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The Effects Of Computer-assisted Repeated Readings On The Reading Performance Of Middle School Students With Mild Intellectual Disabilities

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THE EFFECTS OF COMPUTER-ASSISTED REPEATED READINGS
ON THE READING PERFORMANCE OF MIDDLE SCHOOL STUDENTS
WITH MILD INTELLECTUAL DISABILITIES

by

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ABSTRACT

The No Child Left Behind Act of 2001 has mandated that all public school students will be reading at grade level by the 2013-2014 school year. Florida has embarked on an agenda to ensure that the kindergarten through high school student population is reading at or above grade level by 2014. Many of Florida's low-performing student population, including middle school students with high incidence disabilities, are reading below grade level. Using a multiple baseline across subjects design, this study examined the impact of computer-assisted repeated readings on the reading performance of three middle school students with mild intellectual disabilities over the course of 67 days. Results showed an improvement in reading fluency rate using instructional level text. The study was evaluated using quality indicators of single-subject research in special education. Future research is advocated to replicate this study across different grades and exceptionalities.

To Audrey

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LIST OF ACRONYMS/ABBREVIATIONS

AT   Assistive Technology

AYP   Adequate Yearly Progress

EBD   Emotional and Behavioral Disabilities

ESE   Exceptional Student Education

FCAT   Florida Comprehensive Assessment Test

FDOE   Florida Department of Education

IDEA   Individuals with Disabilities Education Act

NCLB   No Child Left Behind Act of 2001

MID   Mild Intellectual Disabilities

SLD   Specific Learning Disability

CHAPTER ONE: INTRODUCTION

The No Child Left Behind Act of 2001 (NCLB) mandates that every state evaluate the reading performance of all students in public schools in order to determine if the school, school district, and state have met Adequate Yearly Progress (AYP). The goal of NCLB is to achieve 100% of students reading proficiently by the end of the school year 2013-2014. This federal law has increased awareness of the significance of assisting all students in learning to read as well as the need for reading interventions that will raise reading proficiency (No Child Left Behind Act of 2001 [NCLB], 2002).

Each state submits an accountability plan for AYP implementation which outlines the state's reading proficiency goals. The calculation of AYP is based on these goals being achieved by eight subgroups: White, Black, Hispanic, Asian, American Indian, Economically Disadvantaged, English Language Learners (ELL), and Students with Disabilities (SWD).

In complying with NCLB, the State of Florida has established AYP reading benchmarks which it believes will lead to 100% reading proficiency of all subgroups by 2014. For 2007-2008, the state objective was to have at least 58% of each subgroup reading at or above grade level as defined by the reading portion of the Florida Comprehensive Achievement Test (FCAT). Each subsequent school year raises the proficiency level by seven percent until the goal of 100% is attained by 2014 (Florida Department of Education, Office of Evaluation and Reporting, Division of Accountability, Research, and Measurement [FODE, ARM], 2008a).

A focus on the reading grade levels of Florida's middle school students resulted in the passage of the Middle Grades Reform Act of 2005 mandating that reading and language arts

programs offered in middle grades (6th, 7th, and 8th) be research-based proven effective

programs (Middle Grades Reform Act, 2005). The law stated that middle schools with fewer

than 75 percent of its students reading at or above grade level as measured by the FCAT must

initiate a rigorous reading program that addresses the low-performing student population in the

reading components of phonemic awareness, phonics, fluency, vocabulary, and comprehension.

The passage of the Florida Secondary School Redesign Act of 2006 further legislated school

improvement plans must contain "intensive intervention in reading…through innovative delivery

systems" (Florida Secondary School Redesign Act, Florida Statute Title XLVIII, Chapter

1003.413, 2006, ¶ (2)(e)).

As an incentive to promote literacy throughout the state, the Florida Legislature allocates

annual funding for reading through the Florida Education Finance Program. Receipt of this

funding by school districts is incumbent upon their yearly submission of a comprehensive

research-based reading plan which outlines the following provisions: (a) highly qualified

reading coaches, (b) professional development for teachers in scientifically-based reading

instruction that includes the content areas (i.e., math, science, social studies), (c) summer reading

camps for students reading below grade level, (d) supplemental instructional materials grounded

in scientifically-based reading research, and (e) intensive interventions for middle and high

school students reading below grade level (Just Read, Florida, 2008).

Extensive guidance is provided to ensure that each school district accurately details for all

their schools—charter schools, alternative schools, and juvenile justice facilities—the role of

administration, professional development, assessment, curriculum, and instruction in order to

improve student learning (Just Read, Florida, 2008). The financial incentive coupled with

meticulous guidance would seem to be a recipe for success in achieving reading proficiency for all students especially students with disabilities.

Statement of the Problem

Middle school students reading below grade level and having deficits in any of the five components of reading are assigned to an extended period of reading instruction. This time extension can be anywhere from 45 to 110 minutes per school day (Just Read, Florida, 2008). Many of Florida's low-performing student population include middle school students with high incidence disabilities. High incidence disabilities include specific learning disabilities (SLD), speech or language impairments (SI or LI), mental retardation (MR), and emotional and behavioral disabilities (EBD; U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, 2007). In Florida, the term intellectual disability has replaced the term mental retardation (Florida Administrative Code, 2009).

While a strong literature research base contains a variety of studies demonstrating the positive effects of intensive reading instruction on students with disabilities (Chard, Vaughn, & Tyler, 2002; Roberts, Torgesen, Boardman, & Scammacca, 2008; Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebuch, C. K., et al., 2007; Vaughn, Levy, Coleman, & Bos, 2002), examination of FCAT reading data on middle school students with high incidence disabilities over four school years (2004-2005 through 2007-2008) revealed that this population of students continued to fall short of the annual reading benchmarks even with intensive reading programs in place. The impact of this instruction has produced questionable results. The inability to attain the reading benchmark proficiencies year after year should generate the

consideration of other options. Enhancing reading outcomes for students with high incidence

disabilities underscores the need to examine other service delivery models as mandated by

Florida law (Florida Secondary School Redesign Act, 2006). One possible alternative for all

students with disabilities is the consideration of assistive technology (AT) in the individualized

education program (IEP) as required by the Individual with Disabilities Education Act of 2004

(IDEA 2004). AT raises the question of whether the skill deficit, e.g., a low rate of reading

fluency, necessitates the use of assistive technology that compensates for that deficit or is there

just a need to remediate the skill. Consistent underperformance in attaining a proficient level of

reading fluency while undergoing a regimen of intense remediation should be the catalyst to

consider assistive technology (Edyburn, 2004, 2006). A remediation reading program

supplemented by assistive technology may provide another option for students with high

incidence disabilities. Given an urgent requirement to remediate the reading performance of

middle school students with high incidence disabilities, computer-assisted repeated readings may

offer yet another alternative to enhance reading outcomes.

One school district in Florida is attempting to address the reading needs of students with high

incidence disabilities that make up a segment of the lowest quartile of middle school students

reading below grade level. In disaggregating this district's 2008 FCAT Reading grade level

scores, over 500 middle school students with high incidence disabilities were reading below

grade level. Of that number, approximately 80% had been assigned to a developmentally

appropriate intensive reading program that utilized a systematic, direct instruction methodology.

Even with this intense instruction these students continued to struggle in achieving reading

proficiency. The use of technology to delivery computer-assisted repeated readings is a possible

intervention that may impact reading scores for middle school students with high incidence disabilities.

Purpose of the Study

The purpose of this study was to contribute to the body of reading research that has been conducted exclusively on middle school students with high incidence disabilities. This study examined the effects of computer-assisted repeated readings on the reading performance of middle school students with mild intellectual disabilities when it was integrated into an intensive reading program over period of 67 days.

Application to Practice

A review of the Florida school districts' comprehensive reading plans revealed a variety of educational and instructional technology as a supplement to the reading instruction. Many of the technology-based programs were not the product of what the U.S. Department of Education calls scientifically-based research (Assistance to States for the Education of Children With Disabilities and Preschool Grants for Children With Disabilities, 2006). This type of research is designed to provide schools with evidence-based or research-validated practices that can be used for reading instruction.

There is a need to conduct more research in the naturalistic setting of the classroom in order to bridge the gap between the researcher and practitioner (Fitzgerald, Koury, & Mitchem, 2008). In addition, there is a dearth of studies that have examined the impact of computer-assisted repeated readings on the reading fluency rate of middle school students with mild intellectual

disabilities. To that end, this researcher sought to provide more evidence of the benefits of using technology in reading instruction so that more teachers would be encouraged to use it.

Research Question

Do computer-assisted repeated readings increase the reading fluency rate of middle school students with mild intellectual disabilities?

Definitions of Terms

1. Assistive technology: any item or piece of equipment or product system either acquired commercially, off the shelf, modified or customized and used to increase, maintain, or improve functional capability for an individual with disabilities (Johnston, Beard, & Carpenter, 2007, p. 4).

2. Computer-assisted reading instruction: computer-based reading instruction or remediation (The Access Center: Improving Outcomes for All Students K-8, 2004).

3. Frustration Reading Level: the level of word decoding accuracy in reading defined by less than 90% word accuracy in reading (Rasinski, 2004).

4. High incidence disabilities: The U. S. Department of Education identifies four categories of disabilities—specific learning disabilities (SLD), speech or language impairments (SI/LI), mental retardation (MR), and emotional and behavioral disabilities (EBD)—that constitute approximately 83.7% of students with disabilities receiving special education services (U.S. Department of Education, 2007).

5. Independent Reading Level: the level of word decoding accuracy in reading defined by 97% to 100% word accuracy in reading (Rasinski, 2004).

6. Individualized education program (IEP): a written statement for a child with a disability that is developed, reviewed, and revised in accordance with the provisions outlined in 34 C.F.R. §§ 300.320 through 300.324 (Assistance to States for the Education of Children With Disabilities and Preschool Grants for Children With Disabilities, 2006).

7. Instructional Reading Level: the level of word decoding accuracy in reading defined by 90% to 96% word accuracy in reading (Rasinski, 2004).

8. Intellectual Disability: Rule 6A-6.03011 of the Florida Administrative Code defines an intellectual disability as significantly below average general intellectual and adaptive functioning manifested during the developmental period, with significant delays in academic skills. Developmental period refers to birth to eighteen (18) years of age (Florida Administrative Code, 2009).

9. Intensive reading program: an instructional reading program that focuses on the five components of reading (phonemic awareness, phonics, fluency, vocabulary, and comprehension) and generally runs from 45 to 110 minutes in length per school day. Direct instruction is the primary mode of instruction (Just Read, Florida, 2008).

10. Morphology: the conventions for combining sounds into meaningful units such as words, suffixes, and prefixes (Catts & Kamhi, 2005).

11. Nontransfer effect: the result of an individual's acquired skill to fluently read or comprehend connected text after reading it multiple times (Therrien, 2004).

12. Orthography: the conventions that govern letters and spelling (Fillmore & Snow, 2000).

13. Phonology: the conventions that govern sounds and their combination (Lue, 2001).

14. Prosody: the appropriate use of phrasing and expression to convey meaning in reading aloud (Rasinski, 2004).

15. Readability: the general degree of difficulty of text in a reading passage expressed as a function of grade level (Rasinski, 2004).

16. Scientifically-based research:

(a) Means research that involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs; and (b) Includes research that— (1) Employs systematic, empirical methods that draw on observation or experiment; (2) Involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn; (3) Relies on measurements or observational methods that provide reliable and valid data across evaluators and observers, across multiple measurements and observations, and across studies by the same or different investigators; (4) Is evaluated using experimental or quasi-experimental designs in which individuals, entities, programs, or activities are assigned to different conditions and with appropriate controls to evaluate the effects of the condition of interest, with a preference for random-assignment experiments, or other designs to the extent that those designs contain within-condition or across-condition controls; (5) Ensures that experimental studies are presented in sufficient detail and clarity to allow for replication or, at a minimum, offer the opportunity to build systematically on their findings; and (6) Has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review (Assistance to States for the Education of Children With Disabilities and Preschool Grants for Children With Disabilities, 2006, p. 46576).

17. Semantics: the conventions that govern the meaning of words and their combinations.

18. Transfer effect: the result of an individual's acquired skill to fluently read or comprehend new connected text after previously re-reading other connected text (Therrien, 2004).

19. Word decoding accuracy: the percentage of words a student can read correctly as calculated by words correct per minute (WCPM) divided by the total number of words read, i.e., WCPM plus any uncorrected errors (Rasinski, 2004).

CHAPTER TWO: LITERATURE REVIEW

Introduction

The report of the National Reading Panel (NRP; National Institute of Child Health and Human Development [NICHD], 2000) is considered a cornerstone document in the reading literature in that the U.S. Congress charged the panel with identifying effective instructional reading approaches and determining their readiness for application in the classroom. The panel assembled seven broad questions related to the five components of reading—phonemic awareness, phonics, fluency, vocabulary, and comprehension. Answers to the following questions were needed: (a) Does instruction in these components improve reading? (b) What is the best instructional service delivery model for each component? (c) What is the relationship between student independent reading, achievement, and motivation? and (d) What is the relationship between teacher education and the efficacy of teaching students to read?

Of significance to this author's research study was the National Reading Panel's subgroup report on fluency. Their report provided a comprehensive review of the research on two instructional methods that were effective in improving reading fluency rate. One of those methods was "repeated oral reading practice" (p. 3-1). Within the category of repeated oral reading practice was an approach to fluency instruction called repeated readings.

Fluency and Repeated Readings – A Theoretical Perspective

E. B. Huey (1968) may be credited with providing a foundation of reading fluency theory from which other researchers have proposed their own hypotheses on how reading fluency develops. Huey (1968) recognized the importance of reading practice in order that the individual might establish reading as a natural and automatic process. He commented almost a century ago

that "repetition progressively frees the mind from attention to details, makes facile the total act, shortens the time, and reduces the extent to which consciousness must concern itself with the process" (p. 104).

In addition to Huey (1968), many other researchers (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Kuhn & Stahl, 2003; Pikulski & Chard, 2005; Rasinski & Hoffman, 2003) cite the work of LaBerge and Samuels (1974) as a seminal document in describing reading fluency in terms of automatic information processing, i.e., automaticity. LaBerge and Samuels (1974) advocated a bottom-up serial-stage model of reading (Stanovich, 1980). They outlined the reading process as "a series of processing stages involving visual, phonological and episodic memory systems until it is finally comprehended in the semantic system" (p. 293). These stages represent a hierarchy of cognitive processes where the lower level processes (e.g., letter-sound correspondence, sound-symbol correspondence) must be mastered or become automatic in order to get to the higher level processes, i.e., the goal of reading which is comprehension (Fuchs et al., 2001). The lack of automaticity in these processes leads to cognitive overload such that the student focuses his/her efforts on lower level processes, i.e., decoding words, rather than comprehending that which is read resulting in reduced fluency reading rate and text comprehension.

While Samuels (2006) noted that his work with LaBerge provided the theoretical framework that led to the development of his method of repeated readings to improve reading fluency, Chard, Ketterlin-Geller, Baker, Doabler, and Apichatabutra (2009) concluded that Perfetti's (1985) verbal efficiency theory and Logan's (1988) instance theory of automatization provided "intuitive support for the notion of repeated reading as an intervention for fluency building" (p. 265).

Perfetti (1985) saw comprehension, the goal of reading, hindered by the effectiveness of verbal processes including semantic, orthographic, and phonetic components. This verbal effectiveness or efficiency he defined as "the quality of a verbal processing outcome relative to its cost to processing resources" (p. 102). The implication was that deficient decoding skills led to nonfluent reading and poor comprehension. He viewed phonics training and practice at all grade levels as one remedy to make fluency more efficient. He noted that any practice seeking to improve reading should be connected to a sound theoretical framework and should also captivate the interest of students and teachers.

Logan's (1988) instance theory of automaticity is founded on three assumptions: obligatory encoding, obligatory retrieval, and instance representation. In the context of reading, obligatory encoding occurs when single or repeated exposure to letters, words, and their meaning are stored into memory. Obligatory retrieval involves retrieving the same or familiar letters, words, and their meaning from memory as a result of exposure to some set of the same or familiar letters, words, and their meaning. Finally, instance representation assumes that each exposure to letters, words, and their meanings, no matter how small the exposure, is individually coded, stored, and retrieved from memory. Logan's (1988, 1997) theory, as it pertains to reading fluency, states that repeated practice of reading the same words on different occasions increases the speed of word recognition and comprehension of those same words in future opportunities when compared to previous episodes of reading.

Definition of Fluency

In light of this theoretical framework, fluency has been defined in different terms by many researchers. Chard, Vaughn, and Tyler (2002) defined fluency as "the speed and accuracy with

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which a student reads connected text orally" (p. 388). Pikulski and Chard (2005) synthesized the definitions proposed by the National Reading Panel (NICHD, 2000) and *The Literacy Dictionary* (Harris & Hodges, 1995) into one: "Reading fluency refers to efficient, effective word-recognition skills that permit a reader to construct the meaning of text. Fluency is manifested in accurate, rapid, expressive oral reading and is applied during, and makes possible, silent reading comprehension" (p. 510).

For the purpose of this study, the researcher chose Meyer and Felton's (1999) fluency definition: "the ability to read connected text rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding" (p. 284). This definition distinguishes itself from any emphasis or connection to comprehension (Menon & Hiebert, in press).

Repeated Readings Research

Introduction

Samuels (1979) and Dahl (1974, 1979) are credited with coining the term repeated readings. The original method of repeated readings is described by Samuels (1979) as "rereading a short, meaningful passage several times until a satisfactory level of fluency is reached" (p. 404). Student reading fluency rate was visually graphed for the purposes of data keeping and student motivation. Emphasis was placed on speed rather than accuracy in order to increase reading rate. Samuels (1979) supplemented the procedure by making use of a contemporary piece of technology—a tape recorder. He gave his students the option to listen to pre-recorded reading

passages on audiotape as they silently read along with them. Overall, his new method produced marked improvements in his students' fluency rate.

Around the same time as Samuels' (1979) first use of repeated readings, Carol Chomsky (1976) implemented a repeated readings format using books on tape. Five third grade students were given the opportunity to choose from a selection of two dozen storybooks on tape. Each student listened to their book as they followed along with a printed copy of the book. They also had an opportunity to record themselves reading along with the book or independent of it. Chomsky (1976) noted that all the students made significant progress in reading their books fluently and with some degree of prosody. She reported that the children's desire to read without prompting and their confidence increased during the course of the study which took about four months.

Over the course of three decades, repeated readings has evolved into a popular instructional method as evidenced by the different repeated readings formats and the diverse media which integrates the method (Biggs, Homan, Dedrick, Minick, & Rasinski, 2008; Hudson, Lane, & Pullen, 2005; Mathes & Fuchs, 1993; Tyler & Chard, 2000). In addition, repeated readings has contributed to the development of national performance norms for oral reading fluency used to assess reading fluency (Hasbrouck & Tindal, 2006).

Syntheses of Research on Repeated Readings

Dowhower (1989) provided one of the first summaries of the research on repeated readings (RR). Her analysis of over a dozen studies concluded that RR facilitates studying, listening, and reading out loud. She synthesized a set of guidelines to help with RR implementation. These included passage length, level of reading accuracy, reading passage readability, and determining

fluency speed goals. She also recommended RR be incorporated into the reading program through direct instruction, classroom learning centers, or cooperative learning. Five years later, Dowhower (1994) revisited her previous review and provided a more comprehensive synthesis of the RR research. Reviewing almost twenty years of research, she concluded that there was strong support for the efficacy of repeated readings such that it should be incorporated into all facets of reading instruction.

In their review of the literature on repeated readings, Meyer and Felton (1999) generated a set of practical questions from the 15 studies they reviewed. Questions included:

1. What is the relationship between reading fluency rate, accuracy, and repeated readings?

2. What is the minimum number of re-readings to increase fluency rate?

3. How long should a repeated readings session be?

4. What type of teacher training is required to implement repeated readings?

5. What methods of repeated readings are most effective, e.g., assisted or unassisted?

6. What is the relationship between reading fluency and level of text?

7. Does repeated readings increase the probability of transfer effects, i.e., the ability to fluently read or comprehend new reading passages after a repeated readings session?

8. What is the relationship between repeated reading and comprehension?

Future researchers (e.g., Chard et al., 2002; Hiebert, 2005; Strong, Wehby, Falk, & Lane, 2004; Therrien & Kubina, 2007; Valleley & Shriver, 2003) would use these questions as a starting point for their own studies.

The National Reading Panel's (NICHD, 2000) report on fluency identified 98 studies for their analysis of repeated readings and guided repeated oral reading. Fourteen of those studies demonstrated improvements in reading fluency through the use of repeated readings and guided oral reading on students' reading fluency when using the same passage of text, i.e., no measure of reading transfer. Twelve single-subject designs of which several were multiple baseline designs measured the impact of repeated readings and guided oral reading methods of K12 students with significant reading problems including students with disabilities. Eleven of the 12 studies saw improvements in fluency rate and accuracy. The panel concluded that repeated readings provided clear evidence for advancing positive progress in reading. However, absent from this synthesis was an in depth discussion of students with disabilities and how they might benefit from these fluency interventions (Chard et al., 2002).

As a follow up to the unintentional shortcoming of NRP's synthesis on fluency, Chard et al. (2002) compiled 24 studies that examined two interventions on reading fluency with elementary students with learning disabilities: repeated readings and word practice. Twenty-one of those studies examined the impact of repeated readings without a model. Nine studies were examined that used repeated readings with a model. Examples of models included adults, peers who were fluent readers, or technology, e.g., computer or audio recording. Of these studies, eight used a multiple groups design, five used a single group design, and 11 were case studies or single-subject design. From their standpoint, the results of the synthesis: (a) supported the use of repeated readings as an intervention to improve fluency and comprehension, and (b) substantiated the theoretical frameworks of LaBerge and Samuels (1974) and Perfetti (1985).

Wolf and Katzir-Cohen (2001) re-examined the work of Meyer and Felton (1999) including additional fluency studies that focused on: (a) the duration of the repeated readings intervention and what it achieved (e.g., gains in fluency and comprehension), (b) student grade level and the subsequent developmental level of reading addressed, and (c) specific fluency intervention components. Summarizing their conclusions, they advocated for more studies that measured the impact of comprehension and transfer effects as a result of a repeated readings intervention. More studies were required that address improving fluency rate using "sublexical-, lexical-, and passage-level reading" so that fluency development is addressed early in a student's learning career. Finally, they stated that systematic reading instruction "should be directed to accuracy and then to rate at each developmental level of the acquisition of reading subskills—that is, at the level of the phoneme, grapheme, letter, letter pattern (orthographic chunk), word, phrase and sentence, and passage" (p. 229).

Therrien (2004) conducted a meta-analysis of the repeated readings research from 1977 to 2001 focusing on three primary issues: (a) repeated readings' efficacy on improving reading fluency rate and comprehension, (b) components of a successful repeated readings program, and (c) benefits of repeated readings to students with disabilities. His results from the meta-analysis of 18 studies suggested that repeated readings improved reading fluency rate and comprehension of general and special education students. In addition, the results demonstrated the potential of repeated readings on improved fluency and comprehension of new reading passages.

Group Studies on Repeated Readings

Rashotte and Torgesen (1985) examined the effect word overlap in a repeated readings intervention had on reading fluency and comprehension. Twelve elementary students with

disabilities ranging in grades 2 through 5 with a mean IQ of 100 participated in the study. The authors used reading passages at the second grade level. Dependent measures were oral reading fluency as defined by speed and accuracy and scores obtained from a set of comprehension questions. Study results suggested that reading speed was affected by the number of words held in common between reading passages while accuracy and comprehension were not. The higher percentage of words that overlapped between passages resulted in higher reading speeds.

Mercer, Campbell, Miller, Mercer, and Lane (2000) examined the impact of repeated readings in letter-sound correspondences, sight words, and connected text on 49 middle school students with specific learning disabilities. The method of repeated readings was used in conjunction with the *Great Leaps Reading Program* (Campbell, 1995) over the course of 6 to 25 school months as the students were available. Results indicated statistically significant improvements in reading fluency and grade level reading scores.

Hiebert (2005) examined the role of text in a repeated readings program for 115 second grade students who were divided into three distinct groups: control, literature, and content. The literature and content groups used a repeated reading method while the control did not. The literature and content groups used different texts for their repeated reading. The literature group used a literature-based textbook while the content group used a set of science and social studies texts. Results indicated that the content and literature groups made greater gains in fluency rate than the control group. In addition, the content group exceeded the literature group in fluency rate. The study highlighted the importance of text genres in reading fluency programs.

Therrien, Wickstrom, and Jones (2006) synthesized components of repeated readings and question generation into a program called Reread-Adapt and Answer-Comprehend (RAAC).

Thirty students, 16 of which were students with learning disabilities, in the fourth, fifth, seventh, and eight grades participated in the four month study. Results of the study indicated significant improvement in reading fluency of practiced and unpracticed passages. The authors recommended future research examine the significance of each intervention component, repeated readings and question generation, as compared to the combination of the two.

O'Connor, White, and Swanson (2007) compared the effects of repeated readings and continuous reading on the reading fluency and comprehension of 37 elementary grade students with and without disabilities. Their results revealed increases in fluency rate, word identification, and comprehension for the intervention groups as compared to the control groups but no significant difference was found between the repeated readings and continuous reading methods.

<div align="center">Single-Subject Design and Repeated Readings</div>

The use of the single-subject research design in literacy research is prevalent. (Chard et al., 2009; Horner, Carr, Halle, McGee, Odom, & Wolery, 2005; Neuman & McCormick, 2000, 1995). McCormick (1995) noted that single-subject research denotes "a process rather than to the actual number of participants" (p. 4). She listed distinctive marks to this method of research. They included: (a) personalized evaluation of data, (b) use of baseline data, (c) repeated measures, (d) establishing data stability, (e) manipulating variables, (f) standard measurement procedures, (g) visual data analysis, and (h) establishing internal and external validity. Kazdin (1982) identified four types of single-subject designs: (a) the ABAB design also known as the reversal or withdrawal design, (b) the multiple baseline design, (c) the changing criteria design, and (d) the multiple-treatment design.

Weinstein and Cooke (1992) conducted a single-subject research design using four elementary school-aged male students with disabilities to measure the impact of repeated readings on achieving a pre-determined reading fluency rate (fixed-rate criterion) and attaining three successive improvements in fluency rate (improvements criterion). They were also interested in the transfer effect fluency rate would have on unpracticed passages. All four students had an IQ that ranged from 74 to 96 and reading grade levels from 1.0 to 1.3. The dependent variable was reading fluency rate as measured by the number of words read correctly in one minute. Their results indicated all four students made fluency gains using either criterion. They noted the transfer effect was more prominent in the fixed-rate criterion use of repeated readings.

Multiple Baseline Across Subjects Design and Repeated Readings

One particular single-subject design is the multiple-baseline design of which there are three types: multiple baseline across behaviors, settings, and subjects. Multiple baseline designs provide a common sense approach to research in an instructional setting that can be accomplished by researcher or practitioner (Cooper, Heron, & Heward, 1987).

The multiple baseline across subjects design (MBD) has been especially suited for literacy research in repeated readings. For example, Scott and Shearer-Lingo (2002) used a multiple baseline across subjects study design to examine the impact of repeated readings on the reading fluency rate and on task behavior of three seventh grade male students with emotional and behavioral disabilities. Their results indicated an increase in reading fluency rate and on task behavior.

Steventon and Fredrick (2003) conducted a multiple baseline across subjects study design on three general education students to examine the effects of repeated reading on reading fluency rate and accuracy on practiced and unpracticed reading passages. Reading passages were used from the *Corrective Reading Decoding Strategies Level B2* (Engelmann, Meyer, Carnine, Becker, Eisele, & Johnson, 1999). Their results indicated an increase in fluency rate for practiced passages but not unpracticed passages.

Strong, Wehby, Falk and Lane (2004) implemented a multiple baseline across subjects study design with six middle school students with emotional and behavioral disabilities (EBD). They sought to measure the impact of *Corrective Reading* supplemented by a repeated readings intervention on reading fluency rate and comprehension. Results indicated an improvement in four out of the six students in reading fluency rate while improvements in comprehension were mixed. Significant to their study was the documentation of an intervention approach that allowed them to measure the effects of *Corrective Reading*, "an empirically validated reading program," with the additional intervention of repeated readings.

Tam, Heward, and Heng (2006) integrated a repeated readings intervention along with vocabulary instruction and error correction into a multiple baseline across subjects design that examined the fluency rate and comprehension of five elementary school-aged English language learners. Their results demonstrated the positive effects of the intervention program with this distinct population of students. Citing the relative ease of classroom or home implementation of this program, they advocated the program as a supplement to reading instruction for English language learners who struggle with reading.

Alber-Morgan, Ramp, Anderson, & Martin (2007) conducted a multiple baseline across subjects study design using four middle school students with emotional and behavioral disabilities (EBD). They examined the combined effects of repeated readings with error correction and performance feedback on student reading fluency rate and comprehension. Their results indicated an increase in reading fluency rate while the impact on comprehension was inconclusive.

Gile (2009) conducted a counterbalanced multiple baseline across participants design with components of a reversal design by comparing two interventions—listening passage preview and repeated readings—on the fluency rate of seven students with autism spectrum disorder. Student ages ranged from 7 to 14. Her results saw small increases in reading fluency rate for both treatments with the repeated readings intervention having the greater impact on fluency rate increases.

Use of Technology in Repeated Readings

The use of technology for enhancing the reading skills of students with disabilities is well-documented in the literature (Fitzgerald et al., 2008; Fitzgerald & Koury, 1996; Hall, Hughes, & Filbert, 2000; Lundberg, 1995; MacArthur, Ferretti, Okolo, & Cavalier, 2001). In their report, the National Reading Panel (NICHD, 2000) identified computer technology as a viable service delivery option for reading instruction but that additional research was needed to directly examine the effects of technology as it is used in the classroom to augment reading instruction. A key characteristic of computer-assisted instruction is its ability to concentrate instruction without putting additional burdens on teachers (Mathes, Torgesen, & Allor, 2001). Another characteristic is its ability to engage and motivate students (Alvermann, 2002).

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In their research synthesis on repeated readings, Chard et al. (2002) noted that computer-assisted repeated readings was a viable and realistic method of modeling fluent reading for students. In one of the first research studies that examined computer-assisted repeated readings, Carver and Hoffman (1981) examined the impact of a computer-assisted repeated readings program on the reading performance of 12 high school students classified as poor readers. Their study was a replication of earlier research they had conducted but without computer assistance. Their findings indicated an increase in fluency due to the computer assistance, however not in overall reading ability. The authors suggested that repeated readings may support increases in reading fluency from practiced passages to unpracticed passages. They offered the possibility that repeated readings may improve the reading of those students significantly below grade level but only for those who have an ability to listen that is higher than their ability to read.

LeVasseur, Macaruso, and Shankweiler (2008) utilized a computer-assisted repeated readings approach to compare repeated readings of text and with word lists using 49 elementary school students. Their results indicated significantly greater gains in words correct per minute (WCPM) from reading text than reading word lists.

Biggs, Homan, Dedrick, Minick, and Rasinski (2008) measured the effect of a novel application of a repeated readings methodology—an interactive singing software. Their study measured the intervention's impact on 48 students' fluency rate and instructional reading level. The treatment group exhibited significant growth in fluency rate and reading level as compared to the control group.

Coleman (2008) used a repeated readings methodology with computer modeling, error correction, and performance feedback to measure the reading fluency of four elementary students

with physical disabilities. Her results demonstrated increases in reading fluency, accuracy, and comprehension for practiced reading passages while three out of the four students exhibited an increase in reading fluency on unpracticed passages.

<div align="center">Repeated Readings – An Evidenced-Based Practice?</div>

In a recent article by Roberts, Torgesen, Boardman, and Scammacca (2008), they described evidence-based practices for adolescent students (5th – 12th grade) with learning disabilities in the areas of word study, fluency, vocabulary, comprehension, and motivation. Repeated readings was identified as a frequently studied evidenced-based practice for fluency. Citing from the meta-analysis conducted by Scammacca, Roberts, Edmonds, Wexler, Reutebuch, et al. (2007), Roberts et al. (2008) reported that the evidence-based practice of repeated readings had a limited effect on adolescent students' with disabilities fluency and overall reading ability. In light of these findings, the question arises: Should repeated readings be considered an evidence-based practice?

The U. S. Department of Education's Institute of Education Sciences *What Works Clearinghouse* (WWC) considers itself "a central and trusted source of scientific evidence for what works in education" (U. S. Department of Education, n.d.). One of the organization's priorities is to provide administrators and educators multiple resources to evaluate whether off-the-shelf reading programs have sufficient rigorous research evidence to be considered an evidence-based practice for classroom use.

An examination of the WWC database revealed 13 reading programs that purported to improve reading fluency. WWC-published intervention reports on these reading programs

indicated no program had an extensive list of studies documenting strong evidence of a positive effect on reading fluency.

A more refined search of the WWC database on the key words "repeated reading" and "repeated readings" resulted in no programs listed. However, the WWC database did have the *Quick Reads* fluency program which uses a repeated readings methodology with short expository texts (Hiebert, 2003). This reading program was reviewed by the WWC in July 2007 but was not considered an evidence-based intervention since it did not have any studies meeting the WWC evidence standards. Two recent studies on *Quick Reads* conducted by Vadasy and Sanders (2008a, 2008b) highlighted the backlog the WWC has in reviewing studies on interventions that may work in the classroom as well as what should constitute an evidence-based practice—especially one for the special education classroom.

In an effort to establish a set of "quality indicators for research in special education and guidelines for evidence of effective practices" (Graham, 2005, p. 135), *Exceptional Children* published a set of five articles that could be used to support the validation of an intervention as an evidence-based practice (see Brantlinger, Jimenez, Klingner, Pugach, & Richardson, 2005; Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti, 2005; Horner et al., 2005; Odom, Brantlinger, Gersten, Horner, Thompson, & Harris, 2005; Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005).

In order to validate repeated readings as an evidence-based intervention for reading fluency, Chard et al. (2009) created two individual rubrics that addressed research using: (a) the single-subject research design, and (b) the experimental/quasi-experimental research design. Each rubric was based on the work outlined in Horner et al.'s (2005) single-subject quality indicators

and Gersten et al.'s (2005) experimental/quasi-experimental quality indicators. After an extensive research review, Chard et al. (2009) identified 11 studies that met their search criteria: six single-subject design studies (see Begeny, Daly, & Valleley, 2006; Chafouleas, Martens, Dobson, Weinstein, & Gardner, 2004; Daly & Martens, 1994; Freeland, Skinner, Jackson, McDaniel, & Smith, 2000; Strong et al., 2004; Weinstein & Cooke, 1992) and five experimental/quasi-experimental design studies (see Mathes & Fuchs, 1993; O'Shea, Sindelar, & O'Shea, 1985; Rashotte & Torgesen, 1985; Sindelar, Monda, & O'Shea, 1990; Young, Bowers, & MacKinnon, 1996). Matching each rubric with the respective study design, the researchers concluded that repeated readings did not meet the rigorous standards of an evidence-based practice as outlined by Horner et al. (2005) and Gersten et al. (2005).

Summary of Literature Review

The literature base on the method of repeating readings is extensive. The many variations on the method itself can be found in studies conducted over the last three decades. The recent publication of a set of quality indicators for special education research calls into question whether repeated readings should be classified as an evidence-based reading intervention (Chard et al., 2009; Horner et al., 2005; Odom et al., 2005) even in light of a federal definition for scientifically-based research. This study was designed to examine the impact of a computer-assisted repeated readings intervention on the reading performance of middle school students with mild intellectual disabilities. This study will add to the research base regarding the effectiveness of repeated readings on improving students' reading fluency with connected text.

CHAPTER THREE: METHODOLOGY

Introduction

The purpose of this study was to examine the effect of computer-assisted repeated readings on the reading fluency rate of middle school students with mild intellectual disabilities when it is integrated into an intensive reading program. The study occurred over a period of 67 days which included two breaks. The first break was seven days of the 2009 Florida Comprehensive Assessment Test (FCAT) and the second was five days of the 2009 school district's spring break.

Design

The study used a multiple baseline across subjects design (Barger-Anderson, Domaracki, Kearney-Vakulick, & Kubina Jr, 2004; Kucera & Axelrod, 1995) with three middle school students with mild intellectual disabilities to measure the effect of computer-assisted repeated readings on their reading fluency rate.

Research Question

Do computer-assisted repeated readings increase the reading fluency rate of middle school students with mild intellectual disabilities?

Hypothesis

Using computer-assisted repeated readings during a 30-60 day period will make no difference in the reading fluency rate of middle schools students with mild intellectual disabilities.

Selection of Participants

The researcher set the following criteria to select the study's participants:

- Minimum of three participants

- Participants must be classified as having a mild intellectual disability

- Participants must be in middle school

- Participants must be assigned to an intensive reading program

- Participants' reading level must be significantly below their grade level (i.e., three or
  more grade levels)

Using these criteria, the researcher reviewed the student populations of twelve middle schools
in one Central Florida county and located one middle school that had a population of seven
students who fit this criteria. All seven students had been pre-assessed by the school using the
SRA Corrective Reading placement test (Engelmann, Johnson, Carnine, Meyer, Becker, &
Eisele, 2002) and the *Scholastic Reading Inventory* (SRI) computer adaptive classroom-based
assessment program that computes student reading levels using the *Lexile*® score format
(Scholastic, n.d.). These two scores determined their placement into an intensive reading
classroom which utilized the *SRA Corrective Reading Decoding Strategies (Decoding B2)*
curriculum (Engelmann et al., 1999).

One special education teacher provided the reading instruction for the seven students in this
intensive reading classroom. A paraprofessional also was assigned to the room. Both the special
education teacher and paraprofessional were asked to participate in this study and agreed.
Consent forms were sent to the parents/guardians of all seven students in the reading classroom.
All seven students and their parents/guardians agreed to participate in the study but only three of

the students met the criteria for establishing a stable baseline for this multiple baseline across

subjects design. Quality indicators for single subject research designs typically require at least

three participants in order to demonstrate experimental control and effect (Horner et al., 2005).

<u>Participants</u>

Three male students (N = 3) in the sixth grade (n = 1) and eighth grade (n = 2) participated in

the study. Descriptive details of the participants are provided in Table 1. These three students

were enrolled in a math, science, and technology magnet school located in a Central Florida

school district. This middle school had a population of 1347 students with 835 males and 512

females. Forty-five percent of the enrolled students received free or reduced lunch. The ethnic

distribution of the student population was as follows: White – 50.5%, Black – 20.5%, Hispanic –

14.4%, Asian – 8.2%, American Indian – 0.3%, and Multi-Racial – 6.1%. Special education

students constituted 13.6% of the population. The gifted student population was 15.8%.

Table 1. Participant Descriptions

Student	Age (Y-M)	Gender	Race	Grade	SES	IQ	Lexile Rating	Reading Grade Level
1	12-11	M	C	6	RL	56	259	1.6
2	14-08	M	AA	8	FL	41	130	1.3
3	15-03	M	AA	8	FL	68	107	1.2

Note. SES = Socioeconomic status; C = Caucasian; AA = African American; RL = Reduced

Lunch, FL = Free Lunch

<center>Research Team</center>

One male researcher, one female special education teacher, and one female paraprofessional were involved in the study. The researcher had a master's degree in exceptional education from the University of Central Florida and was certified by the Florida Department of Education in the areas of K12 exceptional student education and reading. The special education teacher had a bachelor's degree in elementary education from Purdue University with endorsements in special education and reading. She was certified by the Florida Department of Education in the areas of K12 exceptional student education and reading. The paraprofessional graduated from the University of Florida with a bachelor's degree in psychology and an education specialist degree in counselor education. She was certified by the Florida Department of Education in the area of middle grades integrated curriculum.

The researcher was present every day of the study directing the baseline, intervention, and maintenance phases. The special education teacher provided the 45 minutes of *Corrective Reading* instruction to the three participants. The researcher administered the reading fluency probes in all three phases, provided the computer-assisted repeated readings to the three participants, and collected, graphed, and analyzed all reading fluency data. He trained the paraprofessional to administer and score the reading fluency probes and used her as a second scorer.

<center>Materials</center>

The researcher selected 120 reading passages at the second grade level from the *Dynamic Indicators of Basic Early Literacy Skills*^{TM} *(DIBELS*®*) 6*th *Edition* (Good, Kaminski, & Dill, 2007), *The Six-Minute Solution: A Reading Fluency Program (Primary Level)* (Adams & Brown,

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2007a), and *The Six-Minute Solution: A Reading Fluency Program (Intermediate Level)* (Adams & Brown, 2007b).

The passages selected from *The Six-Minute Solution* were used for the intervention phase's computer-assisted repeated readings and reading fluency probes. Using a word processor, the researcher created 62 individual 1500 word electronic text (e-text) documents by duplicating two reading passages from *The Six-Minute Solution* until each e-text had 1500 words.

The reading passages for all three phases of the study were determined to be at the students' instructional reading level which for all seven students was the second grade. The researcher calculated the readability for each individual passage using the readability calculation software program *Readability Calculations* (Micro Power & Light Company, 2008). The program consisted of several readability formulas. The Spache Readability Formula Revised (Spache, 1974) was specifically used because of its accuracy in evaluating primary through third grade level reading materials. The mean readability of the 120 reading passages was 2.1 with a standard deviation of 0.21, mode of 2.2, and a range of 1.5 to 2.4.

A text-to-speech software installed on a laptop computer was used to model fluent reading of connected text. The researcher selected *Kurzweil 3000™ Version 10* (Kurzweil Educational Systems, 2007) as the software component of the computer-assisted repeated readings. This text-to-speech software is an optical character recognition (OCR) system coupled with a computer-generated speech engine that transforms electronic printed text into spoken language (Raskind, 2005). The functions of this particular software permitted the researcher to regulate features to the study's needs including the type of human voice (male or female), rate of speech, pitch, volume, word/sentence highlighting, and font style and size.

<center>Variables</center>

Dependent Variable

The dependent variable was reading fluency rate measured as Words Correct Per Minute (WCPM; Hasbrouck & Tindal, 2006; Rasinski, 2004) which is considered a stable measure of reading performance. Reading fluency rate was defined as the number of words pronounced correctly according to standardized letter-sound correspondence in a one minute timing. An incorrectly read word was defined by one or more of the following five types of errors: (a) individual words mispronounced according to standardized letter-sound correspondence, (b) words omitted or skipped, (c) words substituted for another word, (d) words repeated more than once, (e) insertion of additional words, and (f) word or letter reversal (i.e., letters or words within a phrase) (Rasinski, 2004).

Independent Variable

In applied research, the independent variable is the intervention procedure which, when applied, determines what, if any, change occurs to the dependent variable (Schloss, Misra, & Smith, 1992). In this study, the independent variable was the use of computer-assisted repeated readings. Computer-assisted repeated readings were defined as text-to-speech software (TTS) modeling the oral fluent rereading of connected e-text (i.e., reading passages) over a specified period of time.

<center>Experimental Design</center>

A multiple baseline across subjects design was used because of the need to change the same "behavior" (i.e., low reading fluency rate) across several students (Schloss et al., 1992). This

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type of design is also known to be most appropriate in educational settings for literacy research when studying individuals placed in remedial instruction (Kucera & Axelrod, 1995; McCormick, 1995; Schloss et al., 1992) and is considered to be very well-matched with classroom instruction (Neuman & McCormick, 2000). The design application was appropriate for the study's self-contained environment in that it did not require the intervention to be withdrawn and could be used with more than one student who was in need of the same intervention (Cooper et al., 1987). The staggering of the intervention over three individuals provided a more convincing case of experimental control and intervention effectiveness. Table 2 summarizes the baseline, intervention, and maintenance protocols. The researcher made every effort to keep these protocols simple and succinct so that other classroom teachers could replicate this practice and minimize student cognitive overload which might occur as a result of too many instructional steps.

Table 2. Baseline, Intervention, Maintenance Protocols

Step	Baseline Protocol	Intervention Protocol	Maintenance Protocol
1	CR (WA, GR, WE) – 45 min	CR (WA, GR, WE) – 45 min	CR (WA, GR, WE) – 45 min
2	Break – 5 min	Break – 5 min	Break – 5 min
3	One Minute Reading Probe	Repeated Readings – 15 min	One Minute Reading Probe
4		Break – 5 min	
5		One Minute Reading Probe	

Note. CR = Corrective Reading; WA = Word Attack; GR = Group Reading; WE = Workbook Exercises

Baseline Phase

Under the direction of the researcher, this phase was conducted in the setting of the special education teacher's self-contained reading classroom of seven students. She provided 45 minutes of *SRA Corrective Reading (Decoding B2)* (Engelmann et al., 1999) instruction which consisted of three parts: word-attack skills, group reading, and workbook exercises. Each part took approximately 15 minutes. Word-attack skills included: (a) the oral reading of regular and irregular words, (b) learning sounds constituted by a variety of letter combinations, and (c) multiple readings of words and their modified versions. Group reading consisted of individual students taking turns reading through a story broken into several sections. After each section, the teacher asked several comprehension questions. Workbook exercises included comprehension questions about the story's characters and sequence of events.

Following the *Corrective Reading*, the students took a five minute break which included the options of going to the bathroom or going outside to get some fresh air. After the break, the researcher, one at a time, gave each student a one minute fluency probe at their instructional level. The probe was administered in an adjacent room with no distractions. The researcher used the following simple script prior to commencing the fluency probe: "You will have one minute to read this passage with speed and accuracy."

Using the reading fluency probe data, the researcher established a stable baseline for three of the seven students. The stable baseline had at least five data points in order to reveal a "reliable picture of what the student would normally do without the presence of the intervention" (McCormick, 1995, p. 9). A baseline was considered stable if at least 85% of the data points of

the baseline phase fell within a 15% range of the mean level of all the data point values

contained within the baseline condition (Tawney & Gast, 1984).

During the baseline phase, a total of 14 fluency probes were administered using the selection

of passages out of the *DIBELS® 6th Edition*. Reading fluency rate data collected from the one

minute fluency probes were graphed in *Microsoft ExcelTM* using procedures outlined by Carr and

Burkholder (1998).

Intervention Phase

Under the direction of the researcher, this phase was conducted in the setting of the special

education teacher's self-contained reading classroom of seven students and an adjacent room

with no distractions. Forty-five minutes of *Corrective Reading* were provided in the classroom.

The computer-assisted repeated readings were applied to the first student (Student 1) that

achieved a stable baseline.

This intervention consisted of moving Student 1 to a reasonably quiet adjacent room where a

laptop computer and ear buds (headset) were set up with the text-to-speech software (TTS).

Using a word processor, two instructional level passages from *The Six-Minute Solution* were

replicated on the laptop computer to produce one 1500 word passage. The passage was read

aloud by the text-to-speech software at a rate of 100 words per minute (wpm) while Student 1

with his ear buds on silently read along. The researcher used the following script to start the

computer-assisted repeated reading: "For the next 15 minutes, you are to silently read along with

computer as it reads to you." The intervention took approximately 15 minutes after which the

researcher directed Student 1 to take a five minute break which included the options of going to

the bathroom or going outside to get some fresh air. Following the break, the researcher gave

Student 1 a one minute reading fluency probe at his instructional level. The researcher used the following script to administer the intervention fluency probe: "You will have one minute to read this passage with speed and accuracy." All intervention probes were from *The Six-Minute Solution*.

The researcher administered the intervention to the second student (Student 2) with an established stable baseline when Student 1 exhibited a positive response to the intervention. A positive response to the intervention was defined as a function of three factors. The first factor was a positive change in level between the baseline and intervention phases. The change in level between the baseline and intervention phases was calculated by finding the difference between the first point of the intervention phase and the last data point of the baseline phase. If the difference was positive, the change in level was considered improving (Tawny & Gast, 1984). The second factor was an ascending trend line (i.e., the slope of the trend line was greater than zero) that was fitted to at least three fluency probe data points recorded during Student 1's intervention phase. The third factor was latency which was the amount of time it took from the application of the intervention to observe a positive change in the reading fluency rate. If positive changes occurred in the first three reading fluency data points, latency was considered short and suggested the intervention had a positive effect on the reading fluency rate.

The presence of these three factors in Student 1 provided sufficient evidence to apply the intervention to the second student (Student 2) with a stable baseline. If the first student did not respond to the intervention after seven fluency probes, the intervention was administered to the second student who established a stable baseline while the remaining five students continued with the CR instruction only.

The three factors were applied to Student 2. If Student 2 did not respond to the intervention after seven fluency probes, the intervention was administered to the third student (Student 3) who established a stable baseline while the remaining four students continued with the CR instruction only.

Having established a stable baseline for three students and having staggered the intervention across Students 1, 2, and 3, the intervention protocol was terminated after the 22nd session for Students 1, 2, and 3. In order to provide equity for the remaining four students, those students were provided the intervention in the regular reading classroom for several sessions but data was not recorded.

During the intervention phase, a total of 45 reading passages were used from *The Six-Minute Solution (Primary Level)*. Thirty of these passages had been used to create 15 e-text passages. The remaining 15 reading passages were used for the one minute fluency probes.

Percentage of word overlap was calculated for the three passages used in each intervention phase session. Percentage of word overlap was calculated by the following formula:

$$Percentage\ of\ Word\ Overlap = \frac{No.\ of\ words\ common\ to\ all\ three\ passages}{No.\ of\ words\ in\ the\ intervention\ fluency\ probe} \times 100$$

Words appearing in only one reading passage were not counted as overlapping words. The mean percentage of word overlap was 19% with a standard deviation of 6% and a range of 11% to 28%. This was considered a low word overlap (Rashotte & Torgesen, 1985; Therrien & Kubina, 2007).

Reading fluency rate data collected from the one minute fluency probes were graphed in *Microsoft Excel^{TM}* using procedures outlined by Carr and Burkholder (1998).

Maintenance Phase

Under the direction of the researcher, this phase was conducted in the setting of the special education teacher's self-contained reading classroom of seven students and an adjacent room with no distractions. The maintenance phase for Students 1, 2, and 3 began with the 23rd session and continued until the 31st session which was the last session. The maintenance phase reflected the degree which the change in reading fluency rate was sustained over a period of time after the intervention was concluded (Lane, Beebe-Frankenberger, & Lambros, 2001). If Student 1, 2, and 3's reading fluency rate increased or remained stable (i.e, trend line slope was greater than or equal to zero) during the maintenance period, this may suggest that the intervention results maintained across time (Lane et al., 2001).

During the maintenance phase, nine passages out of the *DIBELS® 6th Edition* were used to administer the fluency probes. Reading fluency rate data collected from the one minute fluency probes were graphed in *Microsoft Excel™* using procedures outlined by Carr and Burkholder (1998).

<div align="center">Maintenance of Internal Validity</div>

Internal validity is defined as "the extent to which observed differences on the dependent variable in a study are the result of the independent variable and not some uncontrolled extraneous variable or variables" (Ary, Jacobs, Razavieh, & Sorensen, 2006, p. 634). Campbell and Stanley (1963) identified eight potential threats to the internal validity of a research study. Only three threats to internal validity were identified and controlled in this study: history, testing effects, and instrumentation and observation.

History

Events that are unrelated to the independent variable but may demonstrate a change in the dependent variable are referred to as history (Ary et al., 2006). The threat of history is decreased in a multiple baseline across subjects design because the baseline condition runs concurrently for all participants and the intervention is not introduced until a stable baseline is established for one of the participants. In this study, the first student had seven sessions of baseline, the second student had 11 sessions of baseline, and the third student had 14 sessions of baseline. The staggered baseline and intervention aided in determining if changes in reading fluency rate were a function of the computer-assisted repeated readings.

Testing Effects

Changes that occur in the dependent variable as a result of the tests administered in a study are referred to as testing effects (Ary et al., 2006). In this multiple baseline across subjects design, the administration of a reading fluency probe after each baseline and intervention session might be viewed as a cause of change in the dependent variable while multiple administrations may also produce a fatigue effect (Palincsar & Parecki, 1995). The threat of testing effects to internal validity is reduced by examining data daily and minimizing the invasive nature of the measure. In this study, data was collected, graphed, and examined at the conclusion of each session. The process of obtaining fluency measures took less than three minutes while the actual intervention was 15 minutes. In this way, interruptions to the daily routine were minimized.

Instrumentation and Observation

Changes in the way a measure is taken or who observes and records it describe the effects of instrumentation and observation (Campbell & Stanley, 1963; Palincsar & Parecki, 1995). The threat of instrumentation and observation to interval validity is reduced by having in place a system of checklists that can be examined for reliability. The next section describes baseline, intervention, and maintenance protocols and the measures taken to reduce the threat to internal validity due to instrumentation and observation.

<u>Fidelity of Baseline, Intervention, and Maintenance Protocols</u>

The *Corrective Reading Decoding Strategies Teacher's Guide* (Engelmann et al., 2002) provided procedures for how the special education teacher was to administer the 45 minute *Corrective Reading* (CR) lesson. A single *Decoding B2* lesson is divided into four parts: (1) word-attack skills (10 min), (2) group reading (10 to 15 min), (3) individual reading checkouts (10 min), and (4) workbook exercises (10 min). The teacher did not use the reading checkouts because paired students were not capable of checking and counting errors for each other. Word-attack skills, group reading, and workbook exercises were approximately 15 minutes each for a total of 45 minutes. Of the 32 sessions of CR instruction conducted by the special education teacher, the researcher conducted five fidelity checks on the 45 minutes CR instruction—two during baseline, two during intervention, and one during maintenance. Table 3 is the researcher-made checklist used to measure the accuracy of the administration of the CR instruction. The percent of accuracy was calculated by dividing the total score received by the maximum score of eight multiplied by 100. The average accuracy observed was 83% with a low of 63% and a high of 100%.

The researcher conducted 15 sessions of the computer-assisted repeated readings during the intervention phase. Table 4 is the researcher-made checklist used to measure the accuracy of the administration of the intervention. The percent of accuracy was calculated by dividing the total score received by the maximum score of ten multiplied by 100. The average accuracy was 87% with a low of 70% and a high of 100%. Calculations were based on the researcher's self-assessment of all 15 sessions.

Table 3. Phase Protocol Checklist for Classroom Instruction

	Score		
	No	Sometimes	Yes
Item	(0 pt)	(1 pt)	(2 pts)
Followed lesson plan			
Completed all three parts			
Provided student feedback			
Adequate pace of instruction			
Totals			
Grand Total =		Percentage of Accuracy =	

Table 4. Phase Protocol Checklist for Computer-Assisted Repeated Readings

	Score		
	No	Some	Yes
Item	(0 pt)	(1 pt)	(2 pts)
Set up text-to-speech software with the assigned 1500 word passage			
Student moved to the adjacent distraction-free room			
Script followed			
Student completed 15 min of computer-assisted repeated readings			
5 minute break taken			
Totals			
Grand Total =	Percentage of Accuracy =		

Interobserver Agreement

   The researcher trained the paraprofessional to administer probes and record fluency data as a

second scorer. The researcher administered 100% of the fluency probes during the baseline,

intervention, and maintenance phases. Reliability of fluency probe administration was assessed

using the paraprofessional as a second scorer. Reliability checks were done on 35% of all of the

fluency probes using the following formula:

$$Percent\ Agreement = \frac{Agreement}{Agreement + Disagreement} \times 100$$

The worksheet for this calculation is attached as Appendix F. The range of scorers' agreement

was between 92% and 100% agreement with a mean agreement of 98%.

Data Analysis - Introduction

Single-subject research design studies generally use visual analysis of graphed data to determine the effect of an intervention. For this study, data were analyzed using visual and statistical procedures to complement one another in order to understand the statement of the problem as presented in the hypothesis and research question (Franklin, Gorman, Beasley, & Allison, 1996). Visual analysis procedures as outlined by Tawney and Gast (1984) were used for examining within- and between-phases. This visual analysis included measuring the percentage of data overlap between phases. In an effort to promote single-subject research designs of evidence-based interventions in special education (Odom et al., 2005) that report statistical results, this study used a new statistical index, percentage of all non-overlapping data (PAND; Parker & Hagan-Burke, 2007b; Parker, Hagan-Burke, & Vannest, 2007) which was used to calculate the established effect size Pearson's *Phi* (ϕ) which Cohen (1988) described as a legitimate effect size.

Visual Analysis Data Procedures

Within-Phase Analysis

Within-phase analysis comprised five steps. The initial step began with computing the trendline of each student's phase (baseline, intervention, and maintenance) using the ordinary least-squares regression function available in *Microsoft Excel^{TM}*. Second, trendline stability was calculated using a 15% stability standard which established a standard range used to determine the percentage of student phase data points that fell within that range. Trendline stability was classified stable if 85% or greater of a student's phase data points fell within the stability

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standard range, and if less than 85%, it was declared variable. Third, the phase trend was examined for multiple data paths using the ordinary least-squares regression function in *Microsoft Excel[TM]*. Fourth, the phase level stability and range was determined.

Similar to trend stability, phase level stability was calculated using a 15% stability standard which established a range around the phase mean which was used to determine the percentage of student phase data points that fell within that range. Level stability was declared stable if 85% or greater of a student's phase data points fell within the level range, and if less than 85%, it was declared variable. Finally, absolute phase level change was calculated by finding the difference between the data values of the first and last session of each phase.

Between-Phases Analysis

Between-phases analysis involved four steps. First, trend direction was examined for any change in slope between phase trendlines. Second, trend stability was examined for any changes between phases. Third, absolute change in level between phases was calculated by taking the difference between the last session data value of a phase and the first session data value of the follow on phase. For example, the change in level from baseline to intervention was the difference between baseline's last session data value and intervention's first session data value. The last step for between-phase analysis was determining the percentage of overlap between the intervention and baseline phases and maintenance and intervention phases. For example, percentage of overlap between words correct per minute (WCPM) intervention and baseline phases was computed as the number of data points of the intervention phase that fell within the range of the baseline phase divided by the total number of data points in the intervention phase and then multiplied by 100.

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Additional Criteria for Visual Analysis Procedures

Two additional criteria for visual analysis were used as proposed by Kazdin (1982): change in fluency rate means across phases, and the latency of the fluency rate change from the baseline phase to the intervention phase and from the intervention phase to the maintenance phase. Latency is the amount of time it takes to see change in the dependent variable as a result of the intervention.

<div align="center">Statistical Analysis</div>

Parker, Hagan-Burke, and Vannest (2007) recently introduced a new method for calculating effect size for multiple baseline designs. This index is called the percentage of all non-overlapping data or PAND which can be used to calculate Pearson's *Phi* which Cohen (1988) describes as a legitimate effect size. Parker et al. (2007) noted that the PAND calculation requires at least 25 data points and does not have to meet parametric data assumptions (e.g., equal variance, homogeneity, and serial independence). PAND can be calculated by hand or using a statistical software package. The researcher used *Microsoft Excel* to set up all the baseline and intervention data—66 data points—and then used the crosstabs statistical module in the Statistical Package for Social Sciences (SPSS). The same procedure was done for the intervention and maintenance data—61 data points.

PAND was used to calculate effect size, the measure of the degree of strength between the independent (intervention) and dependent (fluency score) variables for all three participants using the baseline and intervention phase data for WCPM and then for the intervention and maintenance phase data for WCPM. The following formula was used to find *Phi:* 2(PAND) – 1 (Parker & Hagan-Burke, 2007b). This computation was validated with the SPSS crosstabs

module output which provides an option to calculate *Phi*. Since *Phi* is interpreted as a Pearson *r* for a 2 x 2 contingency table (Parker & Hagan-Burke, 2007a), effect size values of .10, .30, and .50 represent small, medium, and large effect sizes respectively. Details of these calculations are provided in Appendix E.

<div align="center">Social Validity</div>

In a seminal document on social validity, Montrose Wolf (1978) advocated that the research community validate its work in three areas of social validity. In the context of this study, the three areas were: (a) social significance of the research question, (b) social appropriateness of the study's methodology, and (c) social importance of the study's results. The first area addressed the question of whether or not an increase in reading fluency rate would benefit the following stakeholders: (a) school, (b) local educational agency, (c) the local community, and (d) society in general. This question is answered in the results section of this study.

The second area addressed the simple question of whether the results of the study justified the means to achieve them, i.e., was it worth it. This question was answered by examining one criterion as suggested by Schloss et al. (1992): the cost effectiveness of the program.

The final area of social validity addressed the question of whether the consumers, i.e., the students, found the program of benefit. The researcher conducted an informal interview with each of the three students by asking two simple questions: (a) What did they like about the computer-assisted repeated reading? and (b) What did they not like about the computer-assisted repeated reading?

Quality Indicators of Single-Subject Research

In an effort to evaluate whether this study met the quality indicators of single-subject research set forth by Horner et al. (2005) and determine if this study was "a credible example of single-subject research," the author used the rubric developed by Chard et al. (2009) for single-subject research designs. See Appendix C. The author, his dissertation chair, and another professor from the University of Central Florida, College of Education each filled out the rubric. The evaluators were asked to read the articles by Horner et al. (2005) and Chard et al. (2009) and then proceed to evaluate this research study. The evaluators assigned a score of 1, 2, 3, or 4 to each of the components of the seven quality indicators. For an evaluator's rubric, the components of each indicator were totaled and then an average was calculated. Using all three evaluators' scores for each indicator, an average rating was calculated for each quality indicator to determine if the research study was of a high caliber. Any rating three points or greater was considered acceptable and suggested the study would be considered single-subject research of high quality.

CHAPTER FOUR: RESULTS

Visual Analysis

The purpose of this study was to measure the effect computer-assisted repeated readings had on the reading fluency rate of students with mild intellectual disabilities. The results suggested that all three participants had a positive increase in reading fluency rate as a result of the computer-assisted repeated readings.

Student 1

Applying the phase level stability standard of 85% (Tawny and Gast, 1984), Student 1 achieved a stable baseline after seven fluency probes with a mean words correct per minute (WCPM) of 85. Baseline trend direction and stability were decreasing and variable. The introduction of the intervention resulted in a short latency as evidenced by a large and immediate change in level of his WCPM. His first intervention day (Session 8) saw an increase of 18 WCPM from the last day of baseline with an overall phase mean of 110 WCPM. Two data paths were observed during the course of the intervention. The initial trend was increasing but then transitioned to decreasing. There was a 7% overlap in WCPM between the baseline and intervention phases with the data showing no indication of leveling out at either the high of 130 WCPM or low of 87 WCPM. The transition to the maintenance phase at Session 23 saw a decreasing and variable trend with an overall phase mean of 99 WCPM. There was an 89% overlap in WCPM between the intervention and maintenance phases with the data again showing no indication of leveling out at either the high of 111 WCPM or low of 82 WCPM.

Student 2

Student 2 began the intervention at Session 12 after Student 1's four consecutive fluency probes that exhibited a strong accelerating trend within the intervention phase. Student 2's eleven previous sessions established a stable baseline with a mean of 79 WCPM. Baseline trend direction and stability were observed to be increasing and stable. The introduction of the intervention resulted in a short latency as evidenced by a small and gradual change in level of his WCPM. His first intervention day saw an increase of 9 WCPM from the last day of baseline with an overall phase mean of 94 WCPM. Zero celeration was observed across this phase as evidenced by the two data paths observed during the course of the intervention. The initial trend was increasing but then transitioned to decreasing. There was an 18% overlap in WCPM between the baseline and intervention phases with the data showing no indication of leveling out at either the high of 111 WCPM or low of 79 WCPM. The transition to the maintenance phase at Session 23 saw two distinct data paths in trend. The initial trend was decreasing but then there was a sharp increase. The mean for this phase was 84 WCPM. There was a 67% overlap in WCPM between the intervention and maintenance phases with the data again showing no indication of leveling out at either the high of 107 WCPM or low of 66 WCPM.

Student 3

Student 3 began the intervention at Session 15 after Student 2 showed an accelerating trend and positive effect after his first three fluency probes during the intervention. Student 3's fourteen previous sessions established a stable baseline with a mean of 78 WCPM. Baseline trend direction and stability were observed to be decreasing and stable. The introduction of the intervention resulted in a short latency as evidenced by a small and rapid change in level of his

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WCPM. His first intervention day saw an increase of 2 WCPM with the next two sessions

producing an increase of 18 and 11 WCPM respectively. The first three sessions saw an overall

increase of 29 WCPM. The intervention phase mean was 94 WCPM. Data trend during this

phase was increasing. There was a 75% overlap in WCPM between the baseline and

intervention phases with the data showing no indication of leveling out at either the high of 103

WCPM or low of 71 WCPM. The transition to the maintenance phase at Session 23 saw two

distinct data paths in trend. The initial trend was slightly decreasing and then shifted to slightly

increasing. Phase mean was 82 WCPM. There was a 100% overlap in WCPM between the

intervention and maintenance phases with the data showing no indication of leveling out at either

the high of 92 WCPM or low of 75 WCPM.

Table 5 lists student WCPM means for all phases. Figure 1 provides a visual graph of the

students' three phases. Tables 6 through 11 summarize the visual analysis details for each

student's set of phase line graphs.

Table 5. Phase Means and Standard Deviations

Student	M_B	SD_B	M_I	SD_I	M_M	SD_M
1	85	6.6	110	11.7	99	9.9
2	79	7.0	94	8.5	84	14.1
3	78	8.4	90	11.7	82	6.4

Note. M_B = Baseline Mean; SD_B = Baseline Standard Deviation
M_I = Intervention Mean; SD_I = Intervention Standard Deviation
M_M = Maintenance Mean; SD_M = Maintenance Standard Deviation
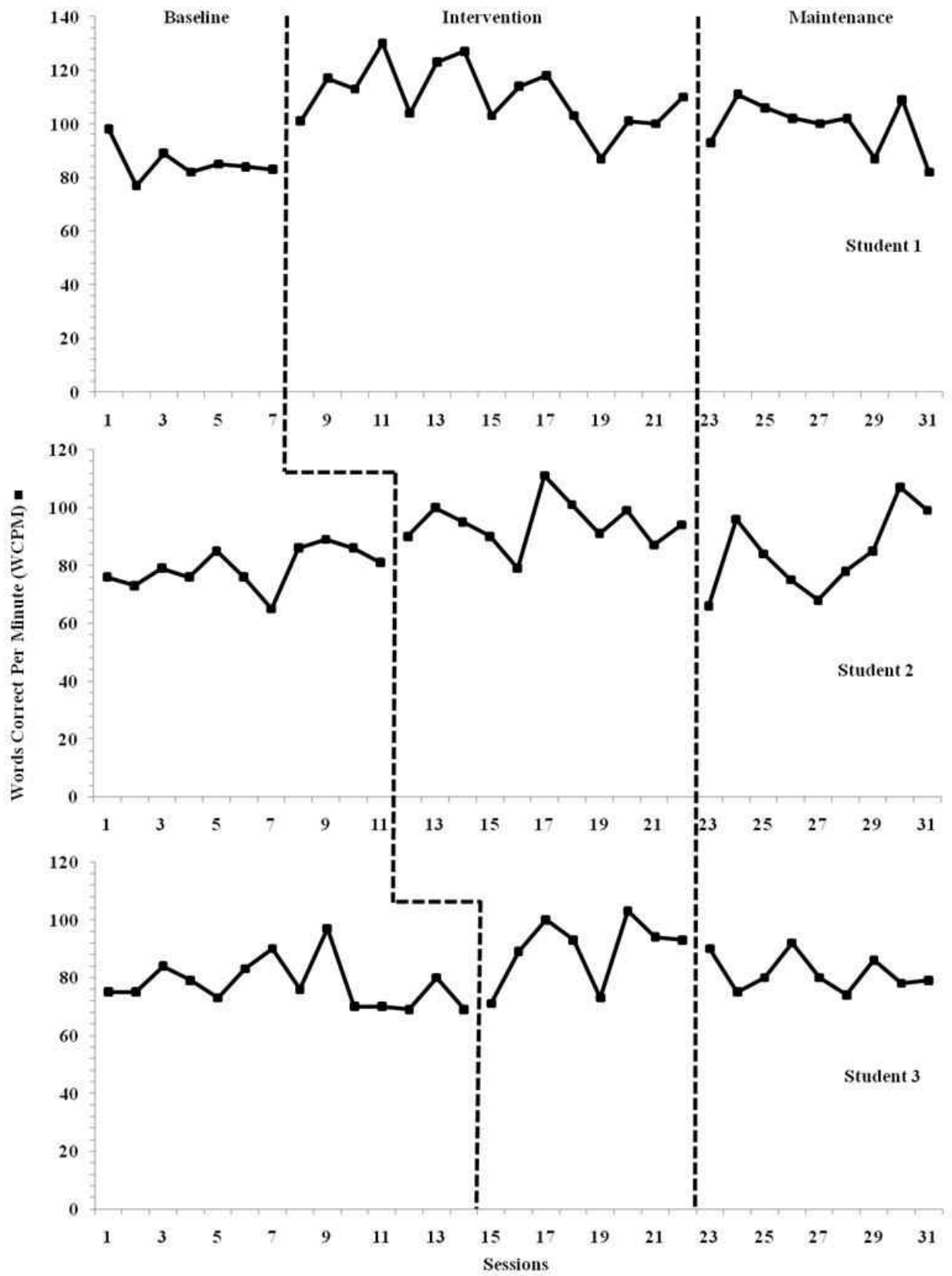
Figure 1. Student Words Correct Per Minute (WCPM)

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Table 6. Visual Analysis for Student 1 (within phase)

Phase	Baseline	Intervention	Maintenance
Phase Length (Sessions)	7	15	9
Estimate of Trend Direction (WCPM per session)	Decreasing (-1.25)	Decreasing (-1.06)	Decreasing (-1.47)
Trend Stability	Variable (71%)	Variable (67%)	Variable (56%)
Data Paths within Trend (WCPM per session)	Decreasing (-1.25)	Increasing to decreasing (.81 to -1.79)	Increasing to decreasing (.50 to -3.80)
Level Stability and Range (WCPM)	Stable 77-98	Stable 87-130	Stable 82-111
Level Change (WCPM)	98 – 83 (-15)	110 – 101 (+9)	93 – 82 (-11)

Table 7. Visual Analysis for Student 1 (between adjacent phases)

Phase Comparison	Comparing the Effects of the Intervention over Baseline	Comparing the Effects of the Maintenance over Intervention
Change in Trend Direction and Effect (WCPM per session)	Decreasing (-1.25) to Decreasing (-1.06) Positive	Decreasing (-1.06) to Decreasing (-1.47) Negative
Change in Trend Stability	Variable to Variable	Variable to Variable
Change in Level (WCPM)	(101 - 83) +18	(110 - 93) -17
Percentage of Overlap	7%	89%

Table 8. Visual Analysis for Student 2 Data (within phase)

	Baseline	Intervention	Maintenance
Phase Length	11	11	9
Estimate of Trend Direction (WCPM per session)	Increasing (.97)	Zero celeration (.03)	Increasing (2.83)
Trend Stability	Stable (91%)	Variable (82%)	Variable (56%)
Data Paths within Trend (WCPM per session)	Increasing (.97)	Increasing to Decreasing (1.06 to -1.80)	Decreasing to Increasing (-1.7 to 8.50)
Level Stability and Range (WCPM)	Stable 65-89	Variable 79-111	Variable 66-107
Level Change (WCPM	81 – 76 (+5)	94 – 90 (+4)	99 – 66 (+33)

Table 9. Visual Analysis for Student 2 Data (between adjacent phases)

	Comparing the Effects of Intervention over Baseline	Comparing the Effects of Maintenance over Intervention
Variables Changed	1	1
Change in Trend Direction and Effect	Increasing (.97) to Zero celeration (.03) Negative	Zero celeration (.03) to Increasing (2.83) Positive
Change in Trend Stability	Stable to Variable	Variable to Variable
Change in Level	(90 - 81) +9	(94 - 66) -28
Percentage of Overlap	18%	67%

Table 10. Visual Analysis for Student 3 Data (within phase)

	Baseline	Intervention	Maintenance
Phase Length (Sessions)	14	8	9
Estimate of Trend Direction (WCPM per session)	Decreasing (-.46)	Increasing (2.00)	Decreasing (-.68)
Trend Stability	Stable	Variable	Variable
Data Paths within Trend (WCPM per session)	Increasing to Decreasing (1.79 to -2.00)	Increasing (2.00)	Decreasing to Increasing (-.30 to .70)
Level Stability and Range (WCPM)	Stable 69-97	Variable 71-103	Variable 74-92
Level Change (WCPM)	75 – 69 (-6)	93 – 71 (+22)	90 – 79 (-11)

Table 11. Visual Analysis for Student 3 Data (between adjacent phases)

Phase Comparison	Comparing the Effects of Intervention over Baseline	Comparing the Effects of Maintenance over Intervention
Variables Changed	1	1
Change in Trend Direction and Effect	Decreasing (-.46) to Increasing (2.00) Positive	Increasing (2.00) to Decreasing (-.68) Negative
Change in Trend Stability	Stable to Variable	Variable to Variable
Change in Level	(71- 69) +2	(93 - 90) -3
Percentage of Overlap	75%	100%

Statistical Analysis

Using a crosstabs statistical module in the Statistical Package for Social Sciences (SPSS) with an *alpha* of .05, percentage of all non-overlapping data (PAND) between the baseline and intervention phases was computed to be 87.9%. The effect size index *Phi* was .76 which is considered a very large effect. Following these same procedures, PAND between the intervention and maintenance phases was calculated to be 70.5%. *Phi* was .40 which may be interpreted as a moderate to large effect size. A summary of PAND and effect sizes are listed in Table 12.

Table 12. Summary of PAND and Effect Size Statistics

	Baseline to Intervention	Intervention to Maintenance	P
PAND	87.9%	70.5%	< .01
Phi	.76	.40	< .01

Social Validity

In assessing the social validity of this study, three areas were examined as recommended by Wolf (1978): (a) the social significance of the research question, (b) the social appropriateness of the study's methodology, and (c) the social importance of the study's results. The research question was: Do computer-assisted repeated readings increase the reading fluency rate of middle school students with mild intellectual disabilities? Increasing the reading fluency rate of students with disabilities can potentially improve a student's reading score on the Florida Comprehensive Assessment Test (FCAT) which is the primary criterion for calculating a school's grade and adequate yearly progress (Florida Department of Education, 2008a, 2008b). Being an "A" school and making AYP are high priorities for any Florida public school. This in turn contributes to the school district's grade and AYP standing. An increase in reading fluency contributes to the student's ability to read and potentially fill out a job application so that he/she might become a productive member of the local community and society at-large.

The second issue of social appropriateness of the study's methodology answers the question of was it worth the cost. In this case, the *Corrective Reading* curriculum had already been in place. The computer-assisted repeated readings utilized a laptop and text to speech software

(TTS) which were provided by the researcher. The specific TTS, *Kurzweil 3000 Version 10*, was used because of its features including exceptional speech quality, highlighted words and sentences while reading, adequate text highlighting synchronized with voice output, and reading speed. Other TTS that have these functions could have been used. Existing desktop computers could be used in lieu of laptop computers. Estimated cost of this set up (laptop and software) would be approximately $1500. Less expensive computer hardware and TTS is available. When the cost of outfitting three to five students with a computer and TTS are compared to buying an integrated reading system network license for an entire school (e.g., $50,000 to $100,000), the cost of this intervention is nominal.

The final area of social validity addressed was the question of whether the students felt they got something out of it. The researcher informally assessed this aspect of social validity by asking the three participants two questions: (1) What did you like about the computer-assisted repeated reading, and (2) What did you not like about the computer-assisted repeated reading. In answer to the first question, all three participants responded that they enjoyed having their own laptop computer to use in class. To the second question, all three remarked that it (i.e., the computer-assisted repeated readings) got boring after about 10 minutes of reading the same thing over and over. However, they all stated they felt the computer helped them read better.

<u>Ratings of Quality Indicators of Single-Subject Research</u>

In an effect to contribute to the research for evidence-based interventions that meet the quality indicators of single-subject research for special education, the researcher voluntarily subjected his study to an evaluation using the rubric created by Chard et al. (2009) that was based on the quality indicators developed by Horner et al. (2005). Three individuals, one of which was the

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researcher himself, evaluated this study using the rubric found in Appendix C. Table 13 lists the

results of the evaluation. Based on the criteria set forth by Chard et al. (2009), the results

suggest that this study may qualify as "high quality single-subject research" (p. 275) which in

turn could be used as a research study that contributes to the declaration that repeated readings

qualifies as an evidence-based intervention.

Table 13. Quality Indicators' Average Ratings

Evaluator	Participants & Setting	Dependent Variable	Independent Variable	Baseline	EC/Internal Validity	External Validity	Social Validity
1	3.33	3.80	2.67	4.00	3.00	3.00	3.00
2	3.33	3.80	2.67	4.00	3.33	4.00	3.75
3	3.67	3.6	3.67	4.00	3.67	4.00	3.50
Average	3.44	3.73	3.00	4.00	3.33	3.67	3.42

Note. EC = experimental control. Adapted from "Repeated Reading Interventions for Students

With Learning Disabilities: Status of the Evidence," by D. J. Chard, L. R. Ketterlin-Geller, S. K.

Baker, C. Doabler, and C. Apichatabutra, 2009, *Exceptional Children, 75*, pp. 269-270.

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CHAPTER FIVE: DISCUSSION

<u>Overview</u>

The purpose of this study was to examine the effects of computer-assisted repeated readings on the reading fluency rate of middle school students with mild intellectual disabilities. Results of the study indicated that all three participants exhibited an increase in their reading fluency rate at their instructional reading level when computer-assisted repeated readings were initiated. This finding strongly suggests that the increase in words correct per minute (WCPM) was a result of the intervention. The strength of the relationship between the intervention and reading fluency rate was significant given the large effect size (.76). These findings are consistent with previous research that found repeated readings of text increases reading fluency rate (e.g., Alber-Morgan et al., 2007; Gile, 2009; Steventon & Fredrick, 2003; Strong et al., 2004; Tam et al., 2006; Weinstein & Cooke, 1992).

These results support the theoretical frameworks of LaBerge and Samuels (1974), Perfetti (1985), and Logan (1988, 1997) that repeated contact with the same words builds word fluency, i.e., automaticity. The use of computer-assisted repeated readings support the research that this instructional method is a viable approach to providing remedial or supplemental reading instruction to students with high incidence disabilities (Chard et al., 2002) of which students with mild intellectual disabilities are a subpopulation.

These results also support the findings of Chard et al. (2002) which indicated that modeled repeated readings (e.g., computer modeling) aided students with a low reading fluency rate. In this case, the use of text-to-speech software on a computer may provide a cost effective substitute for an instructional assistant when a student requires more intensive instruction in the

area of fluency. While one-on-one teacher modeling may be more effective, it may not be

economically practical. Consistent with recent studies (Biggs, Homan, Dedrick, Minick, &

Rasinski, 2008; Coleman, 2008; LeVasseur, Macaruso, & Shankwiler, 2008), the use of

technology may provide a fresh and motivating approach for remediating students' reading

fluency deficits that have been pinpointed without having to dedicate additional instructual

staff.

Perhaps the most significant finding in this study pertained to the area of transfer effects, i.e.,

the result of an individual's acquired skill to fluently read or comprehend new connected text

after previously re-reading other connected text (Therrien, 2004). The results support the

findings of Therrien, Wickstrom, and Jones (2006) suggesting that computer-assisted repeated

readings may improve a student's ability to effectively read new passages in an impromptu

manner.

Since the percentage of overlapping words has been noted as a contributing factor to transfer

effect, it is important to highlight this study's findings with respect to overlapping words. While

Rashotte and Torgesen (1985) reported that fluency gains may also be attributed to a high

overlap of words between intervention passages and probes, this study observed just the

opposite. The study's intervention passages and probes had a mean overlap of 19% which did

not negatively affect the fluency rate of the three students but rather may have contributed to an

increased fluency rate in all three students.

The implications of this study's transfer effect finding is especially significant given the

particular population of students with disabilities observed. Students with mild intellectual

disabilities generally have an IQ that is two to three standard deviations below the mean. This

clearly does not imply that they cannot learn to read unpracticed text fluently as well as learn to comprehend that text. Consequently, the results of this study are encouraging in that the use of computer-assisted repeated readings may increase their cognitive capacity to access both narrative (literature) and expository (academic subject matter) text. Two questions are inevitably raised at this point: (1) Will the technology be available, and (2) Will the teacher choose to use it? Although beyond the scope of this study, these are social justice questions that must be answered (Swain & Edyburn, 2007).

The choice of having a maintenance phase in this study was important in order to observe whether the effects of the computer-assisted repeated readings carried on after this intervention was terminated. During the maintenance phase, Student 1, 2, and 3's mean reading fluency rate decreased which suggests that the effects of the intervention did not maintain across time. However, the negative change in the mean fluency rate when the intervention was removed and the maintenance phase began was predictable given that the length of intervention phase was 15 sessions, 11 sessions, and 8 sessions for Student 1, 2, and 3 respectively. Had there been more sessions with the intervention, the maintenance phase may not have seen such a significant drop in mean fluency rate. The effect size calculated for the transition from the intervention to the maintenance phase was .40, a moderate to strong effect. Removal of the intervention appears to be reflected in that effect size index.

Reading at Grade Level

The increase in students' reading fluency rate is overshadowed by the fact that their reading fluency rate was significantly below the national performance norms for oral reading fluency. In their compiled National Oral Reading Fluency Norms, Hasbrouck and Tindal (2006) indicated

that sixth grade students are classified as reading at grade level if they are able to read an "unpracticed grade-level passage" (p. 640) between 140 and 160 words correct per minute on Similarly, eighth grade students are classified as reading at grade level if they are able to read between 141 and 161 words correct per minute.

Post-study fluency rate data for the Spring 2009 Florida Oral Reading Fluency (FORF) probe was provided to the researcher for Students 1 and 2. Student 3 data was not available due to his withdrawal from the school prior to the date the Spring 2009 FORF probe was administered. Table 14 provides a comparison between the students' recorded fluency rate on a grade level passage and the National Oral Reading Fluency Norms and the Florida Oral Reading Fluency Norms (Florida Center for Reading Research, 2006). The comparison indicates that Student 1 had read a grade level passage approximately 70 WCPM below the 50th percentile ORF national norm. Student 2 had read a grade level passage approximately 80 WCPM below the 50th percentile ORF national norm. In order for Student 1 to be reading 151 WCPM when he graduates from high school in six years, the 50th percentile considered to be "the normal, expected, and appropriate range for a student at that grade level at that time of year" (Hasbrouck & Tindal, 2006, p. 640), he would have to increase his fluency rate by 12 WCPM each year on an unpracticed grade level passage. In the same way, Student 2 would have to increase his fluency rate by over 21 WCPM every year in order to attain a proficient level of reading fluency by high school graduation.

Table 14. National and Florida Oral Fluency Norms Comparison for WCPM

		Oral Fluency Norm		
Student	Student Score	National	Florida	WCPM Gap
1	79	150 or more	147 or more	68 – 71
2	65	151 or more	147 or more	82 – 86

Study Limitations

There were several limitations in this study. First, the study occurred over a period of 67 days during which there were: (a) 31 research sessions that made up the baseline, intervention, and maintenance phases, (b) nine days of FCAT preparation and testing, (c) six weekends, and (d) nine student days off. The breaks between sessions may have impacted the effect of the intervention on the three students. The study may have benefited from a longer period of time to conduct intervention and maintenance phases as evidenced by the within-phase and between-phase data variability. The maintenance phase was limited to nine sessions due to a change in the students' class schedules.

A second limitation was the students themselves. One of them was on medication which may have impacted his performance. Although student absenteeism was not an issue, there were days when students were not feeling well or were generally having a bad day for reasons unknown to the researcher.

The availability of a distraction-free classroom for 100% of the intervention sessions was a third limitation. There were three occasions when the distraction-free classroom was not available. This limitation was highlighted in the researcher's *Phase Protocol Checklist for*

Computer-Assisted Repeated Readings outlined in Table 4. Realistically, no classroom is free of all distractions and this classroom had its share of distractions normally found in any instructional setting, e.g., outside noise and students talking amongst each other during group work.

The use of the percentage of all non-overlapping data (PAND) had its share of limitations. Parker et al. (2007) noted three limitations to the statistical method. First, PAND analysis is not recommended for single-subject design studies that have less than 20 data points but is highly recommended for multiple baseline designs having 60 to 80 data points. Second, the technique is not sensitive to the total absence of data overlap resulting in a PAND of 100% regardless of the range of data found in the two phases' data sets. Third, PAND does not control for positive baseline creep, i.e., the trend line for the baseline data has a small, positive slope. This positive baseline trend should be considered when examining the relationship between the independent and dependent variables. In this study, the within-phase analysis for Student 2 indicated baseline trend was positive (improving). However, level stability and range met the 85% criterion for a stable baseline allowing the researcher to initiate the intervention. In light of this improving trendline, a large effect size derived from PAND does not necessarily imply a change in fluency rate was due to the intervention (Parker et al., 2007).

Finally, even with a three person research team, the special education teacher and paraprofessional were not able to evaluate the integrity of the intervention implementation. This was limited to the researcher's procedural checklist which he filled out himself as previously outlined in Chapter 3.

<u>Future Research and Repeated Readings</u>

The favorable evaluation of this study using the rubric of Chard et al. (2009) highlights the potential that repeated readings may one day be considered an evidence-based practice based on the quality indicators outlined by Horner et al. (2005). What is required will be significantly more single-subject research that replicates this and other research designs in order to support the premise that repeated readings is an effective method of increasing reading fluency for both students with and without disabilities. To that end, the following list of ideas are offered as areas that should be examined for future single-subject research in the method of repeated readings:

1. Replicate this study across different grade levels and exceptionalities in order to contribute to the external validity of this intervention and establish computer-assisted repeated readings as an evidence-based intervention that meets the quality indicators of single-subject research in special education (Horner et al., 2005).

2. Examine the role of text in repeated readings at all grade levels (Hiebert, 2005; Hiebert & Fisher, 2005; Menon & Hiebert, in press). For example, Allington (2006) advocates the use of repeated readings in combination with daily reading of high interest and engaging texts across a spectrum of reading levels. The issue of text level (e.g., instructional vs. frustration) used to measure reading fluency rate needs to be further examined. While the current study used reading passages at the instructional text level, research needs to investigate the impact of using repeated readings using high interest passages at the student's frustration level.

3. Conduct computer-assisted repeated readings research that uses the quality indicators for special education technology as outlined by Gersten and Edyburn (2007) which are

based on those indicators developed by Gersten et al. (2005). Future research may want to develop a set of quality indicators for special education technology that uses single-subject designs based on the framework of Horner et al. (2005).

4. Examine how computer-assisted repeated readings affects fluency (accuracy and rate) and comprehension on expository text used in academic courses.

In developing research questions to the previous list of topics advocated for future study, the words of Schloss, Misra, and Smith (1992) seem most appropriate:

> In establishing an applied research question adaptable to single case experimentation, the essential goal should not be simply to increase or decrease the duration, latency, frequency, intensity, or topography of a response. To do so would simply add to basic research evidence of the effectiveness of empirical learning principles. Rather, the goal is to demonstrate that the application of these learning principles produce outcomes that are of value to the individual and society.…Research questions should go beyond simply asking the extent to which a procedure increases or decreases the performance of a given skill (p. 252).

Final Thoughts - The Remediation vs. Compensation Dilemma

The previous discussion of attaining the minimum WCPM, i.e., 50th percentile on the national norms, by high school graduation seems daunting. The students in this study increased their reading fluency rate by 25, 15, and 12 WCPM respectively. It is reasonable to say the increase in rate was the result of the computer-assisted repeated readings. The calculated effect size was large. These findings appear significant until you take into account that these increases were on unpracticed passages significantly below their grade level. Will these students ever attain

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proficiency in fluency on an unpracticed grade level passage? If not, what can be done? When

does remediating the reading problem stop and compensating for the reading problem begin

(Edyburn, 2004, 2006)? By way of illustration, the answer is simple but its implementation may

be more complex. For example, a student with a visual impairment cannot read printed material

because she cannot physically see it. She requires something that will compensate for her

blindness so she can read printed text. That something might be Braille or text-to-speech

software on a computer. Similarly, a student classified with an intellectual or reading disability

cannot read and understand printed material at the speed to which he is required in order to be

classified as a fluent reader. He needs something that will compensate for his inability to read

and comprehend printed text at grade level. That something might very well be text-to-speech

software. At some point in the academic career of a student with an intellectual or reading

disability, the decision must be made to cease remediating the disability and initiate

compensatory strategies, e.g., the use of assistive technology. The compensatory aspect of

technological assistance must not be neglected. Counteracting this is the legislative mandate to

place students not reading at grade level into intensive remedial reading programs (Florida

Secondary School Redesign Act, 2006). How can the requirements of the law and the needs of

the student both be met? One possible answer may be found in a program found at Landmark

College in Putney, Vermont. Billed as "America's premier college for students with learning

disabilities and attention deficit/hyperactivity disorder" (Landmark College, n.d.), the college

launched a pilot program in 1998 that integrated the use of assistive technology with an intensive

reading and writing curriculum in order to meet the needs of students with major problems in

reading and writing (Hecker, Burns, Elkind, Elkind, & Katz, 2002; Landmark College, 2009;

Meyer & Felton, 1999). A similar program for middle and high school students with reading disabilities may provide a remedy for what many school administrators view as the elusive fix for students with disabilities. To that end, the results of this study may be a catalyst to resolve the issue of when a student with reading disabilities should receive compensatory assistance rather than remediation for reading problems. It will be a matter of integrating the two so that the needs of the many may be met.

APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL DOCUMENTATION

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Initial Review and Approval

From : **UCF Institutional Review Board**
FWA00000351, Exp. 10/8/11, IRB00001138

To : **Mark Cerasale**

Date : **January 30, 2009**

IRB Number: SBE-09-06008

Study Title: **The Effects of Computer-Assisted Repeated Readings on the Reading Performance of Middle School Students with High Incidence Disabilities**

Dear Researcher:

Your research protocol noted above was approved by **expedited** review by the UCF IRB Chair on 1/30/2009. **The expiration date is 1/29/2010.** Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The category for which this study qualifies as expeditable research is as follows:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

The IRB has approved a **consent procedure which requires participants to sign consent forms.** Use of the approved, stamped consent document(s) is required. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at http://iris.research.ucf.edu .

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 01/30/2009 03:54:03 PM EST

Joanne Muratori

IRB Coordinator

January 26, 2009

Dear Parent/Guardian:

Your child has been selected by his/her teacher to participate in a study that is being conducted for dissertation research in conjunction with the University of Central Florida, College of Education. Your child was chosen because he/she is receiving 90 minutes of intensive reading instruction from Seminole County Public Schools as a child with a mild intellectual disability. Your child's identifying information has not been shared in any way with the researcher at this time.

The research project involves the use of text-to-speech reading software which will be used in your child's reading class. The study will take place for 15 minutes each day as part of their regular 90 minute reading class. The study will last for approximately 30-60 days during the second semester of the 2008-2009 school year.

The use of the text-to-speech software differs from the direct reading instruction method provided by his/her teacher in that it uses a laptop computer and text-to-speech software to help the student learn to read faster and with less mistakes. The use of the computer and text-to-speech reading software may be better, the same, or worse than the direct reading instruction method. You can expect your child to spend approximately 15 minutes out of the 90 minute reading class per school day using this computer-assisted reading program. Each day, after using the computer-assisted reading program, your child will read a selected passage for one minute to measure the number of words read correctly and incorrectly in one minute. This fluency rate information will be analyzed to determine the effect the computer-assisted reading program may have on your child's reading performance.

At the end of the study, I will interview your child by asking him/her two simple questions: (1) What did you like about the program? and (2) What did you not like about the program? The interview will be conducted in the classroom and will not be tape recorded.

With your consent, your child will use this software program under my direction, a doctoral candidate at the University of Central Florida as well as a former distinguished teacher at Sanford Middle School.

Your child's name, the names of his/her teachers, and the name of your child's school will be kept confidential and will not be used in any report, analysis, or publication. All identifying information will be replaced with alternate names or codes.

Participation in this study is not a requirement. Your or your child's refusal to participate in this study will not affect your or his/her relationship with his/her teacher or his/her grade in his/her reading class. Your child will be allowed the right to refuse to participate in this study at any time. There is no compensation for participating in this study.

Since a coding sheet will be used to match data, there is a breach of confidentiality risk associated with the study. This is a confidential study. Every effort will be made to maintain the confidentiality of you and your child. All information gathered from this study will be safeguarded under lock and key in my office. Parental consent and child assent forms will be stored separately in my office under lock and key. All information from this study will be destroyed three years after the completion of this study.

Study data and results will be shared with the Seminole County Public School Secondary Reading Administrator, Sanford Middle School Administrators, and the Sanford Middle School Reading Coach.

You may contact me at 407-484-8563 or by email at mcerasale@earthlink.net, or my professor, Dr. Suzanne Martin at 407-823-4260 or by email at martin@mail.ucf.edu. for any questions you have regarding the research procedures. Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (IRB). Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246, or by campus mail 32816-0150. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The telephone numbers are (407) 823-2901 and (407) 882-2276.

Sincerely,

Mark Cerasale
Doctoral Candidate
University of Central Florida

_____ I have read the procedure described on the previous page.

_____ I have received a copy of this form to keep for my records.

I voluntarily give my consent for my child, _____ , to participate in Mark Cerasale's study entitled, "The Effects of Computer-Assisted Repeated Reading on the Reading Performance of Middle School Students with High Incidence Disabilities."

_____/_____
Parent/Guardian Date

_____/_____
2nd Parent/Guardian Date
(or Witness if no 2nd Parent/Guardian)

My name is Mark Cerasale and I am a student at the University of Central Florida. I am interested in seeing if a computer software program that reads to you will help you to read better. On the first day, I will come and give you a one minute reading passage to determine your reading level. Once I determine your reading level, your reading teacher or I will give you a one minute reading passage every day after your 45 minutes of decoding class in order to determine how many words you can read in a minute. After at least five days, you will begin 15 minutes of reading on the computer after your 45 minutes of decoding class. After your computer reading, your reading teacher or I will give you a one minute reading passage to measure how many words you can read in a minute.

My study will take from 30 to 60 days.

Your name, the names of your teacher, and your school will be kept secret and will not be used in any report. You do not have to be in this study if you don't want to, and you can stop at any time.

_____ I want to participate in this study.

APPENDIX B: COPYRIGHT PERMISSION LETTER

Mark W. Cerasale
2879 Spring Heather Place
Oviedo, FL 32766-6619

July 18, 2009

Dear Dr. Chard,

This letter will confirm our recent email exchange in May 2009. I am completing a doctoral dissertation at the University of Central Florida entitled "The Effects of Computer-Assisted Repeated Readings on the Reading Performance of Middle School Students with High Incidence Disabilities." I would like your permission to reprint in my dissertation excerpts from the following:

Chard, D. J., Ketterlin-Geller, L. R., Baker, S. K., Doabler, C., & Apichatabutra, C. (2009). Repeated reading interventions for students with learning disabilities: Status of the evidence. *Exceptional Children, 75*(3), 263-281. This study examined research focused on determining the efficacy of repeated reading approaches for, improving reading fluency for students with or at risk for learning disabilities.

The excerpt to be reproduced is *Figure 1, Quality Indicators of Single-Subject Research Articles and Reports* on pp. 269-270 of the journal article. The excerpt to be adapted is *Table 1, Average Ratings for Single-Subject Research Articles on Repeated Reading* on p. 268 of the journal article. I have three individuals who will evaluate my research study. I will use the format of Table 1 to present the scores.
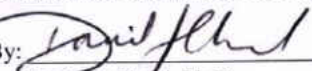
The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages, and to the publication of my dissertation on demand by UMI. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your signing of this letter will also confirm that you own or your company owns the copyright to the above-described material. If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you for your attention in this matter.

Sincerely,

Mark W. Cerasale

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

By: _____
David J. Chard, Ph.D

Date: 7/22/09

APPENDIX C: QUALITY INDICATORS OF SINGLE-SUBJECT RESEARCH ARTICLES AND REPORTS

Participants and Setting	1	2	3	4	Score
Sample characteristics (e.g., age, gender, disability, diagnosis)	No detail provided	Limited detail provided	Some detail provided	Ample detail provided	
Process for selecting participants	No description of selection process	Procedures described but not appropriate and/or with limited detail	Procedures described are appropriate but minimally described	Procedures were appropriate and adequately described	
Critical features of the physical setting	No description provided	Limited description provided	Some description provided	Detailed description provided to allow replication	
Dependent Variable (DV)	1	2	3	4	Score
Description of dependent variable	No description provided	Limited description provided	Some description provided but not operational	Operational description provided	
Measurement procedure	No procedure provided or no quantifiable variables	Procedure provided but no quantifiable variables	Procedure provided but only some variables quantifiable	Procedure provided and all variables quantifiable	
Measurement validity and description	No valid measures and description not replicable	No valid measures or description not replicable	Some measures valid; description is replicable	Measures are valid and description is replicable	
Measurement frequency	No repeated measures	Measurement repeated but very infrequently	Measurement repeated but infrequently	Measurement repeated frequently	
Data collected on reliability (minimal standards: IOA = 80%; Kappa = 60%)	No reliability data reported	Reliability data incorrectly collected or analyzed	Reliability data reported but minimal standards not met	Reliability data reported and minimal standards met	
Independent Variable (IV)	1	2	3	4	Score
Description of independent variable	Only name or vague description of IV provided	IV is described with little detail	Major components of IV provided with some detail (e.g., scripts provided)	All components of IV described in detail with efforts to communicate precision	
IV manipulation	IV is provided with no control	Little control exercised (e.g., monitor, scripts)	Condition assignment is planned	Random assignment to condition	
Fidelity of implementation	No measure of fidelity	Fidelity is monitored but not directly	Fidelity is monitored directly, but at large component level	Fidelity is monitored in detail with corrections provided when necessary	

Baseline	1	2	3	4	Score
DV measurement	DV not measured objectively	DV measured infrequently; data is missing or not stable	DV measured frequently but not stable	DV measured frequently and is stable before intervention	
Description of baseline condition	No description of baseline	Vague description of baseline	Baseline description detailed but limited	Baseline description detailed and extensive	
Experimental Control/Internal Validity	**1**	**2**	**3**	**4**	**Score**
Design demonstrates experimental effect	No demonstration of experimental effect	Only one demonstration of experimental effect	More than one demonstration of experimental effect	Three or more demonstrations of experimental effect	
Design controls for common threats to internal validity (e.g., elimination of rival hypotheses)	No control for threats to validity	Few threats controlled	Most threats controlled	All threats controlled	
Pattern of results	Results do not suggest experimental control	Results suggest a change in trend, level, or variability	Results document a change in trend, level. or variability	Results document a pattern of experimental control	
External Validity	**1**	**2**	**3**	**4**	**Score**
Replication of effects (e.g.. across participants, settings. or materials to establish external validity)	No efforts to replicate efforts	Few replications attempted	Some replication attempted	Multiple replications across variables	
Social Validity	**1**	**2**	**3**	**4**	**Score**
Importance of DV	No importance			Important	
Importance of magnitude of change in DV	No importance	Somewhat important	Important	Very important	
Practicality and cost effectiveness of implementation of IV	Impractical and not cost effective	Either practical or cost effective, but not both	Some evidence of practicality and cost effectiveness	Practical and cost effective	
Typical nature of implementation of IV	IV implemented in atypical manner	IV implemented either in typical context or by typical agent, not both	Implementation extended in somewhat typical contexts and with a somewhat typical agent (e.g., certified teacher)	Implementation extended in typical contexts with typical agents (e.g., the certified teacher)	

Note. From "Repeated Reading Interventions for Students With Learning Disabilities: Status of the Evidence," by D. J. Chard, L. R. Ketterlin-Geller, S. K. Baker, C. Doabler, and C. Apichatabutra, 2009, *Exceptional Children, 75*, pp. 269-270. Copyright 2009 by the Council for Exceptional Children. Reprinted with permission.

APPENDIX D: STUDENT DATA

Student 1 Data

Session	Bwcpm	Iwcpm	Mwcpm
1	98		
2	77		
3	89		
4	82		
5	85		
6	84		
7	83		
8		101	
9		117	
10		113	
11		130	
12		104	
13		123	
14		127	
15		103	
16		114	
17		118	
18		103	
19		87	
20		101	
21		100	
22		110	
23			93
24			111
25			106
26			102
27			100
28			102
29			87
30			109
31			82

Bwcpm = Baseline words correct per minute

Student 2 Data

Session	Bwcpm	Iwcpm	Mwcpm
1	76		
2	73		
3	79		
4	76		
5	85		
6	76		
7	65		
8	86		
9	89		
10	86		
11	81		
12		90	
13		100	
14		95	
15		90	
16		79	
17		111	
18		101	
19		91	
20		99	
21		87	
22		94	
23			66
24			96
25			84
26			75
27			68
28			78
29			85
30			107
31			99

Iwcpm = Intervention words correct per minute

Student 3 Data

Session	Bwcpm	Iwcpm	Mwcpm
1	75		
2	75		
3	84		
4	79		
5	73		
6	83		
7	90		
8	76		
9	97		
10	70		
11	70		
12	69		
13	80		
14	69		
15		71	
16		89	
17		100	
18		93	
19		73	
20		103	
21		94	
22		93	
23			90
24			75
25			80
26			92
27			80
28			74
29			86
30			78
31			79

Mwcpm = Maintenance words correct per minute

APPENDIX E: CALCULATIONS FOR PERCENTAGE OF ALL NONOVERLAPPING DATA

The following procedures for calculating PAND and *Phi* for data from a multiple baseline across subjects design were adapted from p. 103 of Parker and Hagan-Burke (2007b).

The PAND/*Phi* analysis procedure was by crosstabs analysis using the *Statistical Package for Social Sciences (SPSS) Version 15* with data being prepared in *Microsoft Excel*^{TM} *2007* prior to inserting them into *SPSS*. Two separate *Excel* worksheets were used to set up data for phase comparison: baseline/intervention (A/B) worksheet and the intervention/maintenance (B/C) worksheet. The directions that follow apply to both worksheets except where noted.

Five variable columns were created: *Session, Series, ABPhase, Score,* and *Sorted*. *Session* contained serial numbering for each series. *Series* contained a different categorical tag for each parallel series. Since there were three study participants, there were three series (e.g. I, II, III). *ABPhase* was dichotomous containing labels (A, B or B, C) for the two contrasted phases. *Scores* contained original scores from all series. *Sorted* was an empty column in the spreadsheet where results from a sort were later pasted. Refer to Appendix C for the original data sets.

Step 1. Copy *ABPhase*. Using *Excel*, the original data were set up with *Session* ascending (1, 2, 3, etc.), *Series* ascending (I, II, III), and *ABPhase* ascending (A, B) for each series (i.e., each student data set). With the worksheet properly set up, contents of *ABPhase* were copied and held in computer memory or pasted in a separate column so that the data in this column would not be corrupted by any sorting. See Table 15 for an abridged version of the *Excel* file setup for the baseline/intervention PAND/Phi calculations. See Appendix C for the original data sets.

Table 15. Abridged *Excel* Spreadsheet Setup for Baseline/Intervention Student Data

Session	Series	ABPhase	Score	Sorted				ABPhase Copy
1	I	A	98					A
2	I	A	77					A
3	I	A	89					A
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
22	I	B	110					B
1	II	A	76					A
2	II	A	73					A
3	II	A	79					A
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
22	II	B	94					B
1	III	A	75					A
2	III	A	75					A
3	III	A	84					A
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
22	III	B	93					B

Step 2. Priming the Sort Engine: The sort engine had to be primed to properly count tied data across phases. Priming was accomplished through a nested sort of *Session* within *Series*. *Series* was selected as the first variable and *Time* as the second. In this nested sort, since fluency rate scores were expected to improve with the intervention, *Series* was sorted ascending, or top-to-bottom in increasing size, but *Time* was sorted inversely (descending). When comparing the maintenance phase to intervention phase, *Scores* were expected to decrease from one phase to the next so *Series* was sorted ascending, and the nested *Time* was also sorted ascending.

Step 3. Main Nested Sort: This second sort also was nested: *Score* within *Series*. For the
baseline to intervention phase comparison, scores were expected to improve so both variables
were sorted ascending. For the intervention to maintenance comparison, scores were expected to
decrease across phases so nested *Score* was sorted descending.

Step 4. The *ABPhase* data being held in memory (copied in step 1 above) was pasted into the
empty *Sort* column.

Step 5. Using *SPSS*, a crosstabs analysis was conducted on the *ABPhase* and *Sort* columns.
SPSS output for the baseline/intervention and intervention/maintenance phase comparison is
displayed in Figures 2 and 3. They include a 2 x 2 table of proportions and a *Phi* effect size
calculated at an *alpha* of .05.

ABPhase * Sorted Crosstabulation

			Sorted		Total
			0	1	0
ABPhase	0	Count	28	4	32
		% of Total	42.4%	6.1%	48.5%
	1	Count	4	30	34
		% of Total	6.1%	45.5%	51.5%
Total		Count	32	34	66
		% of Total	48.5%	51.5%	100.0%

PAND = 42.4% + 45.5% = 87.9%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.757	.000
	Cramer's V	.757	.000
N of Valid Cases		66	

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Figure 2. SPSS Output for PAND and *Phi* for Baseline/Intervention Phase Comparison

BCPhase * SortedBC Crosstabulation

			SortedBC		Total
			0	1	0
BCPhase	0	Count	25	9	34
		% of Total	41.0%	14.8%	55.7%
	1	Count	9	18	27
		% of Total	14.8%	29.5%	44.3%
Total		Count	34	27	61
		% of Total	55.7%	44.3%	100.0%

PAND = 41.0% + 29.5% = 70.5%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.402	.002
	Cramer's V	.402	.002
N of Valid Cases		61	

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Figure 3. SPSS Output for PAND and *Phi* for Intervention/Maintenance Phase Comparison

APPENDIX F: INTEROBSERVER AGREEMENT CALCULATION FOR FLUENCY PROBES

	Words Correct	Words Incorrect	Totals	
Researcher				
Reading Teacher				
Agree				
Disagree				
Words Percent Agreement				Overall Agreement

Calculation of Percent Agreement:

1. Record Researcher scores in first row.

2. Record Reading Teacher scores in second row.

3. Record the number on which they agreed on the third row.

4. Record the number on which they disagreed on the fourth row.

5. Calculate the Words Percent Agreement for Words Correct and Words Incorrect by using the

formula: $\text{Percent Agreement} = \dfrac{Agreement}{Agreement + Disagreement} \times 100$

6. Sum the Words Correct and Words Incorrect agreements and disagreemetns to find row totals

for each. Use the third and fourth rows.

7. Calculate the Overall Percent Agreement using the following formula:

$\text{Total Percent Agreement} = \dfrac{Total\ Agreement}{Total\ Agreement\ +\ Total\ Disagreement} \times 100$

Sample Calculation

	Words Correct	Words Incorrect	Totals	
Researcher	65	3	68	
Reading Teacher	64	2	66	
Agree	64	2	66	
Disagree	1	1	2	
Words Percent Agreement	98	67	**97**	**Overall Agreement**

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