THE EFFECTIVENESS OF PEER-ASSISTED LEARNING STRATEGIES ON READING COMPREHENSION FOR STUDENTS WITH AUTISM SPECTRUM DISORDER

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Individuals with autism spectrum disorder (ASD) demonstrate strengths in word recognition and decoding, but comprehension skills are not well developed. If reading problems are not quickly addressed, they will continue to affect academic progress. Unless an effective reading intervention is established early, the outcome for struggling readers is not positive. There is little research in the area of reading comprehension for students with ASD. However, one instructional approach that has benefited many beginning readers and has improved reading comprehension skills is Peer-Assisted Learning Strategies (PALS). The current study investigated the effects of PALS on reading fluency and reading comprehension for students with ASD. A single-subject multiple baseline design across participants was used for three students with ASD. Results from the current study demonstrated that students with ASD can improve reading comprehension and reading fluency when using PALS. More specifically, all three students increased their reading comprehension and two students increased their reading fluency. Directions for future research and implications follow a discussion of findings.

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PREFACE

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1.0 INTRODUCTION

Reading comprehension is considered "the most important academic skill learned in school" (Mastropieri & Scruggs, 1997, p. 1). To be able to read and understand written text expands learning opportunities. Understanding text is an important skill needed in order to function independently in society (Chiang & Lin, 2007). If reading problems are not quickly addressed, they will continue to affect academic progress. Reading comprehension is considered to be a major developmental milestone at Grades 3 to 6 (Jacobs, 2002). Two-thirds of students who cannot read proficiently by the end of the 4th grade will end up in jail or on welfare (NCES, 2012). It is predicted that if a child is not reading proficiently in 4th grade, he or she will have approximately a 78 percent chance of not catching up (NCES, 2012). The 2003 National Assessment of Educational Progress (NAEP) found that in the eighth grade, 31% of boys and 21% of girls could not read at the basic literacy level. Many students with poor reading skills suffer low self-esteem, break school rules (Juel, 1996), and have a greater chance of not graduating, going on to postsecondary education or maintaining a satisfying career (Slavin, Cheung, Groff & Lake, 2008). In response to these and similar alarming statistics, changes in federal policy and new research have promoted a new importance on teaching academic content (Knight, Browder, Agnello, & Lee, 2010).

Two important federal laws relating to the education of children were developed: the No Child Left Behind Act (NCLB, 2001) and the Individuals with Disability Education Act (IDEA,

1997). NCLB looks to improve the education of all children; IDEA focuses on the education of students with disabilities. One purpose of NCLB is to improve reading achievement and instruction for all children. Although NCLB does not specifically focus on improving district and school reading programs for students in Grades 4–12, it does make districts and schools accountable for making adequate yearly progress toward state reading standards, which includes students with severe developmental disabilities. This is the first time in history that schools are held accountable for this population to meet state standards in academic content areas (Browder et al., 2009).

Findings from the National Reading Panel (NICHD, 2000) are cited in NCLB language requiring that all students receive explicit systematic reading instruction that includes five essential reading components of reading: phonemic awareness, phonics, oral reading fluency, vocabulary and comprehension strategies. Effective early reading interventions include multiple components that are explicitly integrated, including oral language, phonological awareness, phonics, word recognition, fluency, and comprehension (National Reading Panel, 2000).

The IDEA (Individuals with Disabilities Education Act, which was reauthorized in 1997, and amended again in 2004) includes an increased focus on the use of scientifically-based or evidence-based instructional programs for use with students with disabilities (Marchand-Martella, Martella, & Ausdemore, 2005) in order to boost students' academic growth. In addition, NCLB and IDEA (2004) mandate that students with disabilities (including students with intellectual disabilities and autism spectrum disorders) participate in the general education curriculum and receive effective instruction in order to make adequate yearly progress toward grade level standards (emphasis in reading and math).

According to The Department of Health and Human Services, Centers for Disease Control and Prevention, it is estimated that 1 in 45 births have an autism spectrum disorder. Individuals with autism spectrum disorder (ASD) often display deficits in their ability to use and understand language (Flores, Nelson, Hinton, Franklin, Strozier, Terry, and Franklin, 2013). Intellectual disabilities (IDs) are characterized by social, cognitive, and adaptive skill deficits (Matson & Shoemaker, 2009). Intellectual disability (ID) is the most common co-occurring disability with ASD (Matson & Shoemaker, 2009). Forty-percent of persons with ID have an ASD, while 70% of persons with ASD have ID (LaMalfa, Lassi, Bertelli, Salvini, & Placidi 2004).

Although individuals with ID and ASD may demonstrate strengths in word recognition and decoding, comprehension skills are not well developed (Williamson, Carnahan, & Jacobs, 2012; Whalon, Al Otaiba, & Delano, 2009). In the early years of reading development, predictors of comprehension skills include word-reading skills, such as decoding, letter knowledge, and phonological awareness (Williamson, Carnahan, & Jacobs, 2012). However, as children get older the relationship between comprehension and word-reading skills decline as the text becomes more challenging (Johnston, Barnes, & Desrochers, 2008).

One strategy that has been found to increase reading fluency and reading comprehension in individuals with ASD and their peers is CWPT (Kamps, Barbetta, Leonard, & Delquadri, 1994) and CLGs (Kamps, Leonard, Potucek, & Garrion-Harrell, 1995). CWPT and CLGs are a peer-mediated teaching strategy in which students work together to complete projects, worksheets, and practice skills (Kamps, Leonard, Garrison-Harrell, 1995) in a classwide setting. One peer-mediated teaching strategy that has benefited many beginning readers (Fuchs, Fuchs, Thompson, Al-Otaiba, Yen, Yang, & O'Connor, 2001) and has improved reading comprehension

skills is PALS. PALS is a scientifically based, supplemental, class wide peer-tutoring program that involves pairing higher and lower performing readers to practice beginning reading skills. Research has shown that PALS can have a positive impact in the beginning reading skills of many children (Rafdal et al., 2011) and can significantly increase the reading comprehension skills of students with disabilities (Fuchs, Fuchs, & Kazdan, 1999). However, the research indicates that PALS has been primarily implemented for English language learners or students with learning disabilities. Additional research is needed to determine if PALS is an effective strategy for improving comprehension skills and reading fluency for individuals with ASD.

2.0 LITERATURE REVIEW

2.1 READING DIFFICULTIES FOR STUDENTS WITH INTELLECTUAL DISABILITIES

Research on reading by children with intellectual disabilities was virtually nonexistent prior to the late 1960s (Conners, 1992). Historically, students with intellectual disabilities have had little focus on literacy (Browder et al., 2009). There was a strong belief that this population of children could not learn to read. Educators assumed that students with intellectual disabilities should learn daily living skills instead of academic content (Knight, Browder, Agnello & Lee, 2010).

Fortunately, educational opportunities are increasing for students with intellectual disabilities (Knight et al., 2010). Students with IDs can learn and do much more than once believed (Knight et al., 2010). By teaching reading skills to students with IDs, students have increased opportunities (Knight et al., 2010) in their adult life (Knight, Browder, Agnello & Lee, 2010).

2.1.1 Sight word instruction

Traditionally, reading instruction for individuals with an ID typically focused on a list of specific sight words found in everyday life (Browder et al., 2009). Sight word instruction teaches children to recognize key words in their environment by sight without sounding them out. Through acquisition of sight words, individuals can increase their daily living and self-help skills (Browder & Xin, 1998) and increase participation in the general education and community setting (Conners, 2003).

Didden, DeGraaf, Nelemans and Vooren (2006) investigated teaching sight words to children with moderate to mild IDs. Specifically, they assessed the effectiveness of (a) integrated pictures, (b) picture-fading and (c) words-alone in teaching sight words to students with IDs. Thirteen children with moderate to mild IDs (9 boys, 4 girls) between 10 and 15 years of age participated. The results indicated that 10 of the 13 students reached criterion level fastest in the word alone condition (most effective).

Conners (1992) reviewed the research on reading instruction for children with moderate IDs. Within this review, three major groups of studies were identified: sight word instruction; word-analysis instruction; and oral reading error-correction. When reviewing sight word instruction techniques, three were found to be the most studied; delay, picture fading, and picture integration.

Delay. In the delay technique, the teacher shows the student a word and asks the student to say the word. If the student does not know the word, the teacher says it. Over time, the student's response time decreases and is reinforced for a correct response. Several studies showed positive results. Browder, Hines, McCarthy, and Fees (1984) found that all students in their study learned words. Koury and Browder (1986) found that the progressive time-delay

technique also worked effectively in a peer-tutoring situation. Ault, Gast, and Wolery (1988) showed that the system of constant delay was more efficient than a progressive delay method. Gast, Ault, Wolery, Doyle, and Belanger (1988) compared the system of constant delay with the system of least prompts. Under both procedures all children met criteria however; the constant-delay procedure took less time than did the system of least prompts. Finally, McGee and McCoy (1981) showed that progressive delay was more effective than trial-and-error and about as effective as picture fading.

Picture fading. The picture fading technique uses pictures as cues for written words and then fades out the picture while maintain the written word at a constant intensity. The picture serves the purpose of gaining initial attention and fading serves to shift the attention to the written word. These studies showed mixed results. Dorry and Zeaman (1973) compared picture fading with a paired-associate method. Posttests without pictures indicated that children in the picture fading condition identified more words than children in the paired-associate condition. Dorry and Zeaman (1975) showed that it was not the similarity of picture fading to the condition of post testing that made it effective. Dorry (1976) showed that it was not the changing stimulus that made the picture fading effective. Barudin and Hourcade (1990) compared picture-fading technique with a tactile-kinesthetic technique, a no-picture control, and a no-training sham control, there was no overall difference in the three training techniques. McGee and McCoy (1981) varied the picture-fading technique by superimposing the picture on the word and then fading the picture out step-by-step following the correct response and compared this to trail-and-error and delay. Based on the results, it was difficult to discriminate the effectiveness of progressive delay and picture fading.

Picture-Integration. Other studies found that the picture fading technique is not as effective when compared to the Edmark Reading Program technique or with picture-integration techniques. Walsh and Lamberts (1979) found better recognition, matching, and identification of words following five 10-minute training sessions based on the Edmark Program than following the same amount of instruction based on picture fading. Conners and Detterman (1987) used a format similar to the Edmark Reading Program and found that visual pattern discrimination, learning and recall were related to word-learning efficiency. Smeets et al.'s (1984) studied the importance of integrating the picture and word together. The two methods that were used in this method were equally effective and more effective than the picture-fading technique. Miller & Miller, 1968, 1971; Worall & Singh, 1983 also found the picture-integration technique to be effective. Miller and Miller (1968) they presented symbol-accentuated words-words that had characteristics of the objects they represented (e.g. the word candy was spelled in candy cane letters). Results indicated that subjects learned faster under the symbol-accentuation technique than under the conventional technique. Miller and Miller (1971) determined that an animated version of the symbol-accentuated technique still produced better word identification than did the animated version of the paired-associates techniques.

Results of this review conducted by Conners (1992) indicated that the three areas of research on reading instruction for children with moderate intellectual disabilities indicate that sight-word instruction is beneficial for this population. Sight-word instruction literature suggests that picture integration, constant delay, and the Edmark Reading Program methods are the most effective. Despite the potential benefit of sight word instruction to promote independence in daily living skills, students also need explicit phonics instruction to become literate (Groff, 1998; Stahl, Duffy-Hester, & Stahl, 1998).

2.1.2 Phonemic awareness

Teaching the components of reading (e.g. phonic awareness, phonics, fluency, vocabulary, and comprehension) has not been a focus in the instruction of students with IDs (Wakeman, Spooner & Knight, 2007). Evidence exists that students with moderate intellectual disabilities can acquire phonics skills (Al Otaiba & Hosp, 2004; Barudin & Hourcade, 1990; Nietupski, Williams, & York, 1979 in Browder et al., 2006). Browder, Wakeman, Spooner, Ahlgrim-Delzell and Algozzine (2006) cross referenced research on reading with the National Reading Panel's recommendations in reading and found almost all studies focused on sight word learning, few focused on comprehension while none focused on phonics or phonemic awareness. The lack of research on this type of instruction may reflect prior expectations that individuals with intellectual disabilities might acquire a sight word vocabulary, but would not learn to read (Browder et al., 2006). Phonemic awareness skills are strongly related to success in learning to read (Browder et al., 2009). The ability to decode or read single words strongly determines overall reading ability (Stanovich, 1991).

Finnegan (2012) compared the effects of two systematic methods of phonics instruction in teaching students with significant IDs to read. Fifty-two students were randomly assigned to one of three treatment groups: A synthetic phonics instruction group (participants learned individual letter sounds and how to blend them to make a word); an analogy phonics instruction group (participants learned the sounds of common consonants and common "rimes." By combining a visual "rime" with common letter sound correspondences participants learned to read words with similar patterns); and a control group (participants continued with their regular reading program with no additional instruction). Post-test scores were significantly higher in word identification for students with significant IDs for both the synthetic and analogy phonics

treatment groups then the control group, with the posttest scores of the synthetic phonics treatment group being significantly higher than those of the analogy phonics treatment group (i.e. students who received a systematic approach to phonics instruction outperformed those students who did not). The analogy phonics approach, which more closely resembles sight word instruction, was not shown to be as effective as the synthetic phonics approach.

After examining the effectiveness of "evidence-based" approaches for a specific group of children with intellectual disabilities, Lemons, Mrachko, Kostewicz and Paterra (2012) investigated the effectiveness of decoding and phonological awareness interventions for children with Down Syndrome. Three studies were conducted: road to reading (RTR); RTR plus a phonological awareness activity (RTR+PA); road to code (RTC) program. Fifteen children between the ages of 5 and 13 years participated. RTR and RTR+PA results indicated that the decoding interventions were moderately effective in improving the reading of taught words, both phonetically regular words (PRWs) and high frequency words (HFWs). In addition, there were no improvements in oral reading fluency (ORF) for either group or no increases in the ability to identify initial sounds for children receiving RTR+PA. RTC results showed limited improvements in letter sound knowledge for three out of four of the students. In addition, there were no improvement in the students' abilities in segmenting, blending, or identify initial sounds. Based on these findings, children with mental retardation can learn and use phonetic-analysis strategies and or can benefit from some type of phonics instruction.

2.1.3 Decoding

Conners, Atwell, Rosenquist, and Sligh (2001) suggest that there are differences in reading ability of children with an intellectual disability related to differences in phonological

processing. The present study examined cognitive similarities and differences between stronger and weaker decoders. Forty-four children between the ages of 8 to 12 from 11 public elementary schools participated in this study. The children could identify letters, but were not reading phonologically. The children were compared on general intelligence, language ability, phonemic awareness and phonological memory. Results indicated stronger decoders were significantly older than weaker decoders and scored significantly higher in language ability, phonemic awareness and rehearsal in phonological memory, but not in intelligence. When age was covaried out, the groups differed significantly only in rehearsal in phonological memory. These findings support the idea that when IQ is substantially limited, the ability to rehearse or refresh phonological codes in working memory plays a significant role in determining children's success in learning to read.

2.1.4 Comprehension

The goal of reading instruction is to comprehend what has been read (Knight et. al., 2010). Students who perform better on comprehension tasks also demonstrate better decoding skills, global language skills, and oral reading fluency (Browder et al., 2006). Strategies for teaching comprehension to students with intellectual disabilities are not well researched (Knight et al., 2010). Browder et al., (2006) found that only a few studies include measures of comprehension. When students with intellectual disabilities demonstrate comprehension, it is often done by matching a word to a picture, by using objects to answer questions, or by pointing to pictures or through systematic prompting and feedback (Knight et al., 2010).

Browder, Wakeman, Spooner, Ahlgrim-Delzell, and Algozzine (2006) reviewed 128 studies to determine which evidence-based practices exist for teaching each of the National

Reading Panel's components of reading for students with significant cognitive disabilities. Eighty-eight of the 128 reviewed studies applied a single subject design and 40 used group design. Most of the studies focused on functional sight words. Less than one-third contained a measure of comprehension (n = 31). The researchers found strong evidence that systematic instructional strategies such as prompting and fading to be effective interventions to teach sight words and comprehension. Most studies addressed comprehension through having the students use a sight word in the context of a functional activity or through word-to-picture matching. Some evidence also exists for teaching comprehension using concrete references such as pictures, or an activity to demonstrate understanding.

2.1.5 Direct Instruction (DI)

Most children identified as disabled have trouble in subject areas because of a lack of basic reading skills (Forbness & Kavale 1985). Basic reading and spelling skills significantly improve when phonological awareness and total word structure are taught directly and systematically (Bradley & Bryant 1991; Felton 1993; Williams 1987). Direct Instruction (DI) is a scientifically based model of effective instruction developed by Siegfried Engelmann in the 1960's through a federally funded research and implementation program called Project Follow Through. It evolved from the acronym for DISTAR (Direct Instruction System for Teaching Arithmetic and Reading). Project Follow Through involved 700,000 students in 170 communities across the United States and continued for more than a decade. Each school with an experimental implementation was matched with a "control" school within the same community that would not receive implementation. Twelve models of instruction were compared (one of which was Direct

Instruction). In 1977, results revealed that scores overwhelming favored DI in student achievement over other models and control schools (Gersten, 1985).

Basic Elements of Direct Instruction. DI has several dimensions (Kim & Axelrod, 2005). It has a clear systematic presentation of knowledge. The curriculum is organized around generalizable concepts and skills and is presented in specific sequence so that new knowledge is built upon the review, application, and mastery of older knowledge. The curriculum is "scripted." Teachers are given a script to follow. This ensures that the presentation is consistent, precise, and logical. DI also assists with the application of instructional strategies such as: student participation, positive reinforcement, pacing, and guided practice.

A typical DI lesson includes specific and carefully sequenced instruction provided by the teacher (model) along with frequent opportunities to practice their skills (independent practice) of time (review) (Marchand-Martella, Slocum & Martella, 2004). Each lesson takes approximately 30 to 45 minutes and typically involves 8 to 12 students grouped by ability actively responding to scripted teacher instruction. The teacher-directed prompts generate 3 to 20 responses a minute from each student and elicit choral responses.

Research on Direct Instruction. Mac Iver and Kemper (2002) summarized several studies that reanalyzed data from Project Follow Through and supported DI. Becker and Carnine (1980) found that students in DI schools outperformed students in other Follow-Through reform models on the Metropolitan Achievement Tests (MAT). By the end of third grade, after 4 years of DI students were also performing at approximately grade level in all areas except MAT reading (comprehension). Becker and Gersten (1982) analyzed 5^{th} and 6^{th} grade achievement effects for students from five different schools who all received 4 years of DI. They found significant results of DI on the Wide Range Achievement Test (WRAT) reading test. In a

different study, Meyer (1984) followed the Follow-Through DI students in New York City through high school to look at long-term academic effects. Compared to control groups, he found significantly more DI students graduated from high school, applied to college, and were accepted to college and significantly more control students were retained or dropped out of school. DI students also scored significantly higher on 9th grade reading and math tests.

Gersten, (1985) reviewed multiple studies evaluating the effectiveness of direct instruction curricula and teaching procedures for students with mild academic deficits to individuals with intellectual disabilities. Maggs and Morath (1976) studied the effects of Distar Language I on moderately to severely intellectually disabled children in state institutions. For this study, 28 students, ages 6 to 14 with Stanford-Binet IQs between 20 and 45, were randomly assigned to either a DI group or a comparison group. Results indicated that the treatment group scored significantly higher on the Stanford Binet following 2 years of instruction. The mean gain in "mental age" was: experimental group = 22 ½ months; control group = 7 ½ months. Loyd, Cullinan, Heins, and Epstein (1980) randomly assigned 23 learning disabled students in the intermediate grades into 1 of 3 classrooms. Two experimental classrooms used DI in reading to teach word attack and reading comprehension. Following 8 months of instruction results indicated significant differences between DI students and the comparison groups on WRAT Reading, the Gilmore Comprehension Index, and the Slosson Intelligence Test. Sein and Golman (1980) compared the effectiveness of two-phonics based program (Distar and Palo Alto) on 63 primary grade students between the ages of 6 and 8 who experienced reading difficulties. The IQs of the students involved were in the normal range (mean = 100.1). Post-tests on the Peabody Individual Achievement Test (PIAT) revealed a significant difference between Distar

and Palo Alto. The mean gain for Distar students equaled to 15 months for 9 months of instruction. The mean gain for Palo Alto students was approximately 7 months.

Nelson, Johnson, and Marchand-Martella (1996), studied the Effects of DI on the Classroom Behavior of students with behavioral disorders. They compared direct instruction, cooperative learning, and independent learning instructional approaches. Four student boys, ages 8 years 4 months to 9 years 10 months participated in the study. Each student met the criteria for behavior disorder (BD) in the state of Washington. The student's IQs ranged from 78 to 92. The two target variables measured were the percentages of on-task behavior and of disruptive behavior. Each student was exposed to each of three instructional conditions in an alternating treatment design in which the treatments were presented in random order. The students were in each experimental condition 6 times. Each lesson lasted approximately 30 minutes. Results indicated that students displayed higher rates of on-task behavior and lower rates of disruptive behavior during the DI instruction compared to the cooperative learning instruction and/or independent learning instruction.

DI is supported by research more than any other commercially available instruction program (Watkins & Slocum, 2004). It is an educational system that adjusts the curriculum and instruction to the student's performance level so that students are able to succeed (Kim & Axelrod, 2005).

2.2 READING COMPREHENSION STRATEGIES FOR INDIVIDUALS WITH AUTISM

There is little research in the area of reading strategies for individuals with ASD and only a few published studies investigating reading comprehension. Evidence from these studies indicates that individuals with ASD have strengths in decoding but difficulty with reading comprehension (Williamson, Carnahan, & Jacobs, 2012; Whalon, Al Otaiba, & Delano, 2009; Nation, Clarke, Wright & Williams 2008). If individuals with ASD can read text accurately, but do not know the meaning of key vocabulary, or cannot comprehend the concepts discussed, then reading comprehension skills will suffer (Whalon, Al Otaiba, & Delano, 2010; Whalon et. al, 2009).

2.2.1 Anaphoric Cueing and Reciprocal Questioning

Whalon, Al Otaiba, and Delano (2010) investigated evidence-based reading instruction for individuals with autism as defined by the National Reading Panel (NRP). During their review, eleven studies met the researcher's criteria, but only two studies focused on comprehension. O'Connor & Klein, 2004 looked at the effects of procedural facilitation on the reading comprehension of participants with ASD. To qualify for the study, participants scored high on word identification tasks and low on reading comprehension tasks. Participants were asked to read five stories in four conditions. Following each condition, the researcher administered a created test consisting of 12 items (e.g. free retell, identification of main idea, title generation, answering fact-based and inference questions). Results suggest that anaphoric cueing (the teacher teaches the child to identify words in the text that reference words previously used in the text) is a potential reading comprehension intervention.

Whalon and Hanline (2008) examined the effects of a reciprocal questioning intervention on the question generation and responding of children with autism spectrum disorder. Students with ASD were randomly assigned to one of three general education peers (n=9) from their mainstreamed class to work in cooperative pairs. Students were taught to generate and respond to wh- questions using a story grammar framework (i.e. setting, characters, events, problem, and solution) as they took turns reading a book aloud). Two out of the nine participants made gains. The levels of prompting and were similar among participants with ASD and their peers. In addition, both participants with ASD and their general education peers required more prompting.

2.2.2 Direct Instruction (DI)

Flores and Ganz (2007) studied the effects of a Direct Reading Instruction (DI) reading comprehension program (*Corrective Reading Comprehension A Thinking Basics* (Engelmann et. al., 2002)) with students with ASD. Specifically, they investigated the effect of DI on the reading skills of four children, two of whom had autism and reading comprehension deficits, using a single-subject multiple probe design. Results showed that all four students met criterion across the statement inferences, using facts, and analogies conditions. All students maintained their performance 1 month after instruction.

In a similar study, Flores and Ganz (2009) extended the research on the effects of a Direct Instruction (DI) program (*Corrective Reading Comprehension A Thinking Basics* (Engelmann et. al., 2002)) on the reading comprehension skills for three individuals with ASD. The researchers provided instruction using three stands of the program: picture analogies, deductions, and inductions. The results of the study again indicated a functional relationship between DI and reading comprehension.

Ganz and Flores (2009) also investigated the effects of *Language for Learning* (Engelmann & Osborn, 1999) on oral language skills for three individuals with ASD. The purpose of this study was to extend the research on the effectiveness of a DI language program on the oral language skills of elementary students with ASD, specifically the identification of materials of which objects were made. Three children with ASD were selected for this study based on their scores on a placement test for DI *Language for Learning* (Engelmann & Osborn, 1999). Instruction lasted approximately 20 minutes per day during regularly scheduled instructional time. Instructional procedures were implemented as specified in the teacher's guide. Results indicated a functional relationship between DI and the oral language skill of identifying the materials of which objects are made for all three students.

Flores, Nelson, Hinton, Franklin, Strozier, Terry, and Franklin (2013) looked at the efficacy of DI comprehension and language programs without modifications, using whole lessons for students with ASD. Eighteen students in grades one through seven participated in this study during an extended school year program. Eleven students tested into the *Corrective Reading Comprehension A Thinking Basics* (Engelmann et. al., 2002) (grades 2-7). Seven students placed in the *Language for Learning* (Engelmann & Osborn, 1999) program (grades 1-4). Performance was measured over time using curriculum-based assessments included by the program or developed based on the program. A one-way analysis of variance indicated that the students in the Corrective Reading group and the students in the Language for Learning group made significant growth in skills over time (η^2=.94 and η^2=.99). This study further demonstrates that students with ASD can benefit from DI to increase reading comprehension skills in an instructional group setting.

2.3 CLASSWIDE PEER TUTORING AND COOPERATIVE LEARNING GROUPS

Another strategy that has been found to increase reading fluency and reading comprehension in individuals with ASD and their peers is classwide peer tutoring (CWPT) (Kamps, Barbetta, Leonard, & Delquadri, 1994) and cooperative learning group (CLGs) (Kamps, Leonard, Potucek, & Garrion-Harrell, 1995). CWPT is a peer-mediated teaching strategy in which students work together in tutor-learner pairs on a classwide setting. It includes alternating tutor-learner roles, verbal and written practice of skills, praise and awarding points for correct responses, and announcing winning teams (Kamps, Barbetta, Leonard, & Delquadri, 1994). CLGs have similar goals to peer tutoring formats in that peers work together to complete projects and, worksheets and practice skills (Kamps, Leonard, Garrison-Harrell, 1995).

Kamps, Barbetta, Leonard and Delquadri (1994) measured the effects of classwide of a CWPT program on the reading skills of 3 high-functioning students with ASD and their typical peers in a general education classroom. The 3 male students were considered to be high functioning in intellect, language skills, and academic performance, but lacking in social skills. All students were trained for three 45-minute sessions on CWPT procedures (Greenwod, Delquadri, & Catta, 1988). Components of CWPT included reading of passages, feedback from peers for oral reading, correction of errors, and public posting. Results of reading assessments indicated that CWPT was an effective and efficient strategy for increasing the academic achievement and social interactions of students with ASD and their non-disabled peers. Specifically, CWPT increased reading fluency and correct responses to reading comprehension questions.

In a similar study, Kamps, Leonard, Potucek, and Garrison-Harrell (1995) examined the effects of CLGs in an inclusive format for three students with ASD and their general education

peers. One student with ASD was considered high functioning based on full scale IQ scores on the WISC-R while the other two were described to be functioning at the moderate level of academic performace based on full scale IQ scores on the WISC-III or WISC-R. Four students made up each CLG group and worked on peer group activities for 30 minutes of the 1 hour and 30 minute reading lesson. In the CLGs, students were assigned to complete three structured activities: (a) peer tutoring on vocabulary words; (b) practice on who, what, where, when, and why comprehension questions; (c) an academic game with four to five identified characters and related facts from the story. The results showed that supplemental CLGs were an effective strategy for engaging academic instruction, providing opportunities for student interaction, and for integrating students with disabilities into the general education setting.

2.4 PEER-ASSISTED LEARNING STRATEGIES (PALS)

One peer-mediated teaching strategy that has benefited many beginning readers (Fuchs, Fuchs, Thompson, Al-Otaiba, Yen, Yang, & O'Connor, 2001) and has improved reading comprehension skills is PALS. PALS is designed to help classroom teachers in Grades 2-6 accommodate the diverse instructional needs of children (Fuchs, Fuchs, Al Otaiba, Thompson, Yen, McMaster, Svenson, &Yang, 2001). PALS is a scientifically based, supplemental, class wide peer-tutoring program that involves pairing higher and lower performing readers to practice beginning reading skills. Research has shown that PALS can have a positive impact on the beginning reading skills of many children (Rafdal et al., 2011).

According to the PALS website http://kc.vanderbilt.edu/kennedy/pals, PALS is a scientifically based practice studied over the past 15 years. In these experimental studies

classrooms were assigned to PALS or No-PALS in classrooms that used the same curriculum. It was implemented 2 to 4 times per week during normal instructional time. Students were pre- and post-tested on well-known measures of reading to determine the amount of learning. Results showed that across four types of learners (students with learning disabilities, low-performing students without disabilities, average achievers, and high-achievers) reading achievement was significantly higher in PALS classrooms than No-PALS classrooms. As a result of this evidence, PALS was approved by the U.S. Department of Education's Effectiveness Panel for inclusion in the National Dissemination Network of effective educational practices for the use at the school, district, and state levels.

PALS was developed for students from preschool through sixth grade and high school. Every student in the classroom is paired with one student that is academically stronger. The students in a pair take turns as tutor and tutee while working on structured activities that address the difficulties each may be experiencing. As the students are working, the teacher is able to circulate the classroom, observe the students, and provide help as needed. PALS is designed to supplement a teacher's existing reading program. It takes only several 35-minute sessions per week. Third through sixth grade PALS focuses on the development of fluency as well as comprehension strategies with three activities: partner reading with retells, paragraph shrinking, and prediction relay. It is a reading comprehension strategy program based on a class wide peer-tutoring model and is typically used as a supplement to existing reading programs.

Research has shown that PALS can have a positive impact in the beginning reading skills of many children (Rafdal et al., 2011). Increases in reading fluency and comprehension in students with and without disabilities in grades K-5 was found. PALS significantly increased the reading comprehension skills of high school students with reading disabilities (Fuchs, Fuchs, &

Kazdan, 1999). PALS demonstrates a positive effect on increasing reading comprehension for students in kindergarten to 12th grade for students with reading disabilities.

Fuchs, Fuchs, Thompson, Al-Otaiba, Yen, Yang, and O'Connor (2001) looked at the effectiveness and feasibility of phonological awareness training, with and without a beginning decoding component. In addition, this study is an initial evaluation of PALS in kindergarten to explore the likelihood that students as young as 5 years can make meaningful use of peer-mediated strategies. Thirty-three teachers from four Title 1 and four non-Title 1 schools in Metro-Nashville Public School system participated in this study. The 33 teachers were assigned to one of three study groups within their schools by mean of stratified randomizations; control, phonological awareness training, and phonological awareness training with beginning decoding instruction and practice. PALS was conducted for 20 minutes three times per week for 16 weeks. Teachers attended a full-day workshop to discuss phonological awareness in terms of blending sounds into words, segmenting words into sounds, and rhyming words to hear similarities of sounds. The phonological awareness traning + PALS performed best on alphabetic measures. These findings suggest that teachers can teach Kindergarten children phonological awareness and that combining phonological awareness with decoding instruction and practice strengthens beginning reading performance more than phonological awareness alone.

Fuchs, Fuchs, Thompson, Al-Otaiba, Yen, Yang, O'Connor (2002) investigated whether phonological awareness (PA) training combined with beginning decoding instruction and practice is a more effective approach for special-needs populations than PA training alone. They studied two beginning reading programs; phonological awareness and phonological awareness with K-PALS. Pre- and post-test data were collected on 25 children with disabilities. Results

showed that students with disabilities who participated in PA plus kindergarten PALS (K-PALS) performed higher than the other students in the PA group on letter-sound recognition, and scored higher than both the PA group and control group on word attack. When examining the individual students' data other students with disabilities showed little or no gain on beginning reading skills. K-PALS may be effective for some, but not all students with disabilities.

As a result of previous research, Rafdal, McMaster, McConnell, Fuchs, and Fuchs (2011) conducted a large-scale multisite study to determine the effectiveness of K-PALS for students with disabilities. The researchers nvestigated 89 kindergartners with individualized education programs (IEPs) from 47 classrooms using a covariance on post-test measures. K-PALS was implemented four times per week for 18 weeks. Each session lasted 20-30 minutes. Results indicated that K-PALS was effective for increasing initial alphabetic principal and decoding skills for students with disabilities who were included in general education classrooms for classroom-based reading instruction. These results are consistent with previous findings, which have demonstrated K-PALS effectiveness for students in the general education population (Fuchs et al., 2001; Fuchs et al., 2008).

Sáenz, Fuchs, and Fuchs (2005) evaluated the effects of PALS on the reading performance of native Spanish-speaking students with learning disabilities and their low-, average-, and high-achieving classroom peers. One hundred thirty-two native Spanish-speaking students participated in the study. In order to be included, each classroom had to have an ELL student population and at least two students identified as having a learning disability. All students in each class participated. PALS was conducted during regularly scheduled reading instruction three times per week for 35 minutes sessions for 15 weeks. A one between-subjects and one within-subjects ANOVA was conducted for each Comprehensive Reading Assessment

Battery (CRAB)-score to evaluate the comparability of students in the two treatment conditions prior to the implementation of PALS. Strong results on reading comprehension were obtained for pre- to post-treatment. The effect sizes favored the PALS condition exceeded one standard deviation on CRAB questions answered correctly. PALS activities promoted high achievers' development. This occurred even though they were paired with lower achieving students to practice those strategic reading behaviors.

According to the Institute of Education Sciences (IES) of the U.S. Department of Education, "Scale-up evaluations determine whether or not an intervention is effective when it is implemented—across a variety of conditions—and provide an estimate of how robust the intervention is" (IES, 2010, p. 9). McMaster, Fuchs, Sáenz, Lemons, Kearns, Yen, Compton, and Fuchs (2010) examined the effects of PALS in student reading achievement across different student populations and types of schools. Three locations were selected: the original research site (Nashville, TN); a location with some history of using PALS (Minnesota); and a location that had very little or no history of using PALS (South Texas). After 18 weeks, K-PALS students outperformed controls on measures of phonemic awareness, regardless of site of level of support. The control students in this study were achieving at higher levels than control groups in earlier research (Stronger control). This may suggest that kindergarten reading instruction is generally stronger now than it was a decade ago which may be attributed to changes in kindergarten reading instruction that have occurred since the release of the National Reading Panel report (NICHD, 2000). As a result, researchers need to find ways to strengthen PALS so that it can withstand these types of changes.

In the second half of the study, teachers in grades 3-5 were randomly assigned to PALS or Control. All PALS teachers were told to implement "Top Down" PALS—use it exactly as

described. Teachers participated for two years. In the first year, teachers were randomly assigned to PALS or control. During the second year, teachers chose to implement either "Top Down" or "Bottom Up" PALS. Control teachers continued to serve as controls. The Bottom Up PALS teachers were asked to implement core elements of PALS that have strong research support. Results showed that Top Down and Bottom UP PALS students made reliably greater gains than controls. In addition, Bottom Up PALS students made reliably greater reading gains than Top Down PALS students. These results show that teachers should have some degree of flexibility and customizations of PALS to "fit" into their specific classroom needs.

Calhoon (2005) looked at the combined effects of the Linguistics Skills Training (LST) and PALS (Peer Assisted Learning Strategies) programs on the reading skill acquisition of middle school students with reading disabilities. Specifically, the researchers were interested in seeing if the combination of the peer mediated LST phonological skill and PALS comprehension programs result in significantly greater gains in reading comprehension, word recognition, and reading fluency scores rather than a whole-class remedial reading program. Thirty-eight special education students from two middle school participated in this study. Each student received language arts in a self contained classroom and was reading at least three grade levels below their current grade placement based on pretest scores on the Woodcock-Johnson Test of Achievement (WJ-III; Schrank, McGrew, & Woodcock, 2001). Lessons for the LTS portion of the program occurred three times per week while PALS was implemented twice per week. In contrast, the treatment group received reading instruction using a widely implemented remedial reading program, *Saxon Phonics Intervention* three times per week. Results showed the LST/PALS program was found to be an effective method for increasing letter-word identification, work attack, and passage comprehension in comparison to students in the contrast

group. These finding support other studies using PALS to teach reading comprehension skills to students with disabilities.

2.5 SUMMARY AND CONCLUSIONS

NCLB and IDEA (2004) mandate that students with disabilities (including students with ID and ASD) participate in the general education curriculum and receive effective instruction in order to make adequate yearly progress toward grade level standards (emphasis in reading and math). Although individuals with ID and ASD may demonstrate strengths in word recognition and decoding, comprehension skills are not well developed (Williamson, Carnahan, & Jacobs, 2012; Whalon, Al Otaiba, & Delano, 2009).

Research on reading by children with IDs was virtually nonexistent prior to the late 1960s (Conners, 1992). Traditionally, reading instruction for individuals with IDs typically focused on a list of specific sight words found in everyday life (Browder et al., 2009). However, evidence exists that students with moderate IDs can acquire phonics skills (Al Otaiba & Hosp, 2004; Barudin & Hourcade, 1990; Nietupski, Williams, & York, 1979 in Browder et al., 2006), but strategies for teaching comprehension to students with IDs are not well researched (Knight et al., 2010).

In addition, there is little research in the area of reading strategies for individuals with ASD and only a few published studies investigating reading comprehension. One strategy that has been found to increase reading fluency and reading comprehension in individuals with ASD and their peers is CWPT (Kamps, Barbetta, Leonard, & Delquadri, 1994) and CLGs (Kamps, Leonard, Potucek, & Garrion-Harrell, 1995). CWPT and CLGs is a peer-mediated teaching

strategy in which students work together in peer-tutoring pairs (Kamps, Barbetta, Leonard, & Delquadri, 1994). One peer-mediated CWPT program that has shown a positive impact on beginning reading skills (Rafdal et al., 2011) and can significantly increase the reading comprehension skills of students with disabilities (Fuchs, Fuchs, & Kazdan, 1999) is PALS. PALS is a scientifically based, supplemental, class wide peer-tutoring program that involves pairing higher and lower performing readers. However, the research indicates that PALS has been primarily implemented for English language learners or students with learning disabilities. Therefore, the purpose of this study is to investigate the effects of PALS on reading fluency and reading comprehension for students with ASD. The specific research question includes: What effects will PALS have on (1) reading comprehension as measured by scores on MAZE procedures (corrects versus incorrects) and (2) reading fluency of students with ASD?

3.0 METHODS

3.1 SETTING AND PARTICIPANTS

A public school district twenty miles east of Pittsburgh, Pennsylvania served as the setting for this study. This public school district was chosen due to the prevalence of students identified as having an ASD. Thirteen point eight percent (13.8%) of the school district's special education population is identified as having an ASD. This is 3.5% above the State average of 10.3% (Special Education Data Reporting, 2016). The study took place in a classroom within the student's school. Sessions occurred in the classroom during the grade-level's remediation period. Other students and teachers were present in the classroom, but did not interfere with the PALS instruction.

Following IRB approval, the experimenter sent an e-mail about the study to all special education teachers in grades 3-7 inviting them to an information session on the study (Appendix A). Special education teachers supported the experimenter in recruiting appropriate students. Once appropriate students were identified, a letter was sent to the families of the appropriate students from both the special education teacher and the experimenter (Appendix B and C). Procedures to gather informed consent followed University Institutional Review Board (IRB) procedures once approved (Appendix D).

Participants in this study were three dyads of third and seventh grade students, half of whom were diagnosed with ASD and half of who were neurotypical peers. The students with an ASD diagnosis were defined as such by IDEA and received part of their academic instruction (e.g., Direct Instruction reading, Direct Instruction math, functional writing, and social skills instruction) in a life skills/autistic support classroom. Each student had literacy goals in in their Individualized Education Program and participated in the Pennsylvania Alternate System of Assessment (PASA). In addition, all students were (a) a native speaker of English, (b) free from severe behavior or attention problems prohibiting participation in three 35-40 minute sessions per week, (c) able to communicate through oral speech, and (d) not read above grade level.

The participants defined above were partnered with a neurotypical peer for all sessions throughout the study. The peer partners attended the same local public school as his/her partner with ASD and were in the same grade. The peer partners did not have a diagnosed disability and successfully participated in instruction at grade level. In addition, all peer partners were (a) a native speaker of English, and (b) free from severe behavior or attention problems prohibiting participation in three 35-40 minute sessions per week. PALS also require that students change partners in the dyads every few weeks, which could add an uncontrolled variable in the research design. Therefore, the peer partners remained with the same partner throughout this study as indicated by previous research.

3.1.1 Screening Assessment

Prior to the start of the study, eligible students participated in a brief screening assessment to determine the student's reading level. In order to determine the student's reading level for the DORF and DAZE measures, the experimenter followed the procedures outlined in *Using CBM*

for Progress Monitoring in Reading (Fuchs & Fuchs, 2008). First, the experimenter determined the grade level at which the student was expected to read proficiently by the end of the school year. Then, three reading fluency passages were administered at this level. If the student read between 10 and 50 correct words in 1 minute but with less than 85-90% accuracy, the student was moved to the next lower grade level text and read 3 passages. If the student read more than 50 words correct per minute with 90% or higher accuracy, then the student was moved to the highest level of text in which he/she read between 10 and 50 words correct per minute (but not higher than the student's grade level). Once the grade level was obtained, students were given three reading comprehension measures. The median score of the three passages was recorded. Using the median score from three passages gives the best indicator of student performance over a range of different text and content (Dynamic Measurement Group, 2011). Students were excluded from the study if the median score was above fifty-percent accuracy.

3.1.2 Teacher training

Before the implementation of the study, the teacher(s) attended a 1-day workshop that provided explicit training on PALS and a 1-day workshop that provided explicit training on DIBELS Next. At the trainings, the teachers were given an overview of PALS and DIBELS Next and the opportunity to practice the activities to gain a better understanding of the programs. Teachers were given comprehensive, detailed manuals that contained scripted activities to be used when conducting PALS and DIBELS Next (Fuchs, Fuchs, Simmons, & Mathes, 2008; Dynamic Measurement Group, 2011).

3.1.3 Student training

The manual provided to the teachers at the teacher training contained all of the information needed to implement PALS correctly. The teachers trained students by using twelve scripted lessons from the manual (three lessons per week for four weeks). Each lesson taught the students a specific procedure (partner reading, retell, paragraph shrinking, and prediction relay) or skill and allowed the students to role-play. After the fourth week, the teacher conducted a mini-lesson to provide the students a quick review of PALS activities that were taught during the past four weeks. A mini-lesson was also provided the day prior to a dyad entering the intervention. The students received a folder containing question cards, correction cards and point sheets to assist them with checking for understanding, providing corrective feedback and monitoring progress (Appendix E-G). The experimenter was available during each day of training to provide assistance to the teacher if necessary.

3.2 MATERIALS

The study used *Peer Assisted Learning Strategies Reading Methods for Grades 2-6*, created by Fuchs, Fuchs, Simmons, and Mathes, 2008 and modified *DIBELS Next* (Dynamic Measurement Group, 2011) procedures. Teachers were trained in both programs prior to the start of the intervention. Additional reading passages were obtained at https://dibels.uoregon.edu/, http://www.readworks.org, and http://www.readnaturally.com. An oral reading fluency passage generator and maze passage generator found at www.interventioncentral.org were used to create oral reading fluency passages and maze comprehension tasks. Flesch–Kincaid readability

procedures (Kincaid, Fishburne, Rogers, & Chissom, 1975) were used to confirm grade levels of each passage prior to inclusion. The types of reading materials selected were based on the weaker reader's ability and included fiction and/or non-fiction books. Reading fluency rates and errors were recorded using the Standard Celeration Chart representing individual student performance. Video cameras, tripod, basal texts, novels, library books, and content area books were also used.

3.3 DEPENDENT VARIABLES

Reading comprehension and reading fluency are the two dependent variables that the experimenter investigated. The first dependent variable, reading comprehension, was measured by the DAZE, or the DIBELS maze comprehension task. According to the DIBELS Next Assessment Manual (2011), the DAZE, or the DIBELS maze comprehension task, is a measure of reading comprehension. It can be given to a whole class at the same time, to a small group of students, or to individual students. Students are given three minutes to read a passage silently. The first sentence in the paragraph is unchanged. Starting with the second paragraph, approximately every seventh word is blank, with a maze of options (i.e., three possible word choices for the blank). For each multiple-choice box, two distractor words are randomly selected from the pool of words that appeared within the passage. One of the words in the maze is always correct, and the other two are incorrect. The student receives credit for selecting the words that best fit the omitted words in the reading passage. The score is the number of correct words circled minus half of the number of incorrect words circled.

For this study, the researcher used a modified DAZE procedure. Rather than giving students a 300-word passage and three minutes to read the passage silently, students were given a 100-word passage to read silently and the ability to read the entire passage. The amount of time it took the student to read the passage was recorded as well as the *number of correct words* circled and *incorrect words* circled. The student was instructed to stop if more than thirty second passed between words circled.

Dynamic Indicators of Basic Early Literacy Skills Next Oral Reading Fluency (DORF) measured the second dependent variable, reading fluency. The DORF individually measures the accuracy of reading fluency with connected text. The DORF passages and procedures were based on the program of research and development of Curriculum-Based Measurement of reading by Stan Deno and colleagues at the University of Minnesota (Deno, 1985). For the DORF measure, students are given an unfamiliar, grade-level passage of text and asked to read for 1 minute. Students receive 1 point for each word read correctly in 1 minute. Inserted words are not counted. To be counted as correct, words must be read as whole words and pronounced correctly for the context of the sentence. Errors are counted as incorrect. Errors include words read incorrectly, substitutions, skipped words, hesitations of more than 3 seconds, words read out of order, and words that are sounded out but not read as a whole word.

3.4 INDEPENDENT VARIABLE

The independent variable used throughout the study was *Peer Assisted Learning Strategies Reading Methods for Grades 2-6,* created by Fuchs, Fuchs, Simmons, and Mathes, 2008. PALS uses peer-mediated instruction, a process in which students work in pairs to provide tutoring in

four reading strategies: partner reading, retelling, paragraph shrinking, and prediction relay. In addition to being trained in each of the reading strategies, students are taught to correct their partner's reading errors, award points for correct responses, and provide consistent encouragement and feedback.

3.4.1.1 Activity 1: Partner reading

During Partner reading, the "First Reader," reads for 5 minutes. The lower reader, called the "Second Reader," coaches or monitors the First Reader. As the Coach, the Second Reader marks 1 point on the Point Sheet for every sentence the First Reader reads correctly. If the First Reader makes an error, the Second reader uses a "correction procedure" to help the reader correct the mistake. After 5 minutes, the students switch roles. The Second Reader reads for 5 minutes while the First Reader coaches, marks points and corrects errors.

3.4.1.2 Activity 2: Retell

For 2 minutes, the Second Reader retells all of the events that occurred in the text that the pair read during Partner Reading. The First Reader prompts the Second Reader using the Question Card (see Appendix E) prompts and corrects the Second Reader if he/she produces an incorrect response. Together, both partners determine how many points, up to 10, they deserve for their effort.

3.4.1.3 Activity 3: Paragraph shrinking

For 5 minutes, the First Reader reads approximately 1 paragraph at a time. The Second reader prompts the First Reader to help make a main idea statement about each paragraph. This procedure continues until time expires. If the First Reader makes a mistake, the Second Reader

uses the correction procedure on the Correction Card (see Appendix F). The Second Reader marks points for correct answers to the prompts. After 5 minutes, the students switch roles. The Second Reader reads and responds to prompts while the First Reader coaches.

3.4.1.4 Activity 4: Prediction Relay

During Prediction Relay, the Second Reader prompts the First Reader to make a prediction, read half a page, and check to see if the prediction comes true. This process is repeated for 5 minutes. The Second Reader marks points for correct answers to the prompt. After 5 minutes, the students switch roles. The Second Reader reads and responds to prompts while the First Reader coaches and records points.

3.4.1.5 Points

During PALS, students have the opportunity to earn points (see Appendix G). The amount of points a team can earn is directly associated with each PALS activity. On the last day of PALS each week, the teacher tallies the points for each team and name the weekly winner. The "Second Place" team stands and receives applause. The winning team stands, receives applause, and takes a bow.

3.5 EXPERIMENTAL DESIGN

A single-subject multiple baseline design across participants (Kennedy, 2005) was selected for this study since it sequentially introduces the independent variable across several individuals (or group of individuals) who exhibit behaviors that are similar and occur under similar conditions.

The dependent variables are words read correctly per minute and number of comprehension questions answered correctly. The PALS intervention consisted of four activities: (1) partner reading; (2) retell; (3) paragraph shrinking; and (4) predication relay. Baseline data was collected on all students. The dependent variable of reading comprehension and the Standard Celeration Chart was used to determine steady state and when it is appropriate to move out of baseline. After a minimum of six data points, students entered into the intervention when a student displayed: (1) a stable or decelerating trend of comprehension questions answered correctly; (2) a stable or accelerating trend of comprehension questions answered incorrectly; or (3) a decelerating trend of comprehension questions answered correctly and accelerating trend of comprehension questions answered incorrectly.

3.5.1 Baseline

Baseline data was collected on all students. Baseline data collection involved administering the DORF and DAZE measures. The students remained in baseline for at least six data points. Once six stable baseline data points were collected, one dyad was selected at random to begin the PALS intervention. The next dyad entered the intervention when the dyad directly ahead in intervention reached steady state responding. The dependent variable of reading comprehension was used to determine steady state and when it was appropriate to move out of baseline. This process continued in this manner for the remaining dyads for a staggered effect. Baseline comprehension probes and oral reading fluency probes in the absence of the intervention were collected on all students one time per week.

3.6 PROCEDURES

3.6.1 General Sessions

Each student was placed in a dyad, with one student identified as having ASD and one neurotypical peer in each dyad (i.e., 3 dyads). PALS was conducted during the grade-level's remediation period three times (6-8 weeks; 18 total sessions) a week for 35-40 minutes. Students were paired so that high-achieving students were paired with average-achieving students and average achieving students were paired with low-achieving students. Pairs read books appropriate for the lower reader's level. Within each pair, during each lesson, both students served the role of tutor and tutee. Pairs conducted 4 activities that are designed to promote reading fluency and comprehension. Pairs earned points that go toward a team total. At the end of each week, teams' PALS points were totaled.

The oral reading fluency probes and reading comprehension tasks were collected three times per week using the DORF and DAZE measures. These measures occurred at an earlier time on the same days as the intervention. The order of these two measures were counterbalanced.

3.6.2 Inter-observer agreement and procedural integrity

Since each session was video recorded, the experimenter reviewed each video to determine the accuracy of the student's reading comprehension and reading fluency probes. A second observer provided inter-observer agreement (IOA) and procedural integrity (PI). To validate the reading comprehension and reading fluency probes, the observer scored 20% of the probes from the

video sessions. IOA for each observation was calculated using the total agreement approach for both correct and incorrect words (Kennedy, 2005). To calculate total agreements, the larger amount of words read correctly or incorrectly was divided by the smaller amount of words read correctly or incorrectly. Average total agreement for reading comprehension measured 99% (range 93%-100%). Average total agreement for reading fluency measured 99% (range 86-100%).

The same observer that provided IOA performed PI on 20% of the sessions. To calculate PI, the observer reviewed the video sessions and completed an observable checklist to verify the specific steps of PALS. An observable checklist comprising of 25 teacher behaviors and 84 student behaviors was taken from Fuchs and Fuchs (2006) found at http://www.rtinetwork.org/getstarted/evaluate/treatment-integrity-protocols (Appendix H). The checklist items were scored as either behavior observed, behavior not observed, or not applicable. Each observation yielded three scores: teacher score, student score for each of the three reading activities; partner reading (including retell), paragraph shrinking, and prediction relay and an overall total score. The teacher and student behaviors for each observation were calculated by dividing the total number of observed behaviors by the total number of expected behaviors, yielding a mean accuracy score. The average procedural integrity came to 84% (range 48% -93%).

4.0 RESULTS

4.1 STANDARD CELERATION CHARTS

Standard celeration charts (SCC) were used to display all data for the three participants. Using the SCCs provides two important advantages to teachers and researchers. First, behavior grows by multiplying, not by adding. Secondly, the chart not only shows the frequency of a person's performance, but also at the growth of learning across time (i.e. the celeration) (Calkin, 2005). In addition, a SCC can display multiple behaviors (e.g. corrects and incorrects per minute) on the same graph and allow rate of change comparisons via multiple celerations (Kostewicz & Kubina, 2011).

Analysis of the data occurred within and between conditions. Within conditions measures included celeration, level, and Improvement Index (I.I.). Celeration is "a dimensional quantity that describes change in the frequency of responding over time" (Johnson & Pennypacker, 2009 p. 106). It is found by dividing frequency by time. Level is the average rate of responding within a condition (Gast, 2009). To calculate I.I., two celerations from the same condition must be used. When two celerations values have the same trends or signs, both accelerating (i.e. x) or decelerating (i.e. ÷), take the larger celeration value and divide by the smaller value (Pennypacker, Gutierrez, & Lindsley, 2003). For example, a celeration value of x2 for corrects and a celeration value of x4 for incorrects equals x2 I.I.; x4 would be divided by x2

= x2. In contrast, if the celeration values have different trends or signs, one accelerating (i.e. x) and the other decelerating (i.e. ÷), multiple the two values together and use the sign of change (Datchuk & Kubina, 2011). For example, a celeration value of x2 for corrects and a celeration value of ÷2 for incorrects equals ÷4 I.I.; x2 would be multiplied by ÷2 = ÷4. A multiplication sign (x) or division sign (÷) indicates an accelerating or decelerating change in slope relative to the prior celeration (Pennypacker et al., 2003).

Between conditions measures included celeration multiplier (celeration turn), level change, and Improvement Index Change. The celeration multiplier is the degree of change between celeration values (Datchuk & Kubina, 2011) as the result of intervention. It follows the same formula as the Improvement Index. Level change compares the level at baseline to the level at intervention and is found by dividing the larger number by the smaller number and using the sign of change. The Improvement Index Change is found by comparing the I.I. at baseline to the I.I. at intervention and uses the same formula as the I.I. and the celeration multiplier.

4.2 READING COMPREHENSION

Figure 1 display the maze scores for Nathan, Derek, and George. Solid black dots represent the number of correct words selected in each maze passage and the x's represent the number of incorrect words selected for each maze passage. The solid horizontal bars (i.e. time bar) represent the amount of time it took the student to complete the maze passage and the dashed line on the chart represents the start of the intervention. The horizontal axis displays units of time (i.e., calendar days, weeks, months, of years) whereas the vertical axis displays behavior frequencies (i.e., 1 per day up to 1000 per minute) (Datchuk & Kubnia, 2011). The celeration

lines lie on specific data paths and represent either accelerating (x) or decelerating (÷). Acceleration (x or multiply sign) indicates an increase in the learning of the behavior. Deceleration (÷ or divide sign) indicates a decrease in the learning of the behavior (Calkin, 2005; Kostewicz & Kubina, 2011). For example, a behavior that has a x2.00 celeration means that the frequency of the behavior doubled in a week. However, a celeration of ÷2.00 means that the frequency of the behavior reduced by half.

4.2.1 Baseline

The level in baseline refers to the average correct and incorrect words selected in response to a maze passage. Due to statistical advantages, the experimenter chose to use the geometric mean to calculate level (Clark-Clark, 2005). All three participants (Nathan, Derek, and George) had higher levels of corrects (3, 3, and 4) than incorrects (2, 0.35, and 2) in baseline (Table 1). The celeration measure described the change in frequency of the dependent measure over time. Corrects accelerated by x1.12 (Nathan) and x1.02 (Derek) but decelerated ÷1.01 for George. Incorrects accelerated by x1.36 and x1.26 for Nathan and Derek while George showed a deceleration of ÷1.03 (Figure 1). Comparisons of the corrects and incorrects baseline celerations (i.e. I.I.) for each participant calculated progress. Nathan (÷1.21) and Derek (÷1.24) showed a deterioration of progress whereas George (x1.02) showed an improvement in progress.

4.2.2 Intervention

Maze passage scores changed after entering intervention. Figure 1 shows Nathan (÷1.03) and Derek (÷1.02) produced decelerating corrects and George (x1.05) produced accelerating corrects.

Incorrects accelerated by x1.05, x1.11, and x1.00 for Nathan, Derek, and George. I.I. scores for Nathan (÷1.08) and Derek (÷1.13) showed decaying progress whereas George (x1.05) showed improving progress. In addition, corrects for Nathan (3.5), Derek (4), and George (7) remained at higher levels than incorrects (3, 0.7, 3; Table 1).

Between conditions measures (i.e. level change, celeration multiplier and I.I. change) showed positive effects of the intervention on response to maze passages. Level represents the average rate of responding within a condition. Nathan had a x1.17 correct level change meaning his average corrects increased by 17% (Table 1). Derek and George's average correct responding rose by x1.33 and x1.75 respectfully. Similarly, average incorrect performance increased for all three participants (Nathan, x1.50, Derek x2.00, George x1.50).

Celeration multiplier is the degree of change between baseline and intervention celerations of both correct and incorrect responses to maze passages. The resulting value establishes speed change. Correct and incorrect responses to maze passages from baseline to intervention slowed for Nathan and Derek whereas correct and incorrect responses to maze passages quickened for George. Corrects for Nathan (÷1.15) and Derek (÷1.04) ranged in speed decreases from 13% to 4%. Incorrects for Nathan (÷1.29) and Derek (÷1.14) ranged in speed decreases from 22% to 12%. Corrects for George (x1.06) increased by 6% as well as incorrects (x1.03) by 3%.

I.I. change, the final measure, provides a numerical value for the change in progress between baseline and intervention. Nathan, Derek and George had the following I.I. change values: x1.12, x1.10, and x1.03. These results indicate that the three students improved their reading comprehension skills by 12% (Nathan), 10% (Derek), and 3% (George) respectfully.

Figure 1. Reading Comprehension

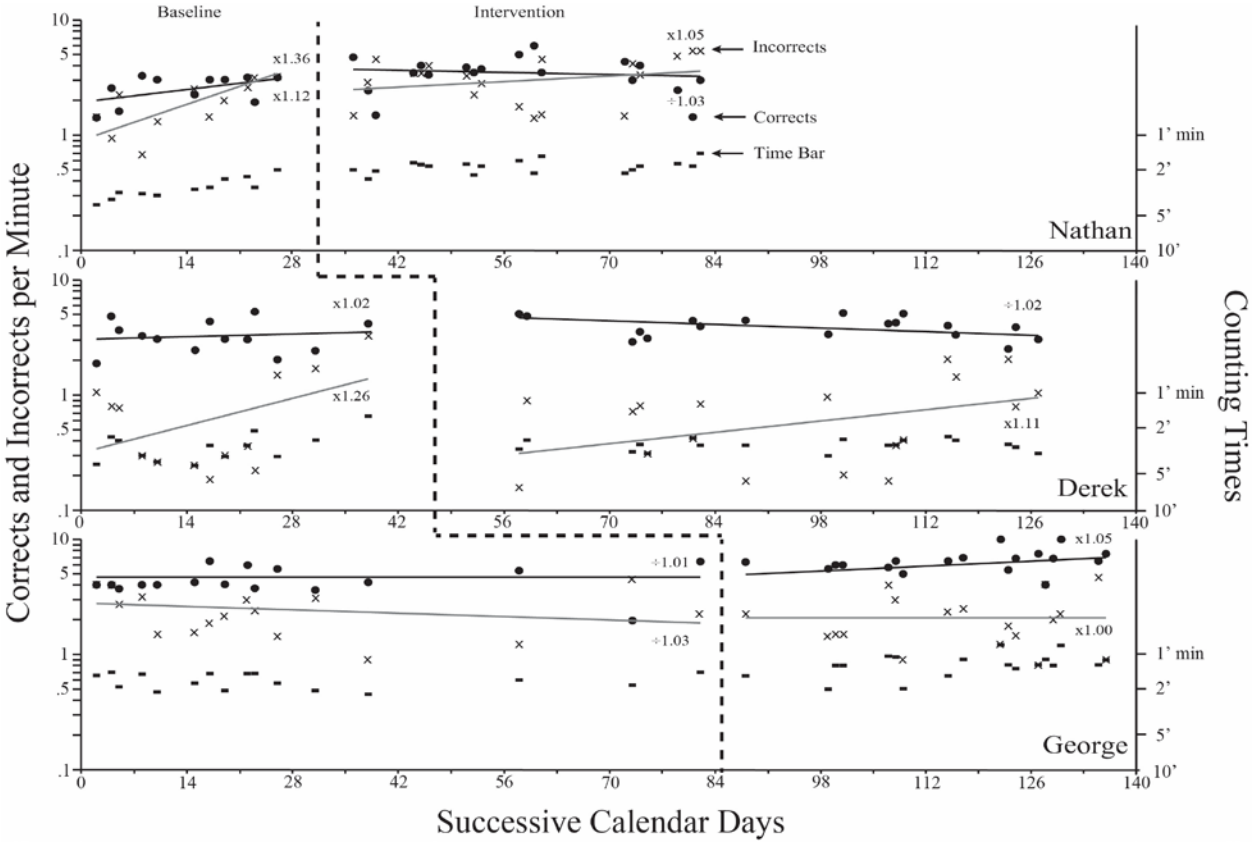


Table 1. Reading Comprehension

	Behavior	*Baseline*			*Intervention*			*Change*		
Name		*Cel*	*L*	*II*	*Cel*	*L*	*II*	*CM*	*LC*	*IIC*
Nathan	C	x1.12	3	÷1.21	÷1.03	3.5	÷1.08	÷1.15	x1.17	x1.12
	I	x1.36	2		x1.05	3		÷1.29	x1.50	
Derek	C	x1.02	3	÷1.24	÷1.02	4	÷1.13	÷1.04	x1.33	x1.10
	I	x1.26	0.35		x1.11	0.70		÷1.14	x2.00	
George	C	÷1.01	4	x1.02	x1.05	7	x1.05	x1.06	x1.75	x1.03
	I	÷1.03	2		x1.00	3		x1.03	x1.50	

Note: C=Corrects, I=Incorrects, Cel=Celeration, L=Level, II=Improvement Index, CM=Celeration Multiplier, LC=Level Change, IIC=Improvement Index Change

4.3 READING FLUENCY

Figure 2 display the reading fluency scores for Nathan, Derek, and George. Solid black dots represent the number of correct words read per minute and the x's represent the number of incorrect words read per minute for each passage. The dashed line on the chart represents the start of the intervention. The horizontal axis displays units of time (i.e., calendar days, weeks, months, of years) whereas the vertical axis displays behavior frequencies (i.e., 1 per day up to 1000 per minute) (Datchuk & Kubnia, 2011). Again, the celeration lines lie on specific data paths and represent either accelerating (x) or decelerating (÷). Acceleration (x or multiply sign) indicates an increase in the learning of the behavior. Deceleration (÷ or divide sign) indicates a decrease in the learning of the behavior (Calkin, 2005; Kostewicz & Kubina, 2011). For example, a behavior that has a x2.00 celeration means that the frequency of the behavior doubled

in a week. However, a celeration of ÷2.00 means that the frequency of the behavior reduced by half.

4.3.1 Baseline

The level in baseline refers to the average correct and incorrect words read in 1 minute. Similar to reading comprehension, the experimenter chose to use the geometric mean to calculate level (Clark-Clark, 2005). All three participants (Nathan, Derek, and George) had higher levels of corrects (56.5, 57, and 83.5) than incorrects (8, 3, and 5) in baseline (Table 2). The celeration measure described the change in frequency of the dependent measure over time. Corrects accelerated by x1.03 (Derek) and x1.00 (George) but decelerated ÷1.04 for Nathan. Incorrects accelerated by x1.05 for George whereas Nathan and Derek showed a deceleration of ÷1.01 and ÷1.19 (Figure 2). Comparisons of the corrects and incorrects baseline celerations (i.e. I.I.) for each participant calculated progress. Nathan (÷1.03), Derek (÷1.23), and George (÷1.05) all showed a deterioration of progress.

4.3.2 Intervention

Reading fluency scores changed after entering intervention. Figure 2 shows Derek (÷1.03) and George (÷1.05) produced decelerating corrects and Nathan (x1.03) produced accelerating corrects. Incorrects accelerated by x1.06 and x1.05 for Derek and George but decelerated ÷1.05 for Nathan. As a result, I.I. scores for Derek (÷1.09) and George (÷1.10) showed decaying progress whereas Nathan (x1.08) showed improving progress. In addition, words read correct

for Nathan (66.5), Derek (65), and George (80) remained at higher levels than incorrects (15, 5, 4; Table 2).

Between conditions measures (i.e. level change, celeration multiplier and I.I. change) showed positive effects of the intervention on reading fluency for two out of the three students. Level represents the average rate of responding within a condition. Nathan and Derek had x1.18 and x1.14 correct level change meaning their average corrects increased by 18% and 14% (Table 2). However, George had a ÷1.04 correct level change meaning his average corrects decreased by 4%. Similarly, Nathan and Derek's average incorrect responding rose by x1.88 and x1.67 whereas George's decreased by ÷1.25.

Celeration multiplier is the degree of change between baseline and intervention celerations of both correct and incorrect responses to maze passages. The resulting value establishes speed change. For Nathan, correct words per minute increased (x1.07) by 7% and incorrects decreased (÷1.04) by 4%. Corrects slowed for Derek (÷1.06) and George (÷1.05). However, incorrects quickened (x1.26) for Derek whereas incorrects slowed (÷1.01) for George.

I.I. change, the final measure, provides a numerical value for the change in progress between baseline and intervention. Nathan, Derek and George had the following I.I. change values: x1.11, x1.13, and ÷1.05. These results indicate that two of the three students improved their reading fluency skills by 11% (Nathan) and 13% (Derek). George's reading fluency skills worsened by 5%

Figure 2. Reading Fluency

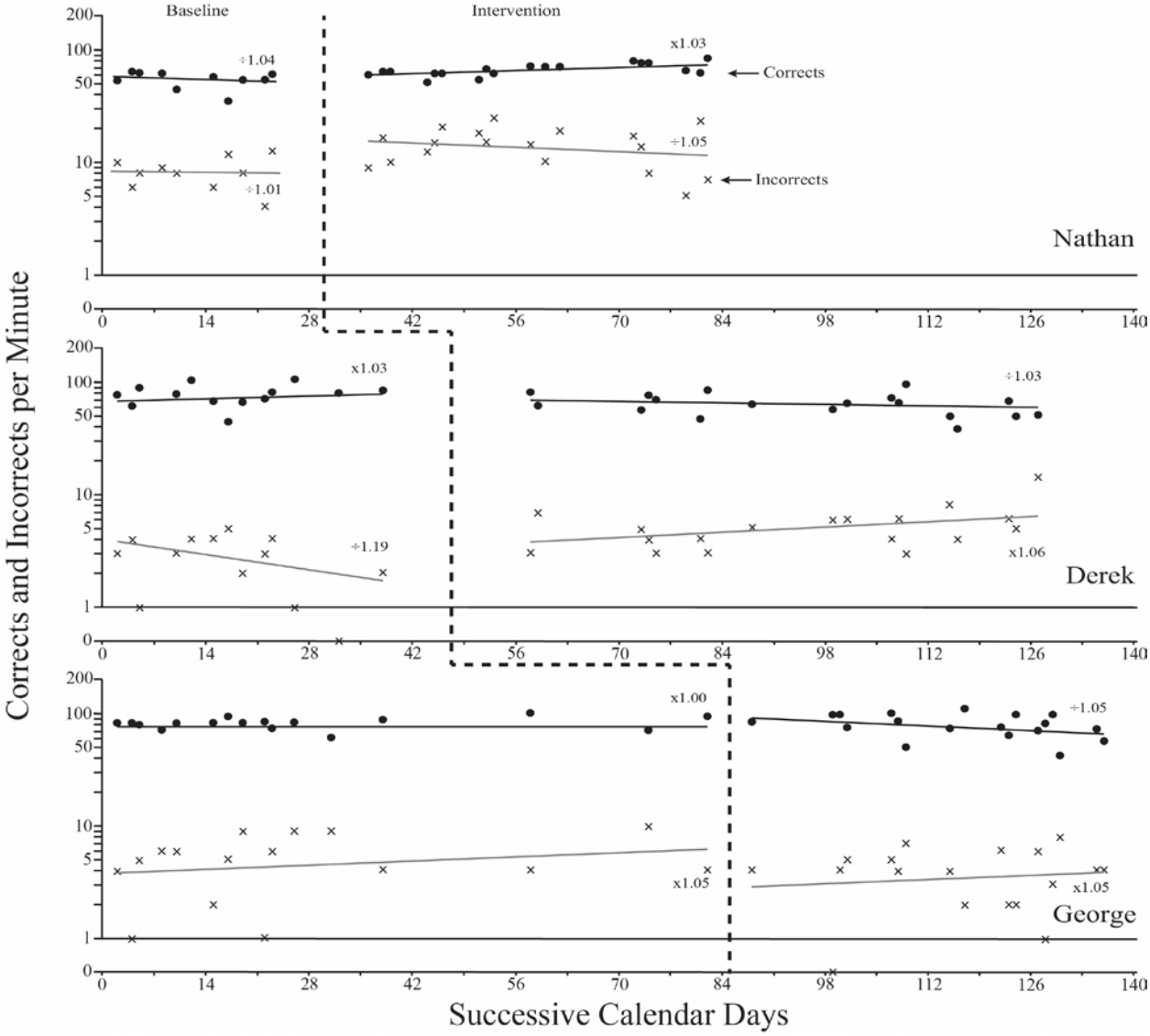


Table 2. Reading Fluency

Name	*Behavior*	*Baseline*			*Intervention*			*Change*		
		Cel	*L*	*II*	*Cel*	*L*	*II*	*CM*	*LC*	*IIC*
Nathan	C	÷1.04	56.5	÷1.03	x1.03	66.5	x1.08	x1.07	x1.18	x1.11
	I	÷1.01	8		÷1.05	15		÷1.04	x1.88	
Derek	C	x1.03	57	÷1.23	÷1.03	65	÷1.09	÷1.06	x1.14	x1.13
	I	÷1.19	3		x1.06	5		x1.26	x1.67	
George	C	x1.00	83.5	÷1.05	÷1.05	80	÷1.10	÷1.05	÷1.04	÷1.05
	I	x1.05	5		x1.05	4		÷1.01	÷1.25	

Note: C=Corrects, I=Incorrects, Cel=Celeration, L=Level, II=Improvement Index, CM=Celeration Multiplier, LC=Level Change, IIC=Improvement Index Change

5.0 DISCUSSION

Although individuals with ASD may demonstrate strengths in word recognition and decoding, comprehension skills are not well developed (Williamson, Carnahan, & Jacobs, 2012; Whalon, Al Otaiba, & Delano, 2009). In order for students with ASD to increase comprehension skills and make adequate yearly progress toward grade level standards, teachers need to use effective reading strategies such as PALS (Fuchs et al., 2001; Fuchs et al., 2002; Rafdal et al., 2011; Sáenz et al., 2005). While PALS has been approved by the U.S. Department of Education's Effectiveness Panel for inclusion in the National Dissemination Network of effective educational practices for the use at the school, district, and state levels, the majority of the specialized research over the past 15 years has been primarily been for general education students. With that being said, in recent years a small number of studies on PALS have started to expand their focus to include specialized populations such as English language learners or students with disabilities. Despite this growing literature base, researchers have limited their focus on students with many types of disabilities, PALS versus no PALS, pre- to post-treatment, larger sample sizes, the use of PALS with a supplemental program, or studies that have been conducted for longer periods of time.

For example, Sáenz, Fuchs, and Fuchs (2005) evaluated the effects of PALS on the reading performance of one hundred thirty-two native Spanish-speaking students with learning

disabilities for 15 weeks. Strong results on reading comprehension were obtained for pre- to post-treatment.

Calhoon (2005) looked at the combined effects of the Linguistics Skills Training (LST) and PALS (Peer Assisted Learning Strategies) programs on the reading skill acquisition of thirty-eight middle school students with reading disabilities for thirty-one weeks. Specifically, the researchers were interested in seeing if the combination of the peer mediated LST phonological skill and PALS comprehension programs result in significantly greater gains in reading comprehension, word recognition, and reading fluency scores rather than a whole-class remedial reading program. Results showed the LST/PALS program was found to be an effective method for increasing letter-word identification, work attack, and passage comprehension in comparison to students in the contrast group.

Rafdal, McMaster, McConnell, Fuchs, and Fuchs (2011) conducted a large-scale multisite study to determine the effectiveness of K-PALS for students with disabilities. The researchers investigated 89 kindergartners with individualized education programs (IEPs) from 47 classrooms using post-test measures for 18 weeks. Results indicated that K-PALS was effective for increasing initial alphabetic principal and decoding skills for students with disabilities who were included in general education classrooms for classroom-based reading instruction.

Despite the success of these studies, questions remain regarding the effects of PALS on reading comprehension and reading fluency for students with ASD. As a result, a single-case design could shed further light on students' individual responses to PALS. Therefore, the purpose of this study was to investigate the effects of PALS on reading comprehension and reading fluency for students with ASD. The specific research question included: What effects

will PALS have on (1) reading comprehension as measured by scores on MAZE procedures (corrects versus incorrects) and (2) reading fluency of students with ASD?

5.1.1 Question 1: What effects will PALS have on reading comprehension as measured by scores on MAZE procedures (corrects versus incorrects) of students with ASD?

When considering the effects of PALS on reading comprehension, George was the only student that showed an accelerating celeration for correct responses on maze passages following the intervention (x1.05). While George showed improvements during the intervention, his celeration change also improved (x1.06). Improving celeration changes from baseline to intervention shows the intervention had a positive effect changing the course of learning (Kostewicz & Kubina, 2011). Unfortunately, Nathan and Derek did not show improving celeration changes for correct responses, ÷1.15 and ÷1.04.

Incorrect responses did not decelerate for every student. In fact, all three students (Nathan, Derek, and George) showed accelerations (x1.36 to x1.05, x1.26 to x1.11, and ÷1.03 to x1.00) for incorrect responses. However, when looking at celeration changes from baseline to intervention for incorrect responses, Nathan and Derek did demonstrate decelerations for incorrect responses (÷1.29 and ÷1.14) whereas George showed acceleration for incorrect responses (x1.03).

Although George was the only student that showed improving celeration changes from baseline to intervention for corrects responses, Nathan and Derek showed decelerations from baseline to intervention for incorrect responses. As a result, when comparing the celeration changes between baseline and intervention all three students showed accelerations (Nathan, x1.12, Derek, x1.10, and George, x1.03).

5.1.2 Question 2: What effects will PALS have on reading fluency of students with ASD?

In regard to the effect of PALS on reading fluency, Nathan was the only student that showed an accelerating celeration in the number of correct words read per minute following the intervention (x1.03). Additionally, his celeration change also improved (x1.07). Unfortunately, Derek and George did not show an accelerating celeration in the number of correct words read per minute following the intervention (÷1.23 and ÷1.05) or improving celeration changes (÷1.06 and ÷1.05).

Incorrect responses decelerated for Nathan following the intervention (÷1.01 to ÷1.05), whereas Derek showed acceleration (÷1.19 to x1.06) and George maintained (x1.05 to x1.05) in the number of words read incorrectly per minute. When looking at celeration changes from baseline to intervention for the number of incorrect words read per minute, Nathan and George showed decelerations for incorrect responses (÷1.04 and ÷1.01). Derek showed acceleration for the number of words read incorrectly per minute (x1.26).

Although Nathan was the only student that showed improving celeration changes from baseline to intervention in the number of correct words read per minute and decaying celeration changes from baseline to intervention in the number of incorrect words read per minute, George showed a deceleration from baseline to intervention for the number of incorrect words read per minute. When comparing the celeration changes between baseline and intervention, Derek showed accelerations (x1.13).

These findings are important for multiple reasons. First, the findings are consistent with previous research, which has demonstrated PALS effectiveness for students with disabilities (e.g., Fuchs, Fuchs, & Kazdan, 1999, Fuchs et al., 2002, Rafdal et al., 2011, Sáenz, Fuchs, and Fuchs, 2005, Calhoon, 2005). Second, the study validates the use of PALS with an additional population. Previously, no PALS study had examined the effects of PALS for students with

ASD. More specifically, the current study examined the effects of PALS for students with ASD that received part of their academic instruction (e.g., Direct Instruction reading, Direct Instruction math, functional writing, and social skills instruction) in a life skills/autistic support classroom, had literacy goals in in their Individualized Education Program, and participated in the Pennsylvania Alternate System of Assessment (PASA). Third, these findings contribute to the current literature that PALS can improve reading comprehension and reading fluency (Fuchs, Fuchs, Thompson, Al-Otaiba, Yen, Yang, & O'Connor, 2001). More specifically, all three students increased their reading comprehension and two students increased their reading fluency. However, despite these increases it is difficult to gauge the significance of these results on this specific of a population.

5.2 LIMITATIONS

Despite demonstrating positive effects, the current study does present some limitations. Only 18 PALS sessions (approximately 6-8 weeks) were conducted for each dyad. Other studies that support the use of PALS for students with disabilities conducted sessions for 15 weeks up to 2 years (Calhoon, 2005, Rafdal et al., 2011; Sáenz et al., 2005). The limited amount of sessions was due to several factors. First, although the district's special education population identified as having an ASD is above the state's average, several students did not meet the brief screening criteria. As a result, recruitment of students took longer than anticipated. Second, the middle school operates on a 6-day cycle. Since students were only able to participate on days 1, 2, and 3, the intervention often only occurred 2 times per week rather than the recommended 3 days per week. Third, the spring break and weeks of state assessments created large gaps in intervention

sessions of the study. For example, Derek had 19 days in-between baseline and the start of the intervention.

Additionally, there is evidence to suggest that maze comprehension tasks do not accurately measure reading compression skills. January & Ardoin (2012) examined the differences in student accuracy when administering an intact maze probe and a probe with sentences drawn randomly from three different maze probes (scrambled probes). They found that student performed nearly as well on scrambled maze probes as they did on intact maze probes. This shows that maze comprehension tasks only measure comprehension at the sentence level rather than the paragraph or passage level and suggests that maze comprehension tasks do not measure reading comprehension beyond what is measured by oral reading fluency.

Although the findings from this study show promise for the use of PALS in increasing reading comprehension and reading fluency students with ASD, replication to validate and extend these results is needed.

5.3 FUTURE DIRECTIONS FOR RESEARCHERS

PALS research over the past 15 years has been primarily been for English language learners or students with learning disabilities. The results of the current study add to the literature base and support the use of PALS for students with disabilities (e.g., Fuchs, Fuchs, & Kazdan, 1999, Fuchs et al., 2002, Rafdal et al., 2011, Sáenz, Fuchs, and Fuchs, 2005, Calhoon, 2005). However, studies investigating the effects of PALS on students with ASD remain limited.

Further research on the effectiveness of PALS for students with ASD in both reading comprehension and reading fluency would be useful.

In addition, questions remain on whether or not to use maze comprehension tasks as a measure of comprehension. Researchers may want to consider developing a measure that is a better predictor of students' comprehension skills. January & Ardoin (2012) suggest developing probes consisting of individual sentences. The development of sentence-type maze comprehension tasks would allow greater control over the target words and not make every *n*th word the target word.

5.4 CONCLUSION

There is little research in the area of reading strategies for individuals with ASD and only a few published studies investigating reading comprehension. One program that has shown a positive impact on beginning reading skills (Rafdal et al., 2011) and can significantly increase the reading comprehension skills of students with disabilities (Fuchs, Fuchs, & Kazdan, 1999) is PALS. This study attempted to expand the literature to investigate the effectiveness of PALS on reading fluency and reading comprehension for students with ASD. The results of this single-subject multiple baseline design across participants study showed improvements in reading comprehension for three participants and improvements in reading fluency for two. Given the need to increase comprehension skills for students with ASD and make adequate yearly progress toward grade level standards, teachers need as many effective educational programs possible. Therefore, teachers can add PALS as an effective program to improve reading comprehension and reading fluency skills for students with ASD.

APPENDIX A

LETTER TO STAFF

Figure 3. Letter to Staff

August 10, 2015

Dear Teachers:

As the Director of Special Education in the Franklin Regional School District and a current doctoral student in the School of Education EdD program at the University of Pittsburgh, I am seeking your assistance in conducting a research study on Peer-Assisted Learning Strategies (PALS) supplemental reading program.

No Child Left Behind Act (NCLB) and the Individuals with Disability Education Act (IDEA) mandate that students with disabilities participate in the general education curriculum and receive effective instruction in order to make adequate yearly progress toward grade level standards. Although individuals with autism spectrum disorder (ASD) may demonstrate strengths in word recognition and decoding, comprehension skills are not well developed. One strategy that has shown a positive impact on beginning reading skills and can significantly increase the reading comprehension skills of students with disabilities is PALS. However, the research indicates that PALS has been primarily implemented for students with learning disabilities. Therefore, the purpose of this study is to evaluate the effectiveness of Peer-Assisted Learning Strategies on reading comprehension for students with ASD.

Eight students in grades four, five and/or six will be recruited to participate in this study. Each student will be placed in a dyad, with one student identified as having ASD and one neurotypical peer (i.e., 4 dyads). PALS will be conducted during the grade-level remediation period three times a week for 35-40 minutes. A single-subject multiple baseline design across participants will be used to demonstrate changes in reading comprehension and oral reading fluency. Two instruments will be used to determine each student's reading comprehension and oral reading fluency levels: (1) the Dynamic Indicators of Basic Early Literacy Skills MAZE, and (2) the Dynamic Indicators of Basic Early Literacy Skills Oral Reading Fluency. These instruments will be used at an earlier time on the same days as the intervention.

There are minimal risks associated to this research study, and every effort will be made to protect the confidentiality of all participants. The final research report will not include any identifying information about the participants, schools, or the district.

If you interested in assisting with this study, please join me for an informational session on August 25, 2015 at 3:45 pm in the Administrative Conference Room. The meeting should last no longer than 15-20 minutes and light refreshments will be served. If you have any questions, please feel free to contact me.

Thank you for your support.

Sincerely,

Richard E. Regelski, Jr.

APPENDIX B

PARENTAL CONSENT LETTER (ASD)

Figure 4. Parental Consent Letter (ASD)

August 30, 2015

Dear Parent(s)/Guardian(s):

My name is Richard E. Regelski, Jr. and I am a doctoral candidate in the School of Education EdD program at the University of Pittsburgh, and am currently working on my doctoral dissertation. This fall, I am conducting a research project to pilot a supplemental reading program for students who may be struggling with reading comprehension and reading fluency. Your child's teacher has identified students that may benefit from additional academic assistance and your child is someone he/she felt may benefit from additional help.

As part of this study, students will be receiving one-on-one practice in reading at your child's school at no cost to you. This instruction will take place during the grade-level's remediation period three times a week for 35-40 minutes. The purpose of this study is to examine the effectiveness of Peer Assisted Learning Strategies (PALS) on reading comprehension and reading fluency skills for students with autism spectrum disorder. PALS is a scientifically based, supplemental, class wide peer-tutoring program that involves pairing higher and lower performing readers to practice beginning reading skills. Pairs will read books appropriate for the lower reader's level. Within each pair, during each lesson, both students will serve in the role of tutor and tutee. Pairs will participate in 4 activities: (1) partner reading; (2) retell; (3) paragraph shrinking; and (4) predication relay that are designed to promote reading fluency and comprehension.

We would like your permission to screen you child to determine if he or she is eligible to participate in the study. If your child is eligible, we would like permission to provide the reading practice to your child. We would like to share the results of the study with other teachers and researchers through professional publications and conferences.

The flowing is a brief list of the activities described above that your child might be asked to do for this study:

- Complete a short screening (i.e. 5-10 minutes) to determine if he or she is eligible to participate.
    - Your child will be asked to:
        - Read three reading fluency passages at their instructional level
        - Read three reading passages and answer comprehension questions using a multiple-choice cloze task
- Based on this screening assessment, we would determine if your child is eligible to participate. In order for a child to participate in this study, the child MUST have an autism spectrum disorder diagnosis as defined by IDEA and receive support from an individualized education plan (IEP), be in grades 3, 4, 5, 6, or 7, a native speaker of English, be able to communicate through oral speech, and NOT have severe behavior or attention problems prohibiting participation in three 35-40 minute sessions per week, NOT read above grade level or be able to answer comprehension questions above fifty-percent accuracy.
- I will contact you after the screening with a letter to let you know if your child does or does not qualify.
- If your child qualifies, he or she will receive 35-40 minute reading sessions three times per week during the grade-level's remediation period. Each session your child participates, she/he will receive points. On the last day of PALS each week, the teacher tallies the points for each team and names the weekly winner.
- Each session, your child will work in pairs on four reading strategies: partner reading, retelling, paragraph shrinking, and prediction relay. They will also be asked to complete oral reading fluency probes and reading comprehension tasks.

In addition, each time we work with your child, we will video and audio record the session to help us make sure that the reading sessions are completed and scored correctly. These recordings will be used only for

research purposes. You have the option below to let us use them in professional presentations, but this is not required for your child to participate in the study. Video recordings will be stored on a password protected computer. No identifying information will be included with the digital files. All documents that contain identifying information will be kept until the child turns 23 years old. Following this time period, they will be destroyed according to University policy. Non-identifying data collected as part of the study will be stored indefinitely.

There may be some risks associated with your child's participation in this study. During the tasks, your child may experience frustration and embarrassment similar to their normal classroom experience. While no information or scores will be added to your child's school records and reports will not name any individual or school, there is the unlikely possibility of a breach of confidentiality. Efforts will be made to keep the personal information in your child's research record private and confidential but absolute confidentiality cannot be guaranteed. Research records will be stored indefinitely in locked files at the University of Pittsburgh. Identifiable records may be accessed by the University of Pittsburgh Research Conduct and Compliance Office (RCCO) for purposes of monitoring the conduct of the study and could be released in response to an order by a court of law.

We believe that this study has the potential to improve your child's reading comprehension and reading fluency skills. Additionally, the study has the potential to provide information about effective ways to improve reading comprehension and reading fluency skills in not only students with autism spectrum disorder, but all students. We will provide a graph of academic progress and a final report to you at the end of the study if you would like. If you would like these results, please show this on the form at the bottom of this letter. Otherwise, the teaching staff will have primary access to your child's reporting scores. As noted previously, the ROCCO may access scores, and these could be released in response to an order by the court of law.

If you would like more information or if you have questions about any part of this letter, please call Richard E. Regelski, Jr. at 724-516-8124. If you would like to verify this study is being conducted at school, please contact your child's teacher or building principal. Also, if you have any general questions about giving consent or about your child's rights as a research participant, you may call the Human Subject Protection Advocate at the University of Pittsburgh a 1-800-212-2668.

If you decide not to have your child take part, please understand that no negative consequences will occur. Even if you provide consent for your child to participate, your child will have the choice whether or not they would like to participate. If you agree to have your child participate and your child agrees to participate, please understand that his/her participation is voluntary and either of you may withdraw your child's participation or your child may withdraw from the study at any time. If you do withdraw your child from the study, you will have an option of receiving information on your child's progress. After this decision is made, as per university policy, all data related to your child will be kept until they turn 23. If you decide to withdraw your child, please call me, Richard E. Regelski, Jr., at (724) 516-8124 or e-mail at rer33@pitt.edu.

Please complete one of the two consent forms and return the completed form in the self-addressed stamped envelope or to your child's teacher. Please retain the unsigned form for your records. Thank you for your support.

Sincerely,

Richard E. Regelski, Jr.

1. **Please check the following choices:**

_____ YES, I give permission for my child, _____,
(child's name)
to participate in this project. I understand that my child's participation is voluntary and that he/she may withdraw for the project at any time.

_____ NO, I do not wish for my child to participate in this project.

_____ _____
Parent Name Date

_____
Parent Signature

2. **If you would like a copy of your child's results, complete the following items:**

My telephone number: _____
My U.S. mailing address: _____
_____
My Email: _____

3. **If you give us permission to share video/audio recording of your child in professional presentations, please indicate so below. No identifying information will be shared and this is NOT required to participate in the study.**

_____ YES, I give permission for my child, _____,
(child's name)
to be shared in professional presentations related to this study. I understand that providing this permission is voluntary and that I may change my mind at any time during or after the study.

_____ NO, I do not wish for my child's video/audio recordings to be shared.

University Of Pittsburgh Institutional Review Board
Approval Date: 7/31/2015
Renewal Date: 7/30/2018
IRB #: PRO15050475

APPENDIX C

PARENTAL CONSENT LETTER (NEUROTYPICAL)

Figure 5. Parental Consent Letter (Neurotypical)

August 30, 2015

Dear Parent(s)/Guardian(s):

My name is Richard E. Regelski, Jr. and I am a doctoral candidate in the School of Education EdD program at the University of Pittsburgh, and am currently working on my doctoral dissertation. This fall, I am conducting a research project to pilot a supplemental reading program for students who may be struggling with reading comprehension and reading fluency. Your child's teacher has identified peer partners that may benefit from assisting other students that are in need of additional academic assistance and may benefit from peer help.

As part of this study, peer partners will be practicing reading skills with students that are in need of additional academic assistance. This instruction will take place during the grade-level's remediation period three times a week for 35-40 minutes. The purpose of this study is to examine the effectiveness of Peer Assisted Learning Strategies (PALS) on reading comprehension and reading fluency skills. PALS is a scientifically based, supplemental, class wide peer-tutoring program that involves pairing higher and lower performing readers to practice beginning reading skills. Pairs will read books appropriate for the lower reader's level. Within each pair, during each lesson, both students will serve in the role of tutor and tutee. Pairs will participate in 4 activities: (1) partner reading; (2) retell; (3) paragraph shrinking; and (4) predication relay that are designed to promote reading fluency and comprehension.

We would like your permission to screen you child to determine if he or she is eligible to help as a peer partner. If your child is eligible, we would like permission to have your child work with student's that are in need of additional academic assistance in reading. We would like to share the results of the study with other teachers and researchers through professional publications and conferences.

The flowing is a brief list of the activities described above that your child might be asked to do for this study:

- Complete a short screening (i.e. 5-10 minutes) to determine if he or she is eligible to participate.
    - Your child will be asked to:
        - Read three reading fluency passages at their instructional level
        - Read three reading passages and answer comprehension questions using a multiple-choice cloze task
- Based on this screening assessment, we would determine if your child is eligible to participate. In order for a child to participate in this study, the child MUST be in grades 3, 4, 5, 6, or 7, a native speaker of English, be able to communicate through oral speech, successfully participate in instruction at grade level, and NOT have severe behavior or attention problems prohibiting participation in three 35-40 minute sessions per week.
- I will contact you after the screening with a letter to let you know if your child does or does not qualify.
- If your child qualifies, he or she will participate in 35-40 minute reading sessions three times per week during the grade-level's remediation period. Each session your child participates, she/he will receive points. On the last day of PALS each week, the teacher tallies the points for each team and names the weekly winner.
- Each session, your child will work in pairs on four reading strategies: partner reading, retelling, paragraph shrinking, and prediction relay.

In addition, each time we work with your child, we will video and audio record the session to help us make sure that the reading sessions are completed correctly. These recordings will be used only for research purposes. You have the option below to let us use them in professional presentations, but this is not required for your child to participate in the study. Video recordings will be stored on a password protected computer. No identifying information will be included with the digital files. All documents that contain identifying information will be kept until the child turns 23 years old. Following this time period, they will be destroyed

University Of Pittsburgh Institutional Review Board
Approval Date: 7/31/2015
Renewal Date: 7/30/2018
IRB #: PRO15050475

according to University policy. Non-identifying data collected as part of the study will be stored indefinitely.

There may be some risks associated with your child's participation in this study. During the tasks, your child may experience frustration and embarrassment similar to their normal classroom experience. While no information or scores will be added to your child's school records and reports will not name any individual or school, there is the unlikely possibility of a breach of confidentiality. Efforts will be made to keep the personal information in your child's research record private and confidential but absolute confidentiality cannot be guaranteed. Research records will be stored indefinitely in locked files at the University of Pittsburgh. Identifiable records may be accessed by the University of Pittsburgh Research Conduct and Compliance Office (RCCO) for purposes of monitoring the conduct of the study and could be released in response to an order by a court of law.

We believe that this study has the potential to improve children's reading comprehension and reading fluency skills. Additionally, the study has the potential to provide information about effective ways to improve reading comprehension and reading fluency skills in not only in students that are in need of additional academic assistance, but all students. We will provide a final report to you at the end of the study if you would like. If you would like these results, please show this on the form at the bottom of this letter. Otherwise, the teaching staff will have primary access to the reporting scores. As noted previously, the ROCCO may access scores, and these could be released in response to an order by a court of law.

If you would like more information or if you have questions about any part of this letter, please call Richard E. Regelski, Jr. at 724-516-8124. If you would like to verify this study is being conducted at school, please contact your child's teacher or building principal. Also, if you have any general questions about giving consent or about your child's rights as a research participant, you may call the Human Subject Protection Advocate at the University of Pittsburgh a 1-800-212-2668.

If you decide not to have your child take part, please understand that no negative consequences will occur. Even if you provide consent for your child to participate, your child will have the choice whether or not they would like to participate. If you agree to have your child participate and your child agrees to participate, please understand that his/her participation is voluntary and either of you may withdraw your child's participation or your child may withdraw from the study at any time. If you do withdraw your child from the study, you will have an option of receiving information on your child's progress. After this decision is made, as per university policy, all data related to your child will be kept until they turn 23. If you decide to withdraw your child, please call me, Richard E. Regelski, Jr., at (724) 516-8124 or e-mail at rer33@pitt.edu.

Please complete one of the two consent forms and return the completed form in the self-addressed stamped envelope or to your child's teacher. Please retain the unsigned form for your records. Thank you for your support.

Sincerely,

Richard E. Regelski, Jr.

1. **Please check the following choices:**

_____ **YES**, I give permission for my child, _____,
(child's name)
to participate in this project. I understand that my child's participation is voluntary and that he/she may withdraw for the project at any time.

_____ **NO**, I do not wish for my child to participate in this project.

_____ _____
Parent Name Date

_____
Parent Signature

2. **If you would like a copy of the results, complete the following items:**

My telephone number: _____
My U.S. mailing address: _____
_____
My Email: _____

3. **If you give us permission to share video/audio recording of your child in professional presentations, please indicate so below. No identifying information will be shared and this is NOT required to participate in the study.**

_____ **YES**, I give permission for my child, _____,
(child's name)
to be shared in professional presentations related to this study. I understand that providing this permission is voluntary and that I may change my mind at any time during or after the study.

_____ **NO**, I do not wish for my child's video/audio recordings to be shared.

APPENDIX D

IRB APPROVAL LETTER

Figure 6. IRB Approval Letter

University of Pittsburgh
Institutional Review Board

3500 Fifth Avenue
Ground Level
Pittsburgh, PA 15213
(412) 383-1480
(412) 383-1508 (fax)
http://www.irb.pitt.edu

Memorandum

To: Richard Regelski
From: IRB Office
Date: 9/1/2015
IRB#: MOD15050475-01 / PRO15050475
Subject: THE EFFECTIVENESS OF PEER-ASSISTED LEARNING STRATEGIES ON READING COMPREHENSION FOR STUDENTS WITH AUTISM SPECTRUM DISORDER

The University of Pittsburgh Institutional Review Board reviewed and approved the requested modifications by expedited review procedure authorized under 45 CFR 46.110 and 21 CFR 56.110.

Modification Approval Date: 9/1/2015
Expiration Date: 7/30/2018

For studies being conducted in UPMC facilities, no clinical activities that are impacted by the modifications can be undertaken by investigators until they have received approval from the UPMC Fiscal Review Office.

Please note that it is the investigator's responsibility to report to the IRB any unanticipated problems involving risks to subjects or others [see 45 CFR 46.103(b)(5) and 21 CFR 56.108(b)]. Refer to the IRB Policy and Procedure Manual regarding the reporting requirements for unanticipated problems which include, but are not limited to, adverse events. If you have any questions about this process, please contact the Adverse Events Coordinator at 412-383-1480.

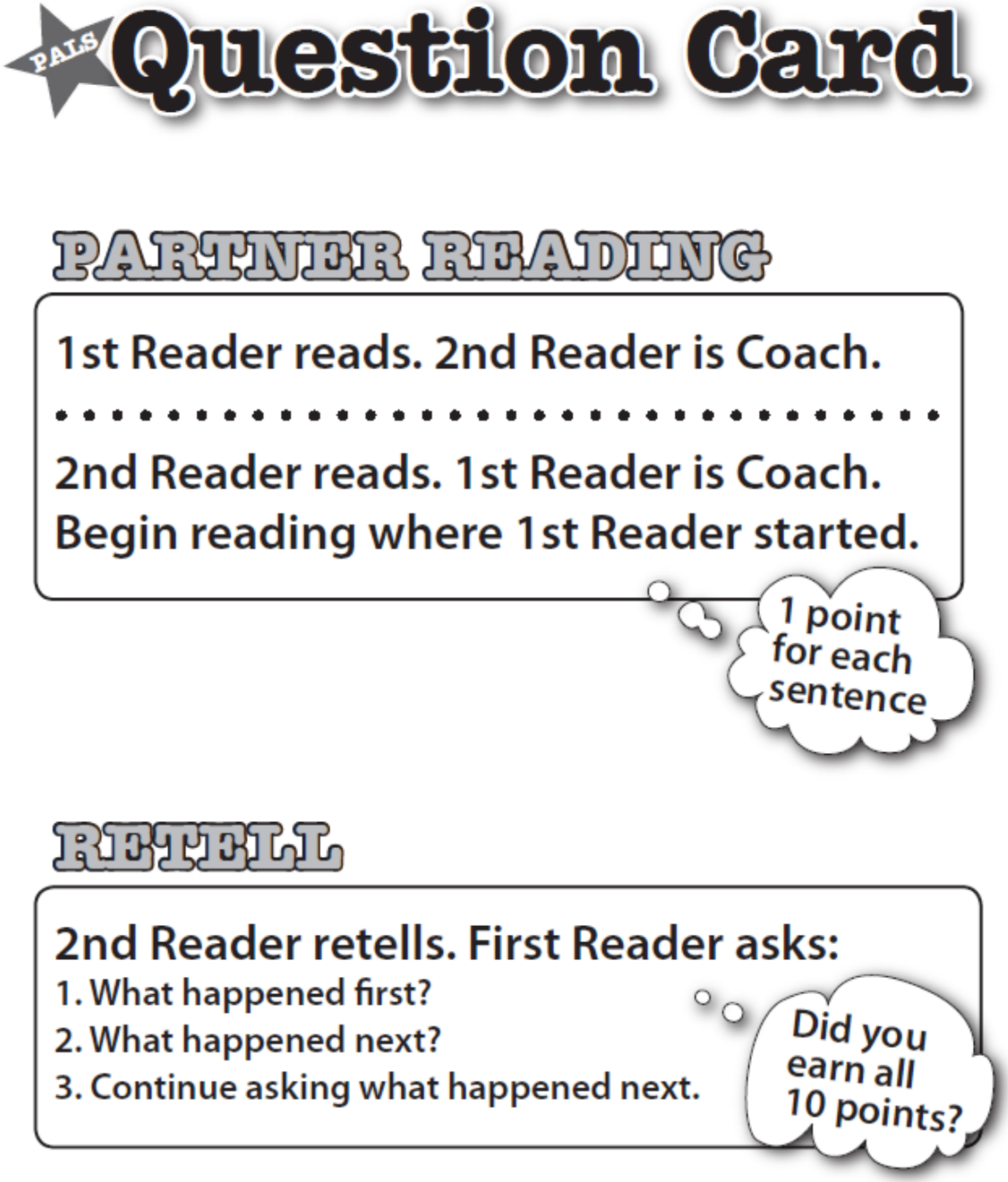
The protocol and consent forms, along with a brief progress report must be resubmitted at least one month prior to the renewal date noted above as required by FWA00006790 (University of Pittsburgh), FWA00006735 (University of Pittsburgh Medical Center), FWA00000600 (Children's Hospital of Pittsburgh), FWA00003567 (Magee-Womens Health Corporation), FWA00003338 (University of Pittsburgh Medical Center Cancer Institute).

Please be advised that your research study may be audited periodically by the University of Pittsburgh Research Conduct and Compliance Office.

APPENDIX E

QUESTION CARD

Figure 7. Question Card



PARAGRAPH SHRINKING

1st Reader reads. Coach says:

1. Name the most important who or what.
2. Tell the most important thing about the who or what.
3. Say the main idea in 10 words or less.

1 point for each step

2nd Reader reads. Coach says:

1. Name the most important who or what.
2. Tell the most important thing about the who or what.
3. Say the main idea in 10 words or less.

1 point for each step

PREDICTION RELAY

Coach asks 1st Reader:

1. What do you predict will happen next?
2. Read half a page.
3. Did the prediction come true?

1 point for predicting
1 point for reading
1 point for checking

Coach asks 2nd Reader:

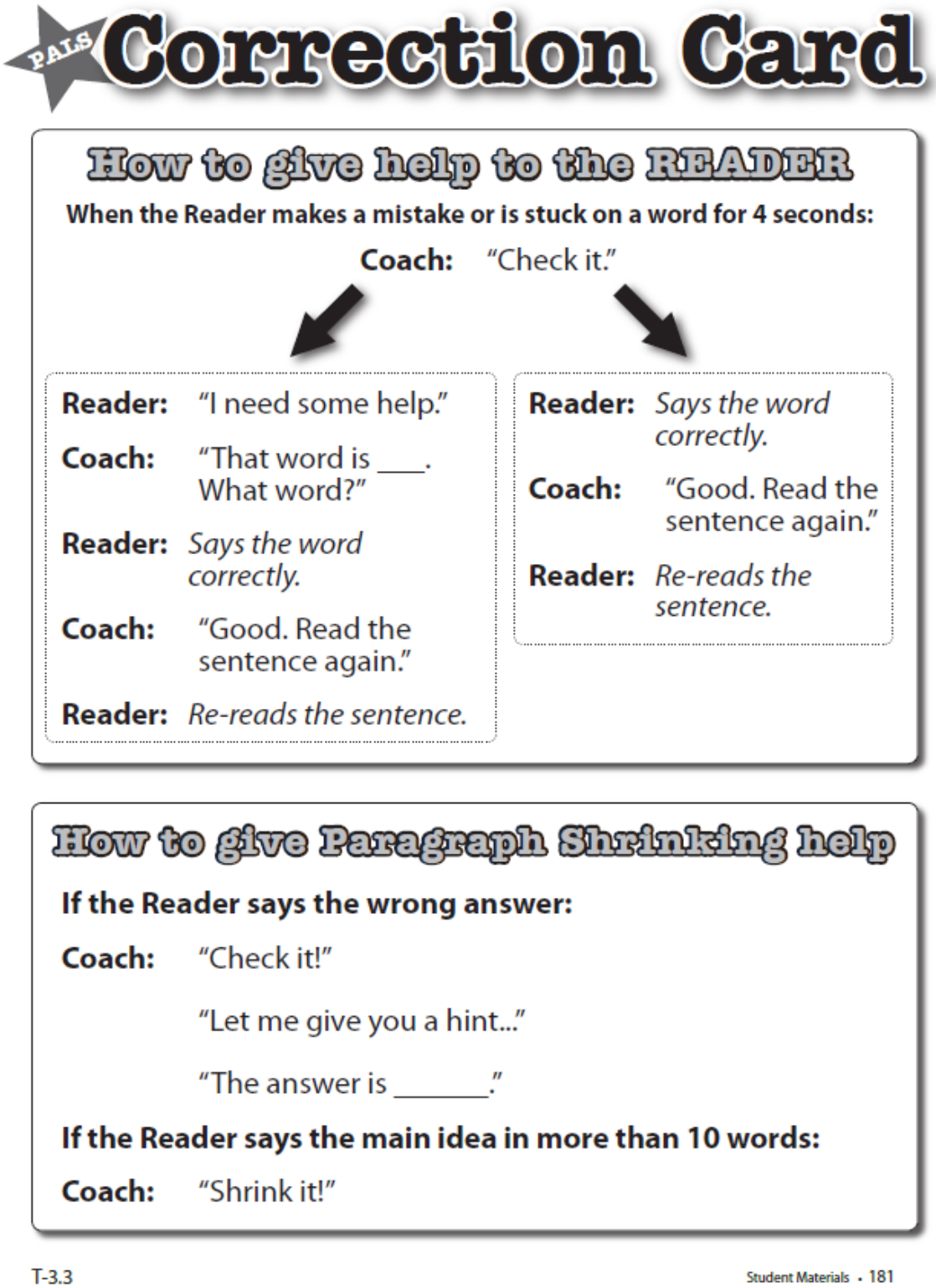
1. What do you predict will happen next?
2. Read half a page.
3. Did the prediction come true?

1 point for predicting
1 point for reading
1 point for checking

APPENDIX F

CORRECTION CARD

Figure 8. Correction Card



PALS Correction Card

How to give help to the READER

When the Reader makes a mistake or is stuck on a word for 4 seconds:

Coach: "Check it."

Reader: "I need some help."

Coach: "That word is ___. What word?"

Reader: *Says the word correctly.*

Coach: "Good. Read the sentence again."

Reader: *Re-reads the sentence.*

Reader: *Says the word correctly.*

Coach: "Good. Read the sentence again."

Reader: *Re-reads the sentence.*

How to give Paragraph Shrinking help

If the Reader says the wrong answer:

Coach: "Check it!"

"Let me give you a hint..."

"The answer is _____."

If the Reader says the main idea in more than 10 words:

Coach: "Shrink it!"

T-3.3

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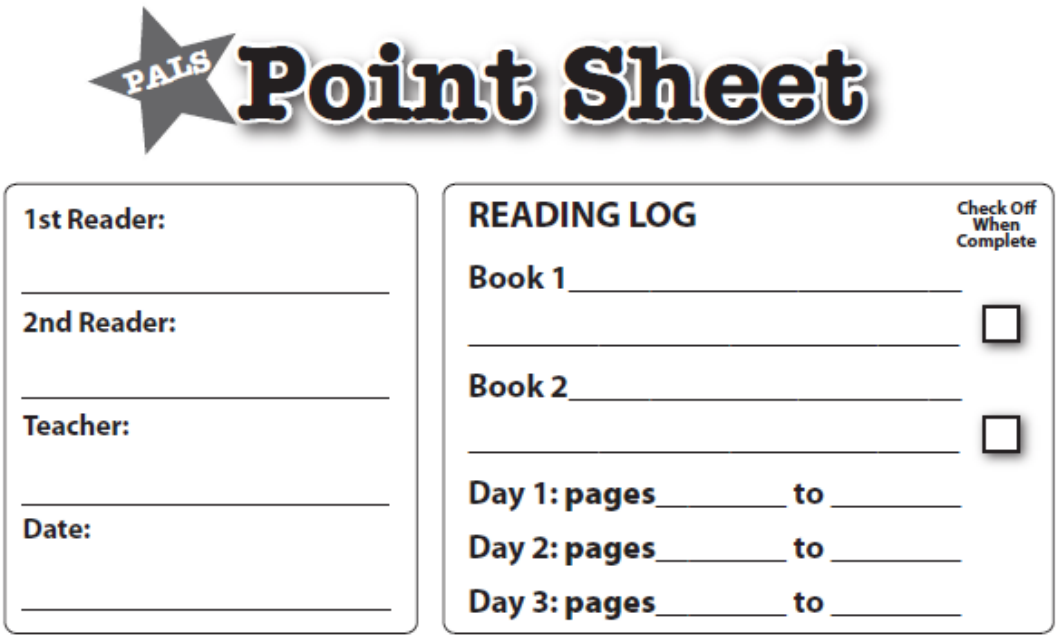
APPENDIX G

POINT SHEET

Figure 9. Point Sheet



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
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281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
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381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
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421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440
441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460
461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500

APPENDIX H

PALS OBSERVABLE CHECKLIST

Figure 10. PALS Observable Checklist

Grades 2-6 Reading PALS Implementation Checklist
Fidelity Time 1 2 3

Teacher:_____ School:_____ Observer:_____
Timeslot:_____ # of Students Present:_____ Grade: _____

PALS OVERALL _____ Start Time _____ End Time

circle = behavior observed
blank = behavior not observed
crossed out = not applicable

Classroom Arrangement/Set-up Checklist

Value		
	Getting Ready for PALS	
1	Get Ready in 1-2 minutes	Start Time End Time
1	Higher performing readers are paired with lower performing readers	
1	Students are seated next to their partners and books are placed between them	
1	Students should know who their partner is for the day	
	Teacher Materials	
1	Training Overheads, if applicable	
1	Timer	
	Student Materials	
1 1	Books with page numbers marked (1 pt for book, 1 pt for page marked)	
1	Pencils	
1	Questions Cards	
1	Point Sheets	
	Comments:	

Partner Reading

Teacher Behaviors

Value	
1	Prompts students to begin activities
1	Prompts students to switch roles
1	Keeps students on task and following PALS rules
1 1	Teacher monitors at least two pairs (1 point for each pair)
1	Teacher awards extra points for good PALS behaviors
1	Teacher provided positive feedback, if applicable
1	Teacher provided corrective feedback, if applicable
1	Partner Reading: Start time Switch roles End Time (Each Reader must have an opportunity to read for 5 minutes to earn 1 point.)
1	Retell Start time End Time Reader 2 retells the story for 1 minute (2nd-3rd) or 2 minutes (4th-6th)

Student Behaviors

Reader 1_____ & Reader 2_____

Value	
1	Reader 1 reads aloud from book for 5 minutes.
1	Reader 2 corrects mistakes using the correction procedure *Correction Procedure: "Stop, you missed that word. Can you figure it out? (waits 4 seconds) If reader figures it out: "Good. Read the sentence again." OR if reader continues to struggle: "That word is____. What word? Read the sentence again."*
1	Reader 2 awards 1 point for each correctly read sentence

Pairs switch jobs

1	Reader 2 reads SAME text for 5 minutes
1	Reader 1 corrects mistakes using the correction procedure above
1	Reader 1 awards 1 point for each correctly read sentence
1	Reader 2 retells the story for 1 minute (2nd-3rd) or 2 minutes (4th-6th)
1	Students mark 10 points for retelling the story.

Paragraph Shrinking

Teacher Behaviors

Value	
1	Prompts students to begin activities
1	Prompts students to switch roles
1	Keeps students on task and following PALS rules
1 1	Teacher monitors at least two pairs (1 point for each pair)
1	Teacher awards extra points for good PALS behaviors
1	Teacher provided positive feedback, if applicable
1	Teacher provided corrective feedback, if applicable
1	Paragraph Shrinking: Start time Switch roles End Time (Each Reader must have an opportunity to read and shrink for 5 minutes to earn 1 point.)

Student Behaviors

Reader 1_____ & Reader 2_____

Value	
1	Reader 1 reads aloud from NEW TEXT for 5 minutes.
	Summarization of each paragraph
1	Reader 1 names the most important "who" or "what" in the paragraph
1	Reader 2 awards 1 point for correct answer
1	Reader 1 states the most important thing about the "who" or "what"
1	Reader 2 awards 1 point for correct answer
1	Reader 1 states the main idea in 10 words or less
1	Reader 2 awards 1 point for correct answer
1	Reader 2 helps fix answers using the correction procedure:
	Correction Procedure: "That's not quite right. Skim the paragraph and try again."

Pairs switch jobs

1	Reader 2 reads aloud from NEW TEXT for 5 minutes.
	Summarization of each paragraph
1	Reader 2 names the most important "who" or "what" in the paragraph
1	Reader 1 awards 1 point for correct answer
1	Reader 2 states the most important thing about the "who" or "what"
1	Reader 1 awards 1 point for correct answer
1	Reader 2 states the main idea in 10 words or less
1	Reader 1 awards 1 point for correct answer
1	Reader 1 helps fix answers using the correction procedure above

Comments:

Prediction Relay

Teacher Behaviors

Value	
1	Prompts students to begin activities
1	Prompts students to switch roles
1	Keeps students on task and following PALS rules
1 1	Teacher monitors at least two pairs (1 point for each pair)
1	Teacher awards extra points for good PALS behaviors
1	Teacher provided positive feedback, if applicable
1	Teacher provided corrective feedback, if applicable
1	Prediction Relay: Start time Switch roles End Time
	(Each Reader must have an opportunity to read and predict for 5 minutes to earn 1 point.)

Student Behaviors

Reader 1_____ **& Reader 2**_____

Value	
1	Prediction sequence continues for 5 minutes.
1	Reader 1 predicts what will happen in the text
1	Reader 2 awards 1 point for a reasonable prediction
1	Reader 1 reads a half page of NEW TEXT
1	Reader 2 awards 1 point
1	Reader 2 asks Reader 1 to confirm whether prediction came true
1	Reader 1 confirms or disconfirms prediction
1	Reader 2 awards 1 point
1	Reader 1 makes a new prediction

Pairs switch jobs

1	Prediction sequence continues for 5 minutes.
1	Reader 2 predicts what will happen in the text
1	Reader 1 awards 1 point for a reasonable prediction
1	Reader 2 reads a half page of NEW TEXT
1	Reader 1 awards 1 point
1	Reader 1 asks Reader 2 to confirm whether prediction came true
1	Reader 2 confirms or disconfirms prediction
1	Reader 1 awards 1 point
1	Reader 2 makes a new prediction

Comments:

Student Points	Teacher Points	Total Points
_____ ____%	_____ ____%	_____ ____%

Overall Suggestions/Comments:

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