment effect. After the withdrawal of the intervention, students continued to maintain their ability to read learned words in isolation.

The second study (see Chapter III) was designed to evaluate generalization of word reading to other phrases. Specifically, we evaluated if the phase reading intervention would allow students to read target words when they were embedded in other phrases. We also compared two instructional methods of teaching words in phrases on students' ability to generalize to new phrases. With one intervention, the same phrase was presented three times per session. With the other intervention, three different phrases were presented once each session. Results indicated that both interventions were effective in increasing students' ability to read words embedded in novel phrases, but that the multi-phrase method resulted in stronger generalization during the early part of the intervention phase. Thus, training multiple phrases may result in more rapid generalization.

One limitation of whole-word instruction is that it may not allow students to read words in context (Browder et al., 2006; Martin-Chang et al., 2007). The findings of Study I demonstrate that teaching words in phrases may improve isolated word reading. The results of the second study demonstrated that higher levels of generalization may occur when more examples are trained; suggesting that training multiple examples can accelerate generalization (Anderson & Spradlin, 1980). Taken together, both studies support the conclusion that computer-delivered phrase instruction enhanced students' abilities to acquire unknown words and that phrase instruction may generalize to words in isolation as well as to other connected text. Further, these two studies provide evidence to suggest that students are learning and reading individual words, rather than memorizing whole phrases.

Future Directions

External validity of findings from both studies is limited. Both studies were conducted with a small number of post-secondary students with IDD. Additional studies should be conducted with larger samples. Also, the students in the current studies reported reading levels ranging from 3rd to 10th grade. Thus, additional studies should be conducted with student who have weaker reading skills, including students with IDD, Specific Learning Disability (SLD) in reading, dyslexia, other reading skills deficits (e.g., student receiving services via Multi-Tiered System of Support), attention problems, and behavior problems.

In the current study we targeted course related word. Similar studies should be conducted with high frequency words across students, including elementary, middle, and high school students. Also, researchers should determine if these phrase reading interventions can enhance students' ability to acquire phonemic skills (Ehri, 2005). Longitudinal studies should be

conducted to determine if similar phrase reading interventions can remedy, mitigate, or prevent reading skills deficits.

Maintenance data collected in the first study showed that acquired words were maintained and that students continued to acquire words after the intervention was applied to another list. Maintenance data collection stopped following the application of the final word list. Due to the short-term nature of the maintenance data collection phase, it is not clear how long students would maintain these acquired words. No maintenance data were collected in the second study; therefore, we are unable to determine whether the learned words were maintained post intervention. Future researchers should conduct studies with both short- and long-term maintenance assessments.

In both studies we measured students' ability to correctly read targeted words. Across studies, students correctly read words not targeted by the intervention. In the first study, students continued to acquire words no longer targeted by the intervention during the maintenance phase. In the second study, we found that students were able to read many of the novel phrases correctly, even though only the target word was taught. Future researchers may want to determine whether testing effects, outside exposure to words, interaction effects, or generalized improvement in reading contribute to increased word learning.

Results from Study I lead us to hypothesize that training one exemplar was sufficient. Study II indicated that training only one exemplar resulted in the same overall learning outcomes as training three exemplars. While these studies show that training one exemplar may be sufficient to foster generalization of phrases to words in isolation and target words to novel phrases; results also support that generalization was obtained faster by training three exemplars. However, because our study may have been confounded by ceiling effects, researchers should

conduct similar studies designed to compare the number of training exemplars using flow list procedures (Hubbert et al., 2000; McLaughlin et al., 1991; Yaw et al., 2014). Also, flow list procedures should be used to explore how many exemplars are "sufficient" by comparing different numbers of examples and measuring their effects on learning outcomes. Researchers may also consider extending the current and future studies by measuring learning speed and comparing how quickly students generalize relative to instructional time (Skinner et al., 2023; Yaw et al., 2014).

Future researchers should investigate intervention alteration procedures that may optimize acquisition, generalization, and maintenance. During the intervention, students in both studies may have learned words not targeted while simultaneously learning the target words. Future studies should explore whether teaching phrases allows students to learn multiple words at a time, which would increase learning speed (Alberto et al., 2010). Also, researchers may want to explore the dose and dose schedule of the intervention. In Study II, the students were given three learning trials per target word. Future researchers may try to determine whether more or fewer exposures to the target words is more effective. Additionally, Future studies should explore different intervention doses (e.g., trial per session) and dose schedules or dosage for optimal learning (Duhon et al., 2022).

Finally, researchers should evaluate other outcome measures associated with course word-learning in students with IDD. For example, researchers should determine whether teaching students words enhances their comprehension and performance in college courses. Researchers could determine if these interventions enhance students' engagement in college courses. Increased engagement in these courses may also strengthen positive self-perception and

reinforce sense of belonging as a student. These and other indirect outcomes should also be explored.

Conclusion

Students often enroll in TPSID programs to develop and build independence and vocational skills (Kleinert, 2012). In most TPSID program models, students take courses with degree-seeking peers in order to enhance their access to an academic curriculum that will prepare them for post-graduation life. While reading skill deficits are prevalent amongst students with IDD (Daly et al., 2015), intervention research for post-secondary students with IDD is limited. Previous researchers found that a computer-based whole-word reading intervention enhances the ability of post-secondary students with IDD to read words (Cazzell et al., 2015; Cazzell et al., 2016; Wright et al., 2021). This dissertation provides additional support for using computer-based interventions to teach whole words and phrases to students with IDD in post-secondary education programs.

Overall, the results from the two studies described in previous chapters (Chapters II and III), provide evidence to support the use of computer-based interventions to teach students course specific words. Words taught were generalized from connected text to isolation and from connected text to other connected text. For students with IDD who are attending post-secondary programs, these findings support the use of such interventions to increase acquisition and generalization of content related words. Future research exploring the outcomes of whole-word and phrase reading instruction should allow educators to enhance reading skills in students with reading challenges.

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APPENDICES

Appendix A: Tables and Figures

Table 1. *Study 1- Participant Characteristics.*

	Maggie	Megan	Caleb
Demographics			
Age	21	20	21
Gender	Female	Female	Male
Approximate Reading Level	6th grade	3rd grade	9th grade
Diagnoses	Intellectual Disability	Intellectual Disability	Autism; Intellectual Disability
Course Enrollment			
Elective Course	Psychology	Psychology	Human Geography
Course Level	Freshman	Freshman	Freshman

Table 2. *Study 1- Average Intervention Sessions to Criteria, Words Acquired in these Sessions, and Cumulative Instructional Seconds (CIS) to Acquire a Word Across Sessions to Criteria.*

	Maggie	Megan	Caleb
Intervention phase			
Mean Session to Criteria	5.33	7.33	4.67
Mean Words acquired at Criteria	4.66	4.33	5.67
CIS to acquire a word	240.19	355.50	172.96

Note: Each session = 210s.

Table 3. *Study 2 - Participant Characteristics.*

	Abel	Troy	Isabelle	Rachel
Demographics				
Age	19	21	23	24
Gender	Male	Male	Female	Female
Approximate Reading Level	10th grade	3rd grade	3rd grade	9th grade
Diagnoses	Autism	Intellectual Disability	Intellectual Disability	Cerebral Palsy
Course Enrollment				
Elective Course	Sociology	Nutrition	Psychology	Psychology
Course Level	Freshman	Sophomore	Sophomore	Junior

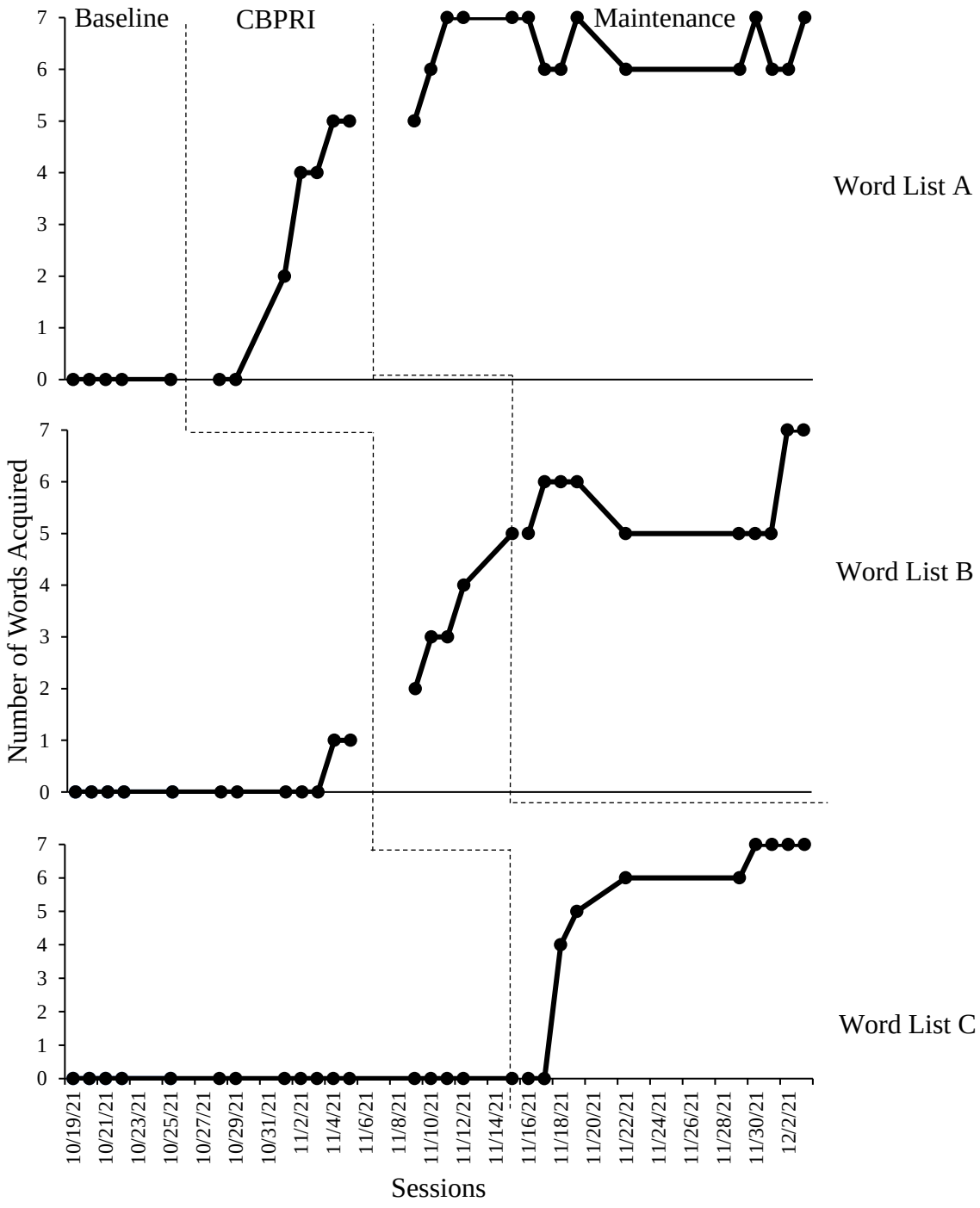

Figure 1. *Words Acquired by Maggie*

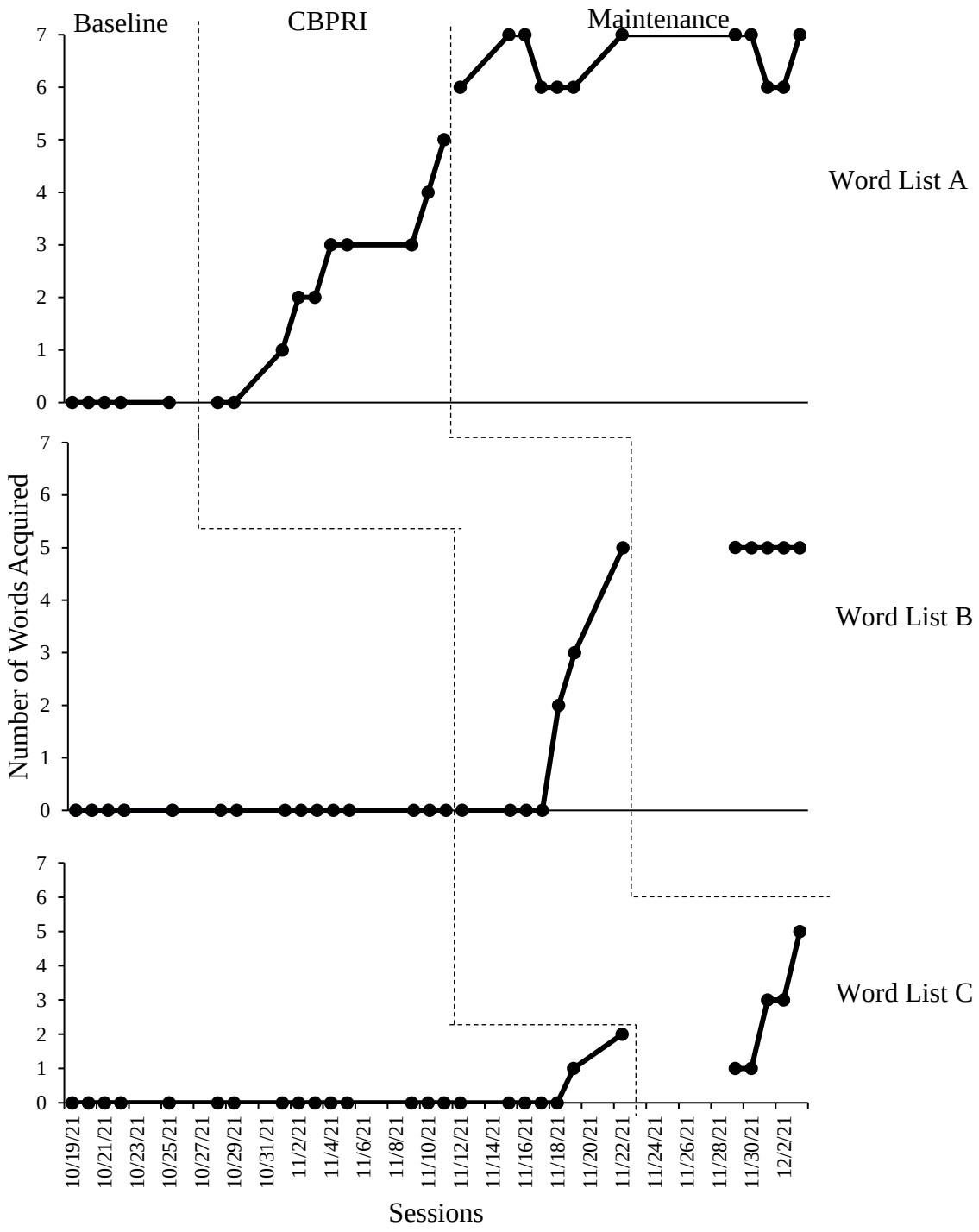

Figure 2. *Words Acquired by Megan*

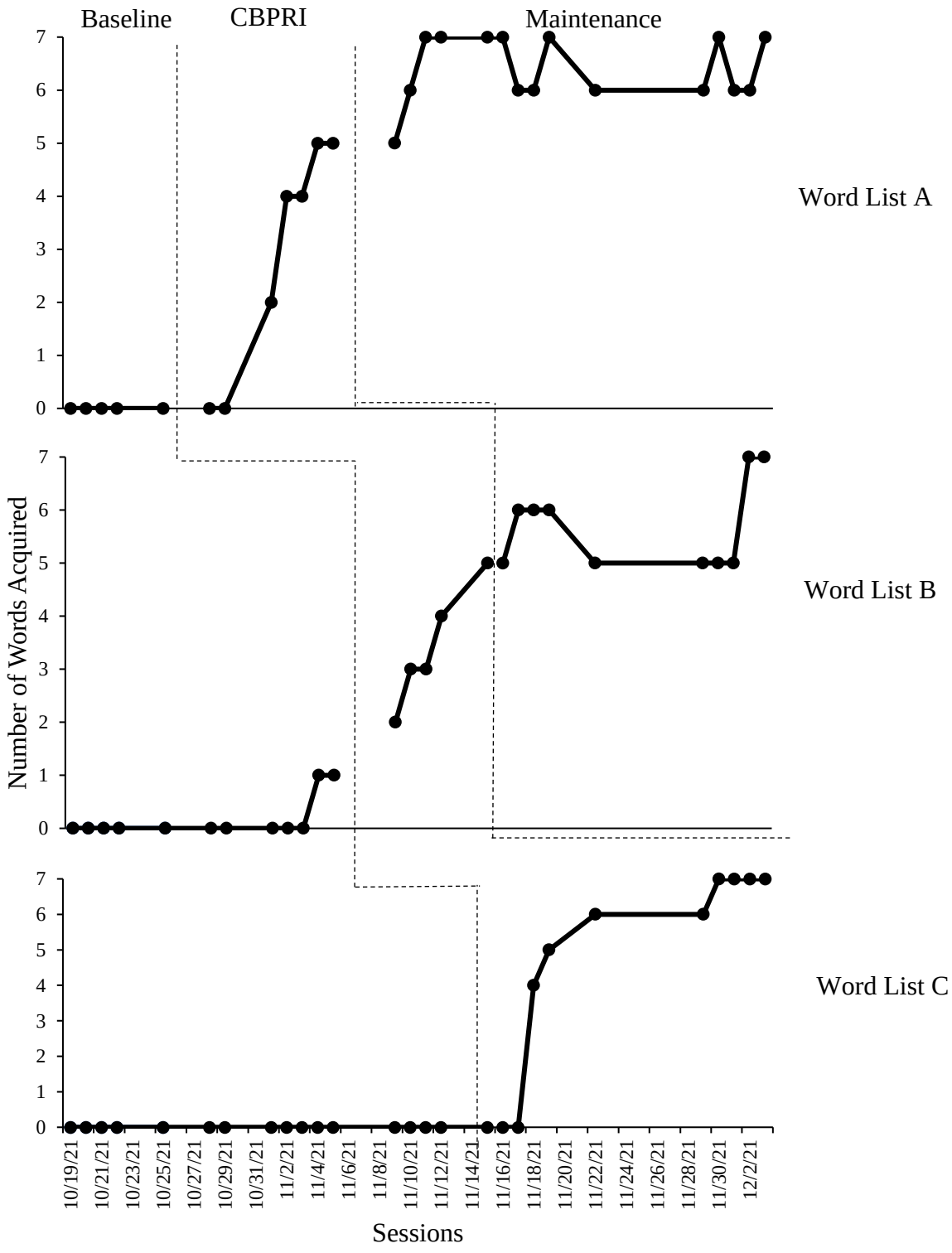

Figure 3. *Words Acquired by Caleb*

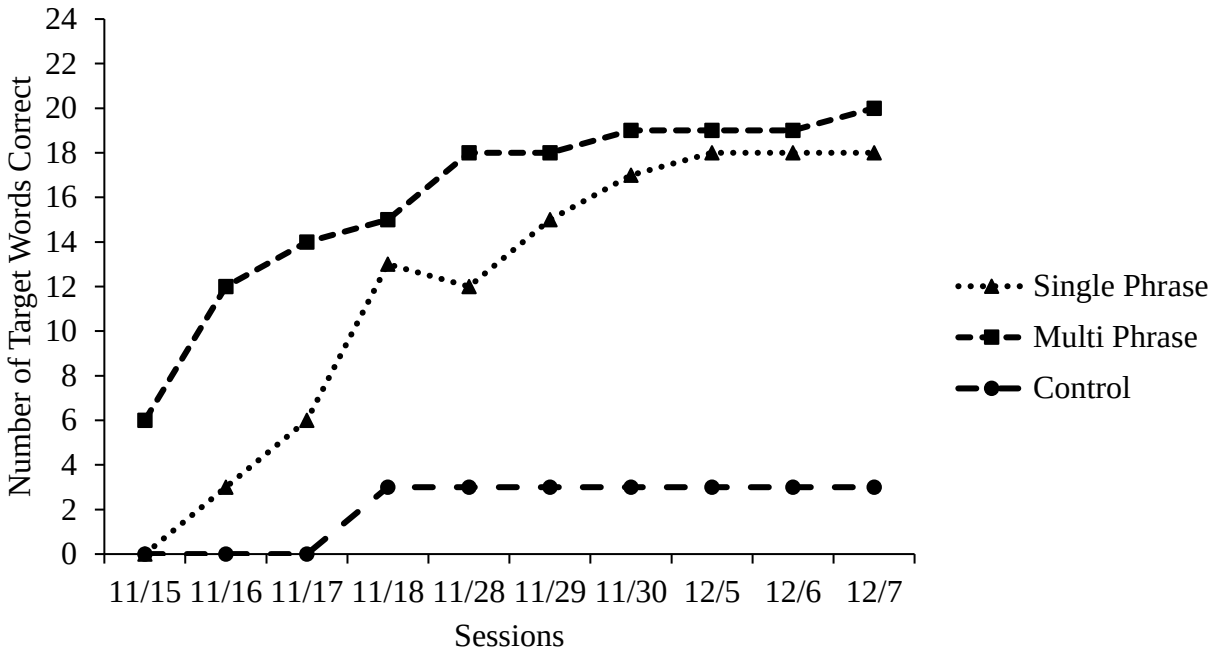

Figure 4. *Target Words Read Correctly by Abel*

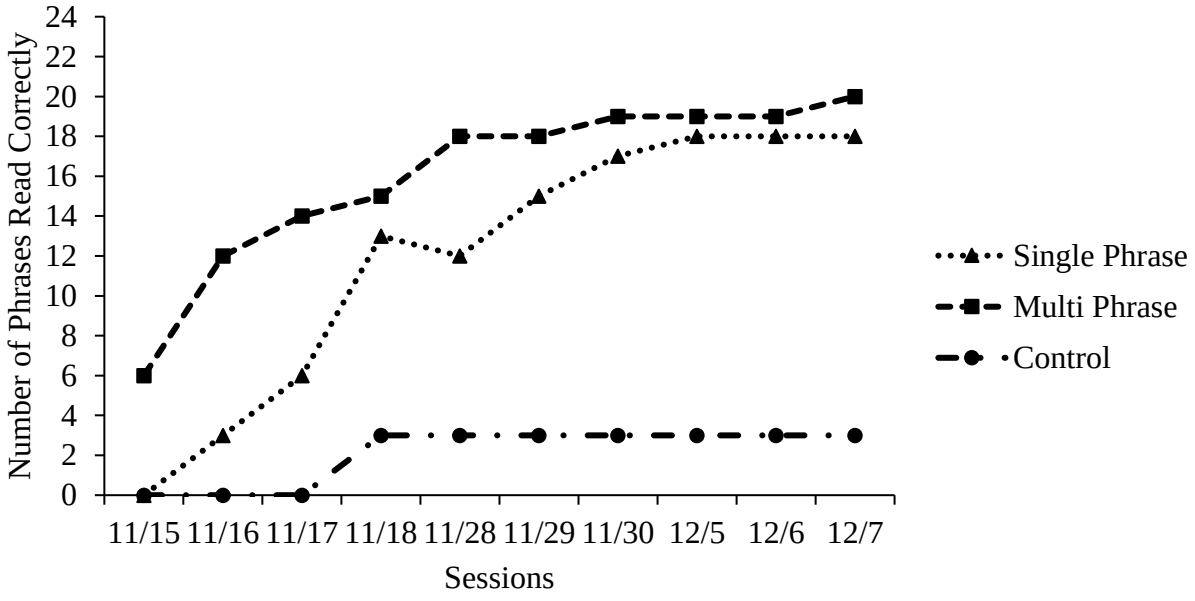

Figure 5. *Phrases Read Correctly by Abel*

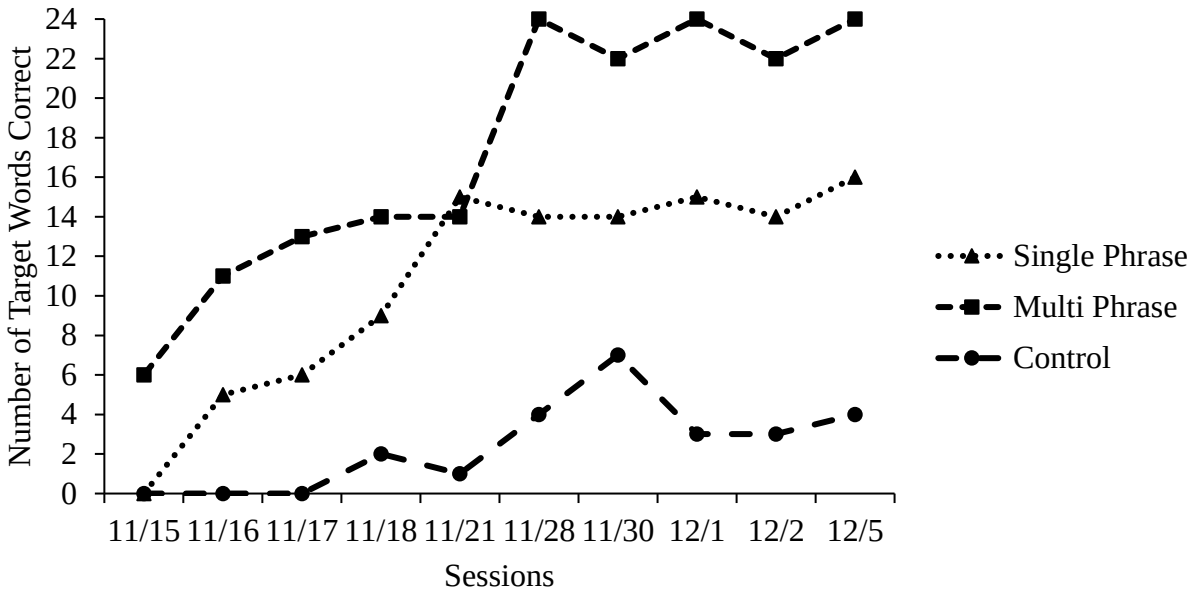

Figure 6. *Target Words Read Correctly by Troy*

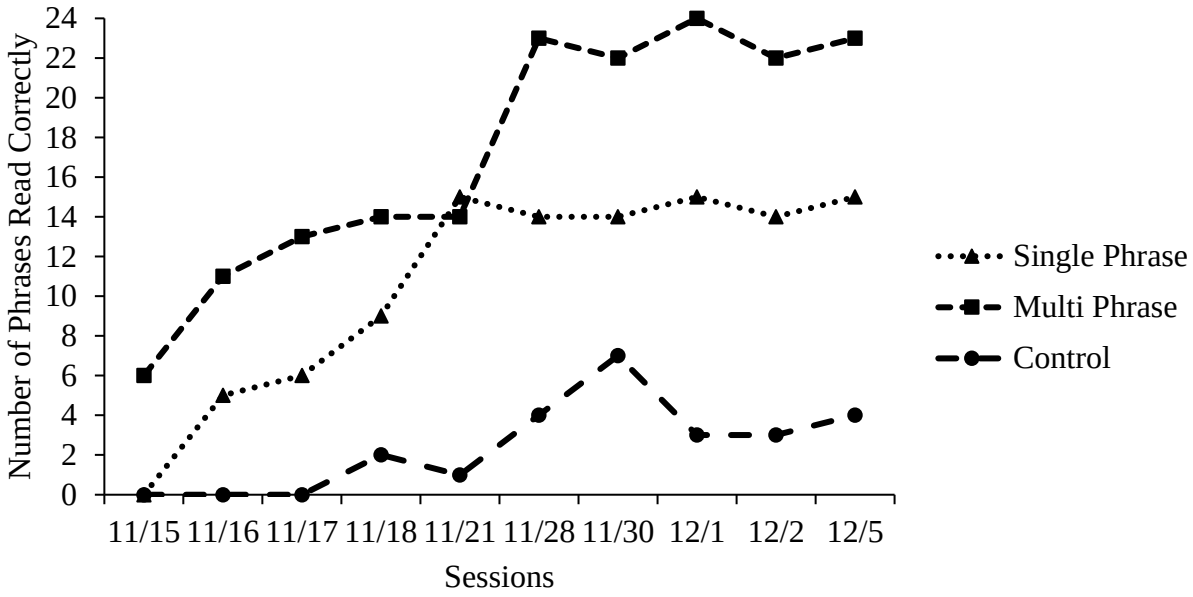

Figure 7. *Phrases Read Correctly by Troy*

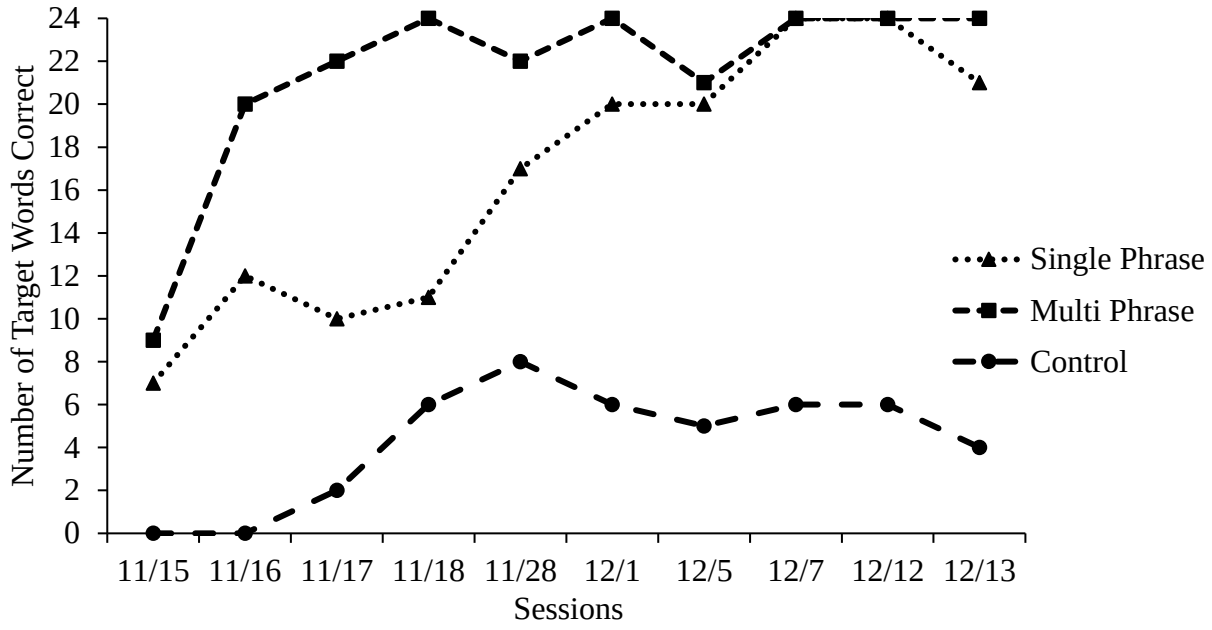

Figure 8. *Target Words Read Correctly by Rachel*

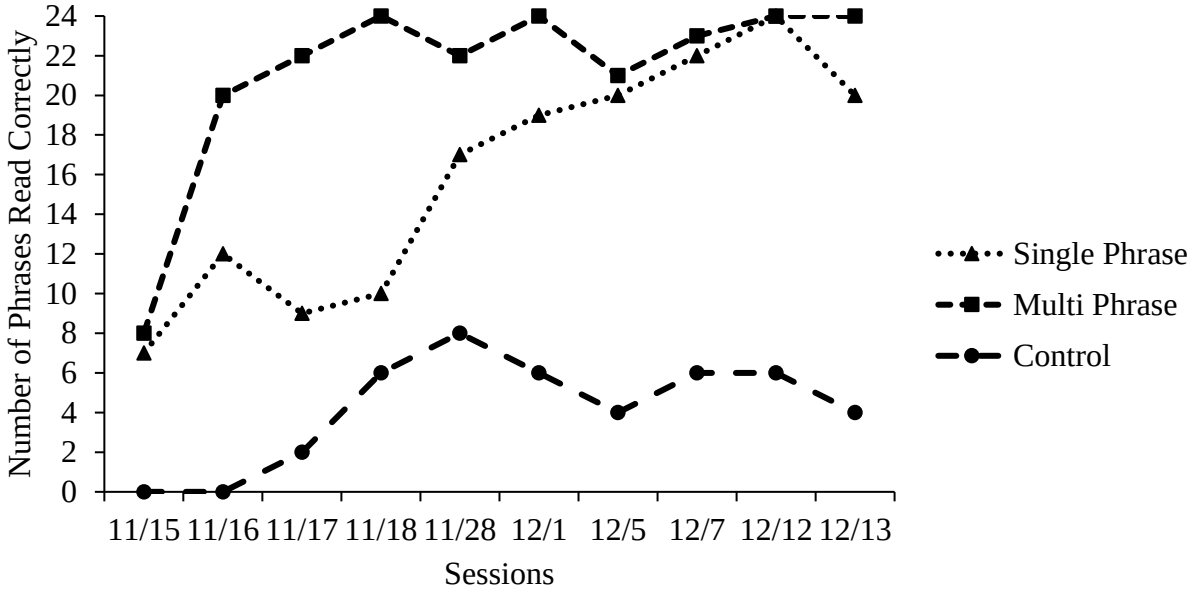

Figure 9. *Phrases Read Correctly by Rachel*

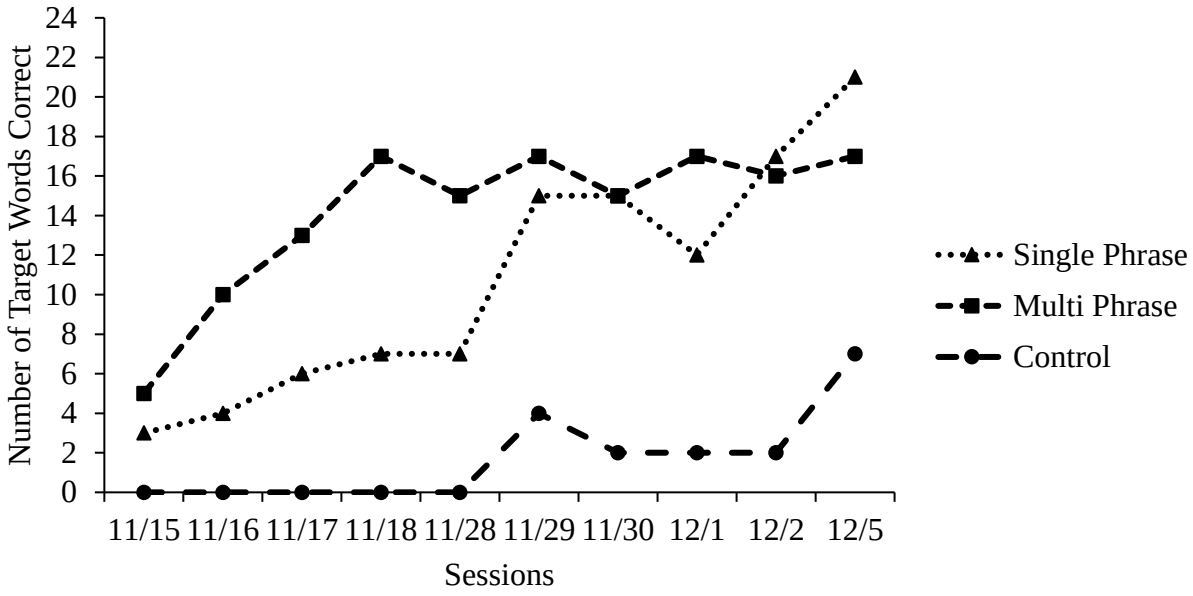

Figure 10. *Target Words Read Correctly by Isabelle*

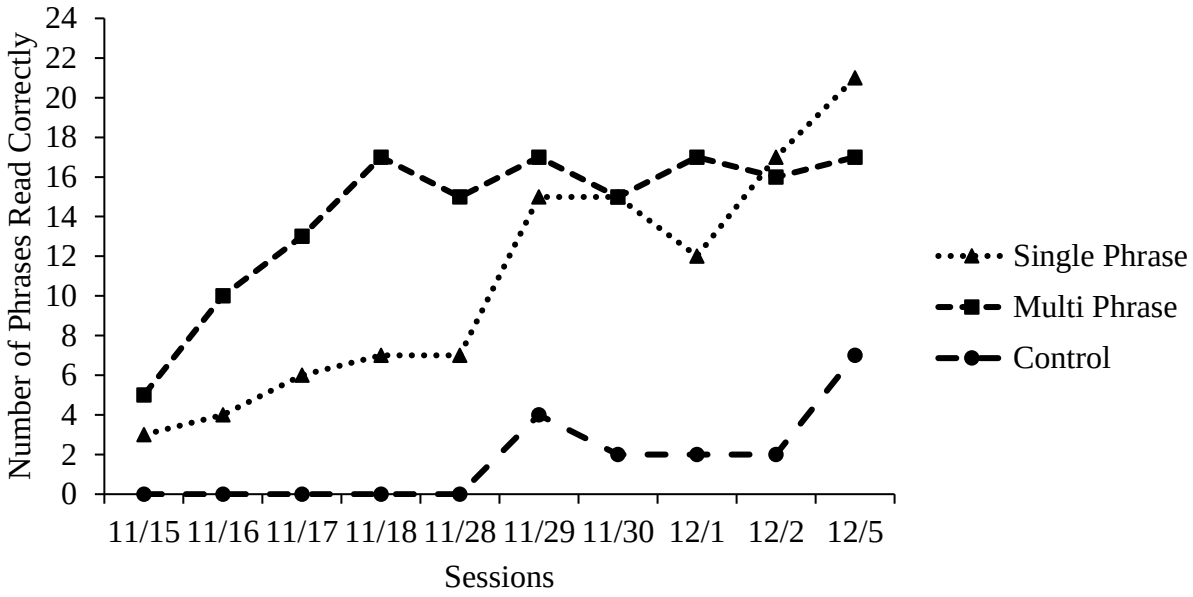

Figure 11. *Phrases Read Correctly by Isabelle*

Appendix B: Stimulus Phrases – Study I

Note: Target words are underlined.

Maggie – Freshman Level Psychology Course

Word List A: overactive amygdala, compliance training, delayed echolalia, coerced labor, placebo drug use, alcohol abstinence, cognitive dissonance

Word List B: convergent evolution, acculturation process, standpoint epistemology, drug habituation, inferiority complex, kinesthetic learning style, mnemonic device

Word List C: authoritarian parenting, social cryptomnesia, visual agnosia**,** diathesis stress model, autogenic training, desensitization therapy, competitive inhibition

Megan – Freshman Level Psychology Course

Word List A: agoraphobia treatment, cultural assimilation, sleep insomnia**,** unwanted obsessions**,** positive reinforcement, emotional trauma, randomizing participants

Word List B: effective altruism, conformity bias, depth perception, specific phobia, prejudice checking, comparison level, mnemonic device

Word List C: conscious awareness, overactive amygdala, acute mania, placebo effect, unconscious bias, sensory deprivation, child psychology

Caleb – Freshman Level Human Geography Course

Word List A: acculturation process, large congregation, epidemiology jobs, non-consumptive water use, tertiary structure, photovoltaic solar panel, hierarchical organization

Word List B: apartheid state, desertification solutions, interregional migration, participatory democracy, transnational corporations, micropolitan cities, irrational ethnophobia

Word List C: autocracy government, dispersed settlement, ethical monotheism, remittance transfers, subsistence agriculture, northeast megalopolis, ethnoburb community

Appendix C: Treatment Integrity Form – Study I

Treatment Integrity Checklist[1]

Date: _____ Observer: _____

		Yes	No
1	Set up a work station containing a desktop and two chairs.		
2	Instruct student to sit in the chair of his/her choice.		
3	Assess all words via flashcards		
4	Instruct student to read the words on the flashcards to the best of his/her ability.		
5	Place responses that are correctly identified within 3 seconds in one pile and those that are incorrectly identified or identified after 3 seconds in another.		
6	Record student correct and incorrect responses on datasheets		
7	Instruct student that upon pressing the computer space bar, words/phrases will be displayed, and they are to try to "beat the recording" by saying the word/phrase before they hear the recording.		
8	Instruct student to repeat the word/phrase after they hear the recording.		
9	After the first completion of the intervention, repeat steps 7-8.		
10	After the second completion of the intervention, repeat steps 7-8.		
11	Thank the student for participating in the intervention and escort out of the room.		
12	Steps 2-11 are completed for each student		

Number of steps completed: _____

Percentage of steps completed: _____

Comments:

[1]Adapted from Cazzell, S., Skinner, C. H., Taylor, K., McCurdy, M., Ciancio, D., Cihak, D., Skinner, A., & Moore, T. (2020). Comparing Computer-Based Sight-Word Interventions in Students with Intellectual Disability: Self-Determined Versus Fixed Response Intervals. Journal of Behavioral Education, 29(3), 469–489. https://doi.org/10.1007/s10864-019-09335-8

Appendix D: Student Acceptability Measure – Study I and II

Participant #: _____

Student Acceptability Form

Directions: Read each statement. Circle the number that represents how you feel about the statement.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
1. I like using the computer-based reading intervention.	1	2	3	4	5
2. I would like to continue using a computer-based reading intervention.	1	2	3	4	5
3. The computer-based reading intervention was easy to use.	1	2	3	4	5
4. The computer-based reading intervention helped me learn new words.	1	2	3	4	5
5. Others in my class would like the computer-based reading intervention.	1	2	3	4	5

Appendix E: Instruction Phrases and Words – Study II

Note: Target words are underlined

Abel – Freshman Level Sociology Course

Multi-phrase*:* medical apartheid, streel level bureaucracy, conspicuous consumption, catatonic schizophrenia, hijacked amygdala, egalitarian society, paradigm windows, family scapegoating, apartheid laws, executive bureaucracy, conspicuous clue, paranoid schizophrenia, amygdala damage, political egalitarian, research paradigm, historical scapegoating, apartheid museum, bureaucracy function, less conspicuous gift, schizophrenia medication, bruised amygdala, egalitarian doctrines, physical paradigm, scapegoating defense

Single-phrase*:* symbol for androgyny, overthrow of bourgeoisie, corporate conglomerates, history of deinstitutionalization, racism and xenophobia, third tier caste, engineered recidivism, tertiary prevention

Troy – Sophomore Level Nutrition Course

Multi-phrase*:* acne treatment, anorexia mortality rate, binge eating disorder, calorie calculator, reduced cholesterol, apnea of prematurity, natural preservatives, saturated solution, hormonal acne, atypical anorexia, unrestricted binge, high calorie meals, cholesterol medication, prematurity age calculator, preservatives allergy, saturated vapor, inflammatory acne, anorexia nervosa, professional binge, calorie intake, total cholesterol, anemia of prematurity, chemical preservatives, water saturated

Single-phrase*:* macronutrient tracker, benign hypertension, symptoms of bulimia, microcrystalline cellulose, Barrett's esophagus, genetically engineered, plaque psoriasis, anaerobic respiration

Isabelle – Sophomore Level Psychology Course

Multi-phrase*:* authoritarian government, certificate of compliance, auditory hallucinations, general perception, unconscious bias, maturation process, forensic psychology, subconscious decision, authoritarian leadership, compliance training, tactile hallucinations, depth perception, unconscious inference, cisternal maturation, subconscious anxiety, child psychology, authoritarian movement, regulatory compliance, hallucinations from medication, perception process, temporarily unconscious, maturation phase, psychology degree, Freud subconscious

Single-phrase*:* agoraphobia symptoms, reciprocal altruism, enlarged amygdala, equal temperament, mnemonic device, undiagnosed dementia, punctuated equilibrium, embryo transfer

Rachel – Junior Level Psychology Course

Multi-phrase: authoritarian tolerance, representative heuristic, associative agnosia, delayed echolalia, harmony of dissonance, cognitive remediation, gestalt principle, maturation phase, authoritarian movement, heuristic thinking, tactile agnosia, immediate echolalia, emotional dissonance, reading remediation, gestalt community, affinity maturation, abusive authoritarian, heuristic approach, agnosia types, echolalia symptoms, cultural dissonance, remediation courses, Bender gestalt test, cisternal maturation

Single-phrase: damaged amygdala, abnormal child psychopathology, allochiria etymology, coerced confession, sensory deprivation, echoic skills, neutral imprinting, smallpox inoculation

Appendix F: Generalization Phrases and Words – Study II

Note: Target words are underlined

Abel – Freshman Level Sociology Course

Multi-phrase: apartheid movement, bureaucracy in government, find conspicuous colors, schizophrenia treatment, enlarged amygdala, egalitarian relationship, paradigm shift, racial scapegoating, apartheid state, imperial bureaucracy, conspicuous bravery, schizophrenia test, overactive amygdala function, egalitarian family, paradigm speakers, scapegoating theory, end of apartheid, federal bureaucracy, conspicuous wealth, childhood schizophrenia, bruised amygdala, egalitarian culture, visual paradigm, scapegoating ads

Single-phrase: androgyny in art, French bourgeoisie, large conglomerates, effects of deinstitutionalization, xenophobia in Germany, caste village, reducing recidivism, tertiary education, androgyny in clothing, bourgeoisie class, conglomerates in America, deinstitutionalization in America, history of xenophobia, social caste, criminal recidivism, tertiary care, tales of androgyny, rise of bourgeoisie, food conglomerates, deinstitutionalization movement, combat xenophobia, caste system, recidivism rates, protein tertiary structure

Control: altruistic behavior, eutrophication process, hunter-gatherer matrilocality, reverse hierarchical diffusion, clinical epidemiology, anomie flower, social anomie, dyad model, anomie theory, social epidemiology, cultural eutrophication, epinephrine receptors, artificial eutrophication, renaissance matrilocality, force dyad, celebrity dyad, altruistic personality, epidemiology jobs, matrilocality primates, hierarchical clustering, dose of epinephrine, be altruistic, epinephrine injection, hierarchical organization

Troy – Sophomore Level Nutrition Course

Multi-phrase: newborn acne, anorexia effects, binge drinking, calorie counter, cholesterol test, complications of prematurity, common preservatives, saturated market, acne scars, anorexia recovery, spending binge, low calorie snack, high cholesterol, extreme prematurity, food preservatives list, low saturated fat, back acne, signs of anorexia, binge watching, calorie deficit, normal cholesterol levels, prematurity awareness, flower preservatives, saturated colors

Single-phrase: acceptable macronutrient, benign cancer, bulimia health risks, powdered cellulose, nutcracker esophagus, genetically modified food, dental plaque, anaerobic digestion, macronutrient ratio, always benign, bulimia weight loss, cellulose function, inflamed esophagus, genetically replicated, plaque buildup, anaerobic workout, food macronutrient calculator, benign tumor, bulimia recovery, cellulose gum, esophagus cancer, determined genetically, plaque removal, anaerobic infection

***Control*:** stooped posture, fermentation formula, posture trainer, fermentation process, skin ulcer, cellular homeostasis, loop diuretics, epinephrine dose, body homeostasis, slow digestion, common diuretics, antioxidants in coffee, posture chair, natural antioxidants, epinephrine drip, alcoholic fermentation, digestion specialist, stress ulcer, diuretics conversion, benefits of antioxidants, homeostasis process, ulcer pain, racemic epinephrine, digestion process, stress ulcer

Isabelle – Sophomore Level Psychology Course

Multi-phrase: abusive authoritarian, compliance officer, visual hallucinations, doors of perception, collective unconscious, maturation theory, sports psychology, subconscious mind, authoritarian countries, visual compliance, drug hallucinations, perception check, unconscious thought, brain maturation, subconscious programming, school psychology, authoritarian

parenting, compliance form, hallucinations at night, social perception, unconscious mind, cell maturation, psychology major, powerful subconscious

Single-phrase: mild agoraphobia, altruism theory, damaged amygdala, temperament test, mnemonic memory, dementia care, equilibrium point, chicken embryo, signs of agoraphobia, true altruism, amygdala removal, even temperament, planet mnemonic, early onset dementia, genetic equilibrium, human embryo, agoraphobia treatment, ethical altruism, amygdala function, temperament theory, mnemonic creator, signs of dementia, thermal equilibrium, embryo cells

Control: obedience study, delusions of jealousy, controlled placebo, conscious effort, social cognitive theory, cultural assimilation, obedience training, blind obedience, placebo effect, placebo pills, religious delusions, cognitive therapy, sleep deprivation, assimilation effect, cognitive disorder, deprivation tank, operational thought, assimilation history, operational risk, conscious mind, health conscious, formal operational stage, useful delusions, food deprivation

Rachel – Junior Level Psychology Course

Multi-phrase: authoritarian government, heuristic models, agnosia causes, internal echolalia, social dissonance, environmental remediation, gestalt approach, maturation effect, authoritarian parenting, availability heuristic, visual agnosia, echolalia in adults, cognitive dissonance, remediation plan, gestalt therapy, brain maturation, effects of authoritarian, usability heuristic, object agnosia, speech echolalia, dissonance theory, remediation services, closure gestalt, maturation theory

Single-phrase: amygdala weakness, developmental psychopathology, reflex allochiria, coerced consent, deprivation tank, echoic memory, imprinting on someone, stress inoculation, enlarged amygdala, psychopathology theories, visual allochiria, coerced labor, oxygen deprivation, echoic prompt, genetic imprinting, attitude inoculation, overactive amygdala, models of

psychopathology, allochiria patient, unlawfully coerced, sleep deprivation, building echoic control, ducks imprinting, inoculation theory

Control: conscious decision, mnemonic generator, competitive inhibition, ingratiation marketing, circadian rhythm, genetic epistemology, dyscalculia accommodations, equity partners, health conscious, meaningful equity, epistemology books, presidential ingratiation, circadian clock, planet mnemonic, private equity, dyscalculia treatment, inhibition training, mnemonic memory, social inhibition, ingratiation tactics, reset circadian, issues in epistemology, conscious mind, characteristics of dyscalculia

Appendix G: Treatment Integrity – Study II

Treatment Integrity Checklist[1]

Date: _____ Observer: _____

		Yes	No
1	Set up a work station containing a computer and two chairs.		
2	Instruct student to sit in the chair of his/her choice.		
3	Instruct student that upon pressing the computer space bar, words/phrases will be displayed, and they are to try to "beat the recording" by saying the word/phrase before they hear the recording.		
4	Instruct student to repeat the word/phrase after they hear the recording.		
5	Assess words/phrases via flashcards		
6	Instruct student to read the words on the flashcards to the best of his/her ability.		
7	Place responses that are correctly identified within 3 seconds in one pile and those that are incorrectly identified or identified after 3 seconds in another.		
8	Record student correct and incorrect responses on datasheets		
9	Repeat steps 5-8 for the next treatment.		
10	Repeat steps 5-8 for the next treatment.		
11	Repeat steps 5-8 for the control.		
12	Thank the student for participating in the intervention and escort out of the room.		
13	Steps 2-12 are completed for each student		

Number of steps completed: _____

Percentage of steps completed: _____

Comments:

[1]Adapted from Cazzell, S., Skinner, C. H., Taylor, K., McCurdy, M., Ciancio, D., Cihak, D., Skinner, A., & Moore, T. (2020). Comparing Computer-Based Sight-Word Interventions in Students with Intellectual Disability: Self-Determined Versus Fixed Response Intervals. Journal of Behavioral Education, 29(3), 469–489. https://doi.org/10.1007/s10864-019-09335-8

VITA

Chelsea Sabrina Wilson was born to Le Von and Mildred Wilson in Cullowhee, North Carolina. She attended Georgia Southern University in Statesboro, Georgia where she graduated in 2018 with a Bachelor of Science degree in Psychology and a minor in Spanish. In August 2019, Chelsea began the School Psychology doctoral program at the University of Tennessee, Knoxville. Chelsea received her Master of Science degree in Applied Behavior Analysis from the University of Tennessee, Knoxville in 2022. She will begin her doctoral internship in the summer of 2023 with the Virginia Beach City Public Schools. Chelsea will complete her doctoral requirements upon the completion of her internship in summer 2024.