Combining explicit fluency instruction with GarageBand digital recording of repeated readings

Teresa S. Riechers

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Combining Explicit Fluency Instruction with GarageBand

Digital Recording of Repeated Readings

By

Teresa S. Riechers

A Graduate Field Experience

Submitted in Partial Fulfillment of the

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Abstract

This action research examines the effect of combining explicit fluency instruction with GarageBand digital recording of repeated readings. Three intermediate-aged students met individually with an instructor for twelve one-hour sessions where they received tutoring on the characteristics of good fluency. In addition, students used the GarageBand program to make digital audio recordings of their repeated readings. The findings showed gains in accuracy and reading rate for all three students and slight gains in comprehension for two of the students.
ACKNOWLEDGEMENTS

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I dedicate this work to my parents, Walter and Sharon Storch, who with great love taught me to work hard, and to do my best in all things.

I also wish to thank my wonderful husband, Ronald and my children, Mark and Emily, for their constant love and support. From them I have learned to dream big and to never give up. I dearly love you all.
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CHAPTER ONE

This thesis is a report of an action research study done to explore the effectiveness of an after school tutoring intervention that combined intensive fluency instruction with computer audio recording of repeated readings. First the chapter begins with an explanation of my reasons for studying reading fluency. Next is a description of the background and need for a system of fluency instruction that combines explicit teaching with regular practice of newly learned fluency skills. The chapter continues with a discussion of the need to utilize computer technology in reading instruction particularly making use of such computer applications as GarageBand audio recording. Next the research question is presented followed by a brief description of the research design. Finally, limitations for the study are given followed by the chapter conclusion. A list of key terms is presented at the very end of the chapter.

Motivations For Studying Reading Fluency

I understand first hand the humiliation and despair that goes with not being able to read. My first motivations to be a teacher came from trying to help two of my siblings who struggled in school and had developed a dislike for any school work that involved reading. Despite my best efforts to help them from home and with little help from school, both siblings’ reading difficulties continued to be a problem that has impacted both their self-esteem and career opportunities. I have been determined to find out how it was possible that I mastered reading and became an avid reader, and my siblings who came from the same loving home, attended the same school, and had the same teachers could
not master reading. Their difficulties have greatly inspired me as an educator to study how reading is acquired and to develop research based methodology to help the many people with reading challenges I encounter in my work as an educator.

**Background and Need**

In my work, I am frequently called upon to work with students in the intermediate grades that are struggling with reading fluency issues such as difficulty with word recognition, slow reading rate, and inability to read with expression. Many of these students need reading practice, but fail to do so because they have developed a dislike for what has become a challenge for them. As the years go by, the consequences of being a non-fluent reader grow exponentially as reading in the content areas becomes increasingly complex. A 1995 National Assessment of Educational Progress (NAEP) report on oral reading found that 44% of fourth graders in the sample scored at the lowest fluency ratings and read grade level text at word per minute rates of 89 or below (Pinnell et al., 1995). Research has identified a relationship between low fluency ratings and lower scores on general measures of reading achievement (Pinnell et al., 1995). To further highlight the problem, 2009 NAEP assessment results show that 67% of fourth graders are functioning below proficiency levels in reading. 83% of these children are from low-income homes and 85% of these children attend school in a high poverty area (NAEP, 2009). These statistics suggest that there may be millions of low-income children that are currently at risk of dropping out or failing to graduate from high school on time because their learning has been greatly impaired by poor reading (Annie E. Casey Foundation, 2010).
More positively, helping students to improve their oral reading fluency has been found to improve overall reading proficiency and lead to gains in comprehension (Baker et al., 2008). In the report of the National Reading Panel, fluency was listed as one of five critical components of reading alongside phonemic awareness, phonics, vocabulary, and comprehension (National Reading Panel, 2000). As an important component of reading instruction, it is important to clarify what reading fluency is. Fluency is an attribute of oral reading characterized by a reader’s ability to read with correct phrasing, adhere to the author’s syntax, and read with appropriate expressiveness (NAEP, 2002). Good readers who have mastery of fluency are able to consistently and evenly integrate such skills as pausing in response to punctuation, phrasing text into meaningful breaks, using intonation, and instinctively putting stress on words within a sentence. Once students are able to integrate such skills, they are better able to think about the meaning of text (Pinnell & Fountas, 2009).

It is essential that teachers regularly assess the fluency development of their students and provide a balanced reading program that promotes fluency growth. Fluency progressively develops from mastering letter/sound relationships and phonics knowledge to word learning skills (Speece & Ritchey, 2005; Eldredge, 2005). In order to be fluent, students must be able to break through the surface structure of text. That is, students must be able to decode words, understand the meaning of words, read words automatically, and read with appropriate expression. As students practice reading they learn how prosody or expressiveness in oral reading affects meaning (Rasinski, 2009). Since the ultimate purpose of reading is to comprehend the printed word, teachers need to focus on
instruction that leads to rich, in depth development of word knowledge and helps students to think critically about what they are reading (Tannenbaum, Torgesen, & Wagner, 2006; Applegate, Appelgate, & Modla, 2009).

In addition to understanding fluency skill development, teachers need to know about effective methodology for supporting fluency growth. Methods such as repeated reading, echo reading, phrase drill error correction, and listening passage preview have all been found to support fluency growth (Rasinski, 1990; Homan, Klesius, & Hite, 1993; Martens et al., 2006). Comprehensive approaches that combine multiple strategies like repeated reading, sound/word boxes, and phrase drill correction have effectively promoted fluency growth with struggling students (Rasinski, 1990; Devault & Joseph, 2004; Martens et al, 2006). The primary goals in fluency instruction should be to allow students to hear fluent reading regularly and to provide additional practice with appropriate leveled materials that are interesting to them (Johns & Berglund, 2010).

**Incorporating Computer Technology Into Reading Instruction**

Including enough practice opportunities in the busy school day can be a challenge. With the prevalence of computer technology in schools today, it makes sense to utilize computer technology to help students to practice oral reading. One way to accomplish this is to use an Apple software application, called GarageBand, which allows users to record podcasts and music. Using this application, it is possible for students to easily make and store digital recordings of repeated readings independently of the teacher. Teachers and students can listen to and discuss ways to improve future repeated reading recordings. While specific
studies using this application of computer audio recording to support fluency development are unknown to this researcher, there have been recent studies done that show positive gains in reading achievement with the use of computer assisted instruction with elementary and middle school struggling readers (Knezek & Christensen, 2007; Macaruso & Rodman, 2009; Lewandowski, Begeny, & Rogers, 2006). One study on the utilization of computer technology found that gains in reading achievement were greatest when teachers received adequate training and support on how to implement the computer technology into their existing curriculum (Savage et al., 2010). In the next section, I will present my research question and briefly explain my study design.

**My Research Question and Study Design**

My work as a substitute teacher and tutor has allowed me to be in many elementary and middle school classrooms. I have observed that one of the greatest needs in providing adequate fluency instruction and practice is time in the busy school day. As efficient time managers for our students it is wise to explore the options provided by computer technology. Many students that struggle with fluency issues in the intermediate grades do not have the motivation or interest to practice their oral reading enough to make the necessary gains. Such students also need more explicit fluency instruction and time to practice.

The goal of my study was to develop a one-hour after school intervention for students who struggle with fluency issues. Struggling students benefit from one to one support and supervision of oral reading practice to help them achieve the necessary fluency levels needed to function successfully at their grade level (Conderman & Strobel, 2008; Vadasy, Sanders, &
Peyton, 2005). My goal was to find out if one-hour tutoring sessions that combined intensive fluency instruction with GarageBand audio recording of repeated readings would be an effective intervention for intermediate-aged struggling readers. Developing such an intervention will enable me to offer a research-based after school tutoring option for the students in my area. This tutoring option is in line with Wisconsin Core Standards (2010) for fluency development:

Students should read with sufficient accuracy and fluency to support comprehension, read on-level text with purpose and understanding, read on-level prose and poetry orally with accuracy, appropriate rate, and expression on successive readings, and use context to confirm or self-correct word recognition and understanding, rereading as necessary (p. 17).

Using a collection of fluency developing materials, a Mac computer with GarageBand application, and a USB snowball microphone, I set up a study that sought to answer the following question:

How does combining intensive fluency instruction with computer digital recording of repeated readings improve the fluency and comprehension growth of three intermediate aged struggling readers?

The study was designed to be an after school tutoring opportunity for students struggling with reading fluency. Three male students, one third grader and two fourth graders, were referred to me through reading specialists at the schools I sub for. The students met with me individually during the months of April, May, and June 2011 at my learning center/office. After the pre test was administered, each student met with me for a
total of twelve one-hour sessions. Each session included a 30-minute fluency lesson addressing such skills as paying attention to punctuation, chunking word phrases, reading dialogue, and reading with emotion. Following the lesson, each student using the USB snowball microphone and the GarageBand application on a Mac computer, audio recorded himself while practicing repeated readings. After audio recording the repeated readings, the student and I filled out monitoring and feedback sheets, discussed how the reading sounded, and planned how to improve readings for the next time. Following each session I listened to the student’s reading to evaluate and plan the next fluency lesson. After the twelve lessons were completed, the study concluded with post testing. In the next section, there is a discussion of the limitations of this study.

Limitations

This study was an exploration of best practices to build fluency in intermediate-aged students by combining explicit fluency instruction with GarageBand audio recording of repeated readings. The study was limited to just three students. In addition, the study took place after school at the end of the 2010-2011-school year and unfortunately was interrupted by end of the year activities, Memorial Day weekend, and the beginning of summer break. We did persist and completed the necessary number of sessions, but lost some of the continuity that would have been present if we could have done all the sessions in a closer span of time. The next section will continue with a conclusion to this chapter.

Conclusion

My inspiration to become a teacher came from watching my family members as they
struggled through life with unresolved reading problems. In my work as a reading teacher, I find many students develop a dislike for school and learning because they are frustrated and humiliated with unresolved reading difficulties. Many students struggle because they have not developed the automaticity required to be fluent readers (Samuels, 2006). Fluency is one of the key elements of skilled reading along with identifying words and constructing meaning. Mastering fluency is the bridge to becoming a proficient lifelong reader (Johns & Berglund, 2010). It is hypothesized that combining explicit fluency instruction with Garage Band audio recording of repeated readings is an efficient and motivating way to help struggling students to cross the bridge to proficient reading. The next chapter will continue with a literature review about fluency development and how to support fluency growth.
Key Terms

**Computer Assisted Instruction** – educational use of computers where instruction is presented through a computer program to a passive student or the computer is the platform for an interactive and personalized learning environment (“Computer-assisted instruction,” 2011).

**Echo Reading** – a research-based method where the teacher models oral reading by first reading short segments of text and then has the students “echo” what was just read (Caldwell & Leslie, 2009).

**GarageBand audio recording** - a software application for Mac OS X and iOS, developed by Apple Inc. that allows users to make digital recordings. Typically the application is used to create music and podcasts. (“GarageBand audio recording,” 2011).

**Listening passage preview** – a fluency training method where the student follows along silently while an accomplished reader reads the passage aloud. Then the student reads the passage aloud receiving corrective feedback. (“Listening passage preview,” 2011).

**Phrase drill error correction** – a fluency training method where the student reads a passage and the teacher records error word phrases on index cards. The teacher then has the student read the phrases on the index cards until the student can read all of them correctly. (Joseph, n. d.)

**Reading comprehension** – a transaction where a reader using life experience and purpose actively constructs the meaning of the printed page. Basic skills required to actively construct meaning include activating prior knowledge, setting the purpose for reading,
predicting, decoding text, summarizing, visualizing, questioning, monitor understanding, clarifying, and reflecting (Wilhelm, 2011).

**Reading fluency** - that part of the reading process where the reader processes the surface levels of the text (Rasinski, 2009). Pertaining to both oral and silent reading, fluency has four components that include: speed, accuracy, appropriate expression (also known as prosody), and comprehension. On the continuum of reading development, fluency bridges a students’ ability to identify words and understand the text (Johns & Berglund, 2010). Students are fluent readers when they can apply the skills of pausing in response to punctuation, divide text into meaningful phrases, make use of intonation and stress, and read at an appropriate pace. When students have successfully integrated these fluency skills, reading becomes automatic and they are able to focus on comprehension of the text (Pinnell & Fountas, 2009).

**Repeated reading** – a well-researched practice for increasing fluency ability that has the student orally reread short passages until the desirable fluency skills have been attained. Typically the teacher provides guidance and feedback as the student practices the readings (Caldwell & Leslie, 2009).

**Sound/Word Boxes** – also known as Elkonin Boxes, the teacher says a word and asks the student to write the letter(s) for each sound heard in a row of boxes on the worksheet. This technique supports the development of phonological awareness by helping students to segment words into their constituent sounds (Caldwell & Leslie, 2009).
CHAPTER 2

Federal efforts at improving education in the United States like the No Child Left Behind Act of 2001 (NCLB) and the Race to the Top competition set up by the American Recovery and Reinvestment Act of 2009 have put pressure on school districts to develop research based reading programs that narrow achievement gaps and insure that all students score in the proficient range on state achievement tests by the year 2014. The National Reading Panel (2000) identified fluency as one of five necessary components of reading along with phonemic awareness, phonics, vocabulary, and comprehension. Problems with achieving fluency in the elementary grades have been demonstrated by a National Assessment for Educational Progress study (2002) that showed 40% percent of fourth grade students who received low fluency ratings as also receiving scores in the lower ranges for overall reading achievement. It was also found in this same study that only 10% of the fourth graders tested were able to read the reading selection with appropriate levels of accuracy and expression (NAEP, 2002). These results suggest the need for teachers to provide an efficient research based system of fluency instruction and oral reading practice that promotes the development of proficient levels of reading fluency in the elementary years.

This literature review will address three areas related to helping teachers to understand fluency development and how to best integrate fluency instruction into the school curriculum. The first section will address research related to understanding what skills are needed for successful fluency development and how fluency ability is linked to successful reading. The second section will focus on research studies about best practices and
combinations of practices for teaching fluency. Finally, the third section will discuss research related to integrating computer technology into reading/fluency instruction.

**Skills Needed for Successful Fluency Development**

Planning effective fluency instruction starts with establishing what skills and sub skills are the necessary components of fluency and the ways in which these skills develop in children. Since the main purpose of reading is to comprehend, it is important to understand how fluency is linked to comprehension. The first study reviewed is Speece and Ritchey (2005), which is a longitudinal study that examined patterns of oral reading growth in at-risk and not at-risk first grade children. The second study reviewed, Eldredge (2005), also reviewed and correlated various skills proposed to be sub skills of fluency in first, second, and third grade children. The last two studies in this section explore the link between fluency and comprehension. Tannenbaum, Torgesen, and Wagner (2006) described the connections between fluent word knowledge and comprehension, and Applegate, Applegate, and Modla (2009) compared students’ fluency rates with their comprehension abilities.

Speece and Ritchey (2005) point out the lack of research describing just what factors affect fluency development in the young child. The purpose of their study was twofold. First, they wanted to show patterns of growth in the oral fluency development of a combined sample of at-risk and typically developing first grade children. Secondly, they wanted to identify predictors of growth and level of fluency of the at-risk children.
The units of analysis were fluency and correlates of oral reading fluency growth, which include Rapid Automatized Naming, phonological awareness, word reading efficiency, IQ, teacher ratings of classroom behavior, basic reading skills, and student background. Fluency was measured with a letter sound fluency assessment and leveled reading passages. Rapid Automatized Naming was assessed with the Rapid Automatized Naming Objects subtest from the Comprehensive Test of Phonological Processing (CTOPP: Wagner, Torgesen, & Rashotte, 1999). Phonological awareness was measured with the Blending and Elision subtests of the CTOPP. Word recognition was assessed using the Word Reading Efficiency subtest of the Test of Word Reading Efficiency (WRE; Torgesen, Wagner, & Rashotte, 1999). Intelligence was measured using four subtests of the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974). In addition, teachers rated student classroom behavior using the Social Skills Rating Scale-Teacher Version (SSRS; Gresham & Elliot, 1990), basic reading skills were measured with the Basic Reading Skills cluster of the WJ-R (Woodcock & Johnson, 1989), and background variables such as mother’s education and chronological age were provided from parent survey.

The data was organized and analyzed using a growth curve analysis to model the growth in oral reading fluency. A second set of analyses was done to compare the differences in growth and level in May between the at-risk sample and the not-at-risk sample. The third set of analyses examined the first and second grade at-risk sample to see if predictions about final level and oral reading fluency could be made using the correlates of growth that were assessed.
The sample consisted of a total of 276 first grade students that were divided into two cohorts of first grade students in two consecutive academic years. The students were enrolled in one of three demographically comparable suburban schools in the Mid-Atlantic States. After giving all first grade students a letter sound fluency assessment, students were identified as at-risk or not-at-risk. Students were identified as at-risk if their performance was at the 25th percentile of their class. The not-at-risk sample included five students from each class who were performing at the 30th, 50th, 75th, and the 90th percentiles of their class. Students in the at-risk group consisted of 140 children, and students in the not-at-risk group consisted of 136 children. The at-risk group was followed to second grade to provide the longitudinal sample. No significant differences were found between the original sample and the 106 children available to participate in the study in second grade.

To implement the study, fluency measures were administered to all first grade students across 20 weeks from January to May. These same measures were administered weekly in one school, weekly for the first six weeks and then monthly for the remainder of the year in the second and third schools. The other measures were given throughout the year. Oral reading fluency measures were given weekly or monthly in second grade across 34 weeks from November to May.

Results for the combined sample of at-risk and not-at-risk students showed the predicted May oral reading fluency level as 38.17 words per minute and the weekly rate of growth as 1.13 words. The predicted May oral reading fluency level 56.91 words per
minute for the not-at-risk group and 36.92 words per minute for the at-risk group. The not-at-risk group’s predicted weekly rate of growth was 1.50 words per minute increase per week and, the at-risk group’s predicted rate was 0.77.

First grade growth models for the at-risk sample reflected an increase in fluency growth across the second half of the year with an overall gradual acceleration of growth. The conditional growth model of oral reading fluency showed the January oral reading fluency scores, January letter sound fluency scores, and academic competence highly predictive of end of the year oral reading fluency performance.

Second grade growth models showed that the average second grade May oral reading fluency score was 48.01 words per minute, and the predicted weekly rate of growth was 0.77. While the at risk students had doubled the number of words they could read in 1 minute from first to second grade their rate of progress had slowed from 1.13 words per minute to 0.77 words per minute by the end of second grade.

Speece and Ritchey (2005) concluded that the growth curve models in this study indicate that oral reading fluency in young children is complex and develops gradually. Their research indicates that by the end of first grade, students identified as at-risk were reading less than half as many words per minute and growing at about half the rate of their non-at-risk peers. Students’ growth in second grade was found to be less than one word per week improvement. Speece and Ritchey confirmed their hypothesis that letter sound fluency was a predictor of oral reading fluency in May for both first and second grade
students in the study. For second grade, their research shows that word level skills become better predictors of fluency. In addition, first grade oral reading fluency levels were demonstrated to be predictive of second grade oral fluency levels. Speece and Ritchey found rapid automatized naming and phonological awareness to be less predictive and suggested this as being due to the number of other variables related to the reading task that were also included in the analyses. Despite the limitations of not doing the predictive analyses with the not-at-risk group, the research from this study shows that reading fluency problems appear early in reading development which suggests the need to include fluency instruction in the earliest stages of reading development.

Speece and Ritchey (2005) found that by the end of first grade young at-risk children are already reading less than half as many words and growing at half the rate as their not-at-risk peers. In first grade, letter sound fluency is predictive of later fluency development whereas in second grade word recognition becomes predictive for later fluency growth. Despite the limitation of not including the non-at-risk group in the longitudinal sample, this study suggests the importance of supporting the development of fluency in the early grades particularly in the areas of letter sound fluency and word recognition. Eldredge (2005) further adds to the research base on components of fluency development including an examination of some of the causal relationships in fluency development.

Eldredge (2005) points out that current definitions of fluency fail to include its component parts and sub skills. For this study he chose to explore phonics knowledge, word recognition accuracy, and reading speed as potential prerequisites
to fluency. The first unit of data analysis in this study was phonics knowledge, which was measured using three pseudo-word tests that contained nonsense words based on the graphophonic structure of real words. The second unit of data analysis was word recognition and was measured with running records with the number of words read correctly recorded. In addition, word recognition was measured with a series of word-recognition tests that consisted of 30 words each and contained regular high frequency words, irregular high frequency words, regular low frequency words, and irregular low frequency words. The third unit, fluency, was assessed with timed and taped running records. In addition, another fluency score was obtained from the word recognition tests by dividing the total number of words read correctly by the number of seconds taken to read them.

The methods of data analysis used were descriptive statistics and cross-lagged panel analysis. Cross-lagged panel analysis involves measuring and comparing two variables at two points in time. This method of analysis is useful for detecting existing causal relationships and showing the predominance of causation between the two variables. In this study, Eldredge (2005) constructed cross-lagged panels between phonics knowledge and word recognition and word recognition and fluency. Four panels were constructed because of the different instruments used to measure fluency and word recognition. To insure reliability all testing measures used the autocorrelations as test-retest reliability indexes.

The sample for this study included 111 first, 117 second, and 76 third graders.
attending schools near Brigham Young University in Utah. Students were
selected randomly from schools representing all socioeconomic groups. The
participants were tested at two intervals nine months apart. The final sample was
limited to only those who were present for both testing periods and included 92
first, 92 second, and 49 third grade students.

Participants were tested with all testing measurements in February and
November after they had moved to the following grade. All the tests were identical
with the exception of the books used for the running records. Tests were
individually administered by trained educators and included written instructions to
help keep the testing uniform.

The descriptive statistics comparing the mean scores of phonics, word
recognition, and fluency all indicated a consistent increase as predicted from one
test session to the other across each grade level. There was one exception with the
running record fluency tests for the 49 third grade students that indicated no
growth over the nine-month period. Results for the third graders showed a
contrast between an unchanging mean fluency score of 102.6 words correct/minute
and speed and accuracy scores for reading words out of context that showed
consistent growth. Eldredge (2005) suggests that this may demonstrate that
fluency at this stage is more dependent on having written-word familiarity than
being able to read words in context.

Results of the cross-lagged analysis showed a strong causal relationship between
phonics measures in February and word recognition in November. A strong causal relationship was also found between word recognition in February and fluency in November. Comparisons of phonics and fluency showed a direct causal path; however, the correlational differences were not found to be significant.

Eldredge (2005) concluded that phonics knowledge leads to word recognition growth and that word recognition growth in turn has a causal impact on reading fluency. In addition, phonics knowledge is a necessary step in that it leads to better word recognition, which in turn leads to better fluency. These variables are by no means to be considered inclusive, but rather some of the prerequisite skills necessary for optimal development of fluency.

Studies by Speece and Ritchey (2005) and Eldredge (2005) describe fluency growth as complex and progressing developmentally from letter sound fluency skills to word recognition skills. Tannenbaum, Torgesen, and Wagner (2006) explore the connections between vocabulary development, fluency, and comprehension.

Tannenbaum, Torgesen, and Wagner (2006) describe three dimensions of word knowledge – breadth, depth, and fluency. Breadth refers to the number of words in a person’s mental lexicon, depth refers to the degree that the individual understands the words that are known, and fluency refers to the rate at which the individual is able to access the meaning of the word. The purposes of this study were to evaluate whether breadth, depth, and fluency are distinguishable factors of word knowledge, to examine the
strength between these proposed dimensions, and to examine the relationship between these dimensions and comprehension.

The units of data analysis for this study were the three proposed dimensions of word knowledge and comprehension. Breadth of word knowledge was measured with the *Peabody Picture Vocabulary Test, 3rd edition* (PPVT-III; Dunn & Dunn, 1997) and the Vocabulary subtest of the *Wechsler Intelligence Scale for Children, 3rd edition* (WISC-III; Wechsler, 1991). Depth of word knowledge was measured with the Multiple Meanings and the Attributes subtests of the *Language Processing Test – Revised* (LPT-R; Richard & Hanner, 1995). Fluency was measured using the Word Use Fluency (WUF) subtest of the *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS; Good & Kaminski, 2002) and a specifically designed Semantic Category Fluency test. Finally, comprehension was assessed using the *Florida Comprehensive Assessment Test–Sunshine State Standards* (FCAT-SSS; Florida Department of Education, 2005) and the *Stanford Achievement Test –Ninth Edition* (SAT-9; Harcourt Assessment, 1996). The test scores from the comprehension tests were obtained from the school district for each participant in the study.

The sample consisted of 203 third grade students who attended school in a suburban school district in a moderately sized southern U.S. city. There were 104 girls and 99 boys from four elementary schools that were both socioeconomically and ethnically diverse. Students were not excluded from the study based on handicapped status or English-Language proficiency.
The procedure involved the administration of the six measures to each participant individually by either a trained undergraduate student or the first author. To limit error variance, the tests were given to the participants in two different 60 minute sessions with the PPVT-III, the Multiple Meanings subtest of the LPT-R, and the Semantic Category Fluency test given during session one and the Vocabulary subtest of the WISC-III, the Attributes subtest of the LPT-R, and the WUF subtest of the DIBELS given during session two.

Methods of data analysis included confirmatory factor analyses, structural equation modeling, and hierarchical regression analyses. Analysis of the three dimensions of word knowledge showed with the tests used, it was not possible to discern three dimensions. It appears that depth and fluency were indistinguishable from each other. Tannenbaum, Torgesen, and Wagner (2006) suggested that this might be because as the learners gain deeper knowledge of word meanings, they have multiple experiences with words. Numerous experiences with words contribute to quicker recalls and access to word meanings.

Results of the confirmatory factor analyses and structural equation models showed high correlations between breadth and depth/fluency. This means that providing students with frequent exposure to many different words would simultaneously allow them to develop both depth of word knowledge and higher levels of fluency. Structural equation modeling and hierarchical regression analyses show that breadth of word knowledge is the most highly related to performance in reading comprehension.
This research implies that when assessing comprehension, measures of both breadth and depth/fluency should be included. It is important to consider that this data was collected concurrently and that while a relationship between these dimensions was established, it would be prudent to follow up with more research of a longitudinal nature.

In this study, Tannenbaum, Torgesen, and Wagner (2006) suggest that the reason depth of word knowledge and fluency are indistinguishable are that similar experiences with words leads to a richer understanding of words and a quicker recall of words while reading. Other important implications of their study are that frequent and broad exposure to vocabulary allows students to develop both breadth of word knowledge and higher fluency levels. In the next study, Applegate, Applegate, and Modla (2009) further explored the nature of the relationship between fluency and comprehension.

Applegate, Applegate, and Modla (2009) observed a trend among their graduate students who were assessing children described as “the best readers” who scored proficiently with fluency but poorly with comprehension. The researchers noted that teachers might be emphasizing reading rate and word recognition over teaching reading as a meaning-getting process. They also theorized that better automaticity in reading should show higher levels of performance in comprehension among students identified as strong readers. In addition, students who demonstrate high levels of fluency should also demonstrate high levels of comprehension when comprehension is defined and assessed as a thoughtful response to text.
To collect data the researchers used the *Critical Reading Inventory–2* (CRI-2; Applegate, Quinn, & Applegate, 2008) to measure both fluency and reading comprehension. The measurement consisted of leveled passages that go from pre-primer through 12th grade. It included narrative and informational text selections and comprehension questions that assessed text-based information, inference, and critical response. The assessment also included a rubric for retelling that included a score for the reader’s response to the text, a computerized program that accurately calculated retelling scores, and a fluency rubric designed to assess pacing, accuracy, and prosody of oral reading.

The sample for this study consisted of 177 children ranging from grades two through grade ten who lived in Pennsylvania, New Jersey, and Delaware. One hundred and nine attended public schools, 45 attended parochial schools, 17 attended private schools, and 2 were home-schooled. 86% were Caucasian and 14% were members of minority groups. In addition, participants in the sample were identified by parents or teachers as strong readers and achieved a score of 16 or higher on the CRI-2 reading fluency rubric.

To implement the study, graduate and undergraduate students who were trained to administer and score the CRI-2 audio taped the oral readings of participants as they read two passages from the CRI-2 at their current grade level. One passage was read orally and one was read silently. Following the reading, the participant did a retelling and answered ten open-ended comprehension questions. Examiners also interviewed parents to confirm parental and teacher assumptions about the participant being a strong reader. Two
experienced CRI-2 users independently crosschecked examiner scores for retellings and comprehension items. Random samples of 30 audiotapes were crosschecked to ensure accuracy of fluency scores.

The results of the study revealed that of the 171 children in the sample, only 30% achieved scores of 85% or higher proficiency with both literal and higher levels of reading comprehension. Thirty six percent of the sample had scores ranging from 80% to 63% indicating some instructional needs in comprehension. In addition, 34% of the sample had scores of 58% or lower revealing their comprehension to be at struggling levels. Of the 57 participants scoring in the struggling range, 29 scored the lowest on the higher order comprehension questions by a margin of 30 percentage points or more.

From these results, Applegate, Applegate, and Modla (2009) concluded that there is an unfortunate tendency for reading proficiency to be judged by students’ speed, accuracy, and prosody without proper consideration of comprehension. Further, the evidence indicates that there may be more emphasis on activities that promote remembering and reciting and less practice with activities that develop critical thinking about what is read. While research shows a correlation between fluency and comprehension, the interrelationship is complex and requires educators to be cautious about identifying strong readers based on fluency alone and oversimplifying reading interventions. The findings from this study challenge fluency theory at both ends of the spectrum from those that believe fluency facilitates comprehension to those that believe fluency is an outcome of
comprehension. This further underscores the need for continued research and investigation into the complex interactions that exist between fluency and comprehension.

The studies in this section illustrate that reading fluency is a multidimensional ability that gradually develops from the early grades on. Disparities in fluency development are present as early as the end of first grade with at-risk students performing at half the levels of not-at-risk students. Adequate fluency development is best supported by instruction in such skills as letter/sound relationships, phonics, and word analysis skills (Speece & Ritchey, 2005; Eldredge, 2005). Helping students to gain deeper knowledge of word meanings simultaneously helps them to build both comprehension and fluency levels (Tannenbaum, Torgesen, & Wagner, 2006). Applegate, Applegate, and Modla (2009) illustrate we must not assume that comprehension abilities are developing alongside fluency and that teachers need to regularly assess comprehension along with fluency levels. Reading instruction needs to include practices that support the development of critical thinking about what is read as well as promote the development of fluency. Besides understanding the relationship between fluency and successful reading, teachers must be aware of a variety of best practices to meet the diverse needs of their students.

**Exploring Repeated Readings and Other Best Practices for Improving Fluency**

Perhaps one of the most familiar remedial techniques for improving fluency is repeated reading. Samuels (1979) described repeated readings as being suitable for any student to get the practice needed to become automatic. The first two studies in this
section compare repeated reading with other fluency promoting practices. First reviewed is Rasinski (1990), who compared repeated reading with the reading-while-listening approach. The second study reviewed is Homan, Klesius, and Hite (1993) that contrasted repeated readings with non-repetitive reading strategies. The last two studies in this section examined the effects of combining repeated reading with other fluency practices. Devault and Joseph (2004) examined the effect of combining repeated readings with sound/word boxes, and Martens et al. (2006) examined the effect of combining repeated readings with phase drill error correction and listening passage review.

Past research has shown support for both the repeated reading and the listening-while-reading approaches as methods to improve fluency skill. Repeated reading involves the student in rereading the same short passage until the desired fluency level is achieved. Listening-while-reading is similar to repeated reading in that short passages are repeatedly read, however while reading, the student simultaneously listens to a more fluent model of the same text. In this study Rasinski (1990) compares the effectiveness of the methods of repeated reading and listening-while-reading in the fluency growth of third grade students. For the purposes of this study, fluency was defined as reading speed and word recognition accuracy. The independent variables included a repeated reading treatment and a listening-while-reading treatment, which was given to all the students in the study. The dependent variables were two equivalent 100-word fourth grade-reading passages that were taken from an informal reading inventory.
The sample consisted of 20 third grade students from several elementary schools in a southeastern community in the United States. Students were grouped into ten pairs with input from classroom teachers and standardized testing scores to create ability groups representing high, average, and low reading levels.

To implement the study, each student in each pair received two separate treatment cycles, with each cycle lasting four days. On the first day of each cycle, both students in each pair orally read one of the two test passages, while the researcher audio taped them, recorded WPM, and all miscues. On the second and third days of the cycle using the pretest passage, one student in the pair read to the instructor. The other student in the pair listened to the instructor fluently read the same passage, while silently following along on their own copy. On the fourth day the students were given the posttest in the same manner as the pretest. The second treatment cycle was given using the second passage and reversing the treatments for each student in the pair. Students were worked with individually, and each repeated reading session and each listening-while reading session was conducted identically for all 20 students in the sample.

Results confirmed that both repeated readings and listening-while-reading methods effectively improved the reading speed and reading accuracy of the third grade students in the sample. There were no significant differences found between the two methods in promoting and improving reading fluency. The evidence from this study supports the uses of both methods in promoting reading fluency and general reading proficiency. With the extensive research and exploration of repeated reading as a best practice for fluency
development, this study demonstrates that the practice of listening-while-reading is a comparable option. Disadvantages to repeated readings such as extra teacher time to work one on one and student boredom can be overcome by including such listening-while-reading activities as listening to tape recorded readings at a learning center. Such activities would have the additional benefit helping students to be more independent and engaged in their own reading growth. Evidence from this study also highlights the importance of the role teachers’ play in being models of fluent reading for their students (Rasinski, 1990). Limitations to this study such as the brief duration of treatment and use of only one grade level in the sample suggest that further research on both methods is needed.

Rasinski (1990) provides support for repeated reading and listening-while-reading or a combination of both as practices that are effective in promoting the growth of reading fluency in children. Homan, Klesius, and Hite (1993) took a closer look at the strategies of repeated reading and non-repetitive reading strategies.

The practice of repeated reading was developed as a way of helping to strengthen the automatic decoding skills of struggling readers. Much research has been done on repeated reading and variations of repeated reading like assisted reading, paired reading, and listening-while-reading to establish them as practices to support gains in reading rate and accuracy. Homan, Klesius, and Hite (1993) questioned whether students reading improved from the repeated reading practice or from the increased amount of time spent reading connected text. One of the purposes for their study was to see if the methods of repeated reading and non-repetitive oral reading strategies like echo reading and unison reading
contributed to gains in overall reading performance. The other purpose was to see if there were any significant differences in the effects of the two practices on reading performance. The independent variables were the repeated reading and the assisted non-repetitive treatments. The dependent variables were six pre- and posttest passages taken from an informal inventory and a basal series. An additional dependent variable was a retell assessment based on the story structures of the passages. The passages consisted of two sets (Forms A and B) that included three readings at the fourth, fifth, and sixth grade reading levels.

The sample included 26 sixth graders that attended a chapter one program at two racially balanced schools in a large metropolitan area. Students in the sample were reading at a high fourth grade to low fifth grade level. The 26 students were chosen from three classrooms and then randomly assigned, 13 students each, to either the repeated reading treatment or the assisted non-repetitive strategy treatment.

To begin the study, Form A or Form B of the pretest was given to each student. The students were told they would be recorded during the assessment and would be asked to retell the stories after they read them. Three teachers who were trained in both practices implemented the treatments. During the one and a half hour language arts block, each teacher worked with a small group of four to five students in each treatment group for 20-minute sessions, three times a week. The posttest was given during the eighth week using the same directions, but with the students receiving the alternate form from the one they had during the pretest. The same researchers recorded the students’ pre and posttest
passages to insure consistency in computing reading rate and accuracy. For the comprehension portion, two raters were trained and then independently scored and transcribed the retellings.

A multivariate analysis showed no significant differences between groups at pretest for reading rate, error rate, or comprehension. Significant differences were found between pre and posttest scores for all subjects. Both treatments show significant improvements in comprehension, but there were no significant differences between the repeated reading and non-repetitive treatments.

The results show that both repeated reading and non-repetitive reading methods improved the fluency (rate and accuracy) and comprehension of sixth grade chapter one students. Homan, Klesius, and Hite (1993) concluded that reading growth also occurred as a result of the students’ focus on connected text reading for three 20- minute sessions over a seven week period. Having found no significant differences between repeated reading and non-repetitive reading methods, the authors recommend flexibility in choosing the method that best helps students to gain the necessary focus on connected reading to improve both fluency and comprehension.

Rasinski (1990) and Homan, Klesius, and Hite (1993) both found no significant differences between repeated reading and non-repetitive practices like unison reading and listening while reading. These findings support the use of a variety of practices to promote fluency and comprehension growth. Devault and Joseph (2004) examined the effect of combining repeated reading with a word box phonics technique.
Devault and Joseph (2004) were interested in finding ways to help high school students with low reading ability. The purpose of this study was to find out if using repeated readings with the phonics strategy of sound/word boxes would be a motivating and effective combination for helping high school students with severe reading disabilities. The independent variables in this study were a combination of curriculum-based repeated readings and use of the sound/word box strategy. Dependent variables included the Dynamic Indicators of Basic Early Literacy, 6th ed. (DIBELS, Good & Kaminski, 2002) and the pre and post word per minute scores of the curriculum based grade level passages that were used as repeated readings in the intervention sessions.

The sample consisted of three secondary level students who were identified in the elementary years as having learning disabilities and who were receiving special education services in the areas of reading and language arts. One male student had an IQ score of 94 and attended regular education classes for everything but reading and math. The other male student had an IQ score of 57 and received special education services for both reading and math. The female student had an IQ score of 94, received special education services for reading only, and had suffered a seizure disorder that had caused her to miss a lot of school during the previous school year. IEP testing showed the three students’ reading levels as ranging from first to second grade level. All three students were identified by their classroom and special education teachers as non-readers, had no expectations for them to read in class, and had all assignments and tests read to them.
To implement the study each student was given the DIBELS to determine his/her independent reading level. Each student received individual direct instruction from an instructor for 15-25 minutes for five days a week. At the beginning of each session the student read a curriculum-based reading passage that was at his/her current instructional level for one minute. The instructor recorded all words read incorrectly or omitted on index cards and went over each word using the sound/word box strategy. The sound/word box strategy involved the teacher modeling and slowly articulating the sounds in each word and then having the student slide the corresponding letters into the divided sections of a rectangle drawn on a dry erase board. The student reread the reading passage again after completing the word box activity, while the instructor recorded the words missed and the number of words read correctly per minute. A new passage was chosen and the same procedure implemented for each intervention session. The DIBELS was repeated at the end of the treatment sessions as post assessment.

Results of the study showed that all three students made gains in the number of words read correctly per minute from the initial to the repeated reading. Devault and Joseph (2004) also noted an increase in the number of words read correctly per minute on the initial reading although this progress was not consistent across sessions. The DIBELS post assessment revealed an increase of two grade levels for each student. The researchers also reported a positive student response to using the sound/word box technique and improvements with student confidence and willingness to read. Although this study had a small sample and did not include assessment for comprehension, Devault and
Joseph (2004) concluded that combining explicit instruction such as the sound/word box technique with repeated reading appear to be effective practices to help promote progression to higher reading levels for secondary students with severe reading delays.

Although Devault and Joseph's (2004) sample only included three students, it was useful research to support combining fluency development strategies as a way of providing interventional instruction to students with severe delays. It was noteworthy that high school students found the use of sound/word boxes and repeated readings as acceptable and motivating ways to help them improve their reading. The last study reviewed in this section is Martens et al. (2007) who examined the effects of combining several fluency promoting practices in training sessions included as part of an afterschool program.

Martens et al. conducted a study that had three purposes. The first purpose was to compare the effects of fluency training using a no treatment control group. The second purpose was to determine how many training trials were needed for a student to reach a mastery criterion on reading passages, and the final purpose was to assess how long students were able to retain their fluency gains over time. The independent variable in this study was the fluency-training program, which included three instructional procedures, performance feedback, and a reward system. Dependent variables included Curriculum-Based Measurement in Reading (CBM-R) survey level probes, which were pre- and posttest passages derived from the Silver, Burdett, and Ginn (1991) reading series. Passages were created for pre-primer through fourth grade levels. A Words Read Correctly/Minute (WRC/M) score was obtained from timing the participants as they read the passages. This
score was computed by dividing the number of words read correctly by the total time in seconds to read the passage multiplied by 60. A second dependent variable was the *Comprehensive Test of Phonological Processing* (CTOPP; 1999), which is a test for children ages 5.1 years to 24.1 years that measures phonological awareness, phonological memory, and rapid memory. The last independent variable was the *Academic Competency and Intervention Acceptability Assessment* (ACIAA), which was used to assess the participants’ perceptions of the fluency-training program after it was over.

The sample in this study consisted of ten second graders (7 female, 3 male) and 20 third graders (13 female, 7 male) who attended a northeastern urban elementary school’s after school program. These students were selected from a larger pool of 72 students that attended the program based on having a standard Phonological Awareness Composite score of 65 or higher using the CTOPP and reading below instructional level using the CBM-R probes to determine reading level. The second graders ages ranged from 7.01 to 8.02 years and the third graders ages ranged from 8.04 years to 10.0 years. All students were eligible for free or reduced-price lunch with one student self-identified as Latino/Hispanic and the rest self-identified as African American.

To start the study all participants were given the CTOPP and the CBM-R probes. Using the CBM-R probes the participants’ starting points in the curriculum were determined as the probes that were read between 50 and 100 WRCM. Participants were then randomly assigned to either the group receiving fluency training or the control group. The study was conducted over a seven-week period for the second graders and over eight weeks for the
third graders. This included a week for pretesting at the beginning of the study and a week for post-testing at the end of the study for each grade.

During the training session weeks, participants from the experimental group were pulled from their regular after school program to attend one 30-minute session on Mondays, Wednesdays, and Fridays. The session included a pre-training assessment that determined the level of passage where the 100 WRCM criterion was not met, fluency training on the passage, and a post-training assessment. The sessions were audio taped to allow assessment of inter-scoring agreement and to check procedural integrity.

The fluency training included reward tickets participants could exchange for prizes, a graph where trainers and participants kept track of progress, and training in phrase drill error correction, listening passage review, and repeated reading. Participants had to read the previous session’s passage at 100 WRCM on the pre-training assessment two days later to progress to the next more difficult passage.

Participants in the control group remained in their regular after school class. Their activities included snack, language arts activities, and worksheets.

Results of this study showed that the second grade and the third grade participants made significant gains over the control group on the CBM-R survey level probes. Second grade participants gained 22.76 WRCM after training on the same day and 21.55 WRCM on the two-day retention probes. Through the five weeks of their training they advanced 2.2 grade levels or 8.8 passages. They averaged 2.21 trainings to master each passage.
Third grade participants gained 24.52 WRCM after training on the same day and 26.4 WRCM on the two-day retention probes. They attended training sessions for 5 1/2 weeks, advanced an average of 2.9 grade levels, and took an average of 1.69 trainings to master each passage.

Results of the ACIAA indicated that the second graders had a more favorable perception of reading at the post-test than the control group. Third graders in both the experimental and control group reported favorable perceptions of reading at the post-test. Both second and third grade students in the experimental group reported liking the training procedures.

The researchers recognized that their sample was small and limited to second and third grade students. The training required a minimum of four adults to help individual students progress through the passages at their own rate. Despite these limitations the researchers concluded that a targeted fluency program that is closely matched to students instructional levels could produce significant gains in oral reading fluency.

Both Devault and Joseph (2004) and Martens et al. (2007) demonstrate positive fluency growth utilizing multiple strategies. Devault and Joseph (2004) showed that using repeated readings together with word/sound boxes could effectively and quickly help delayed readers in high school advance to higher levels of text. Martens et al. demonstrated that combining fluency building strategies (i.e. phrase drill correction, listening passage review, and repeated reading) with student self monitoring and rewards can effectively support growth of up to two grade levels in three 30 minute sessions over a five week period.
To summarize this section, the studies of Rasinski (1990) and Homan, Klesius, and Hite (1993) support the use of repeated readings and other non-repetitive practices like unison reading and listening-while-reading. No significant differences were found between repeated reading and other non-repetitive approaches. These results suggest fluency and comprehension growth are best supported when teachers provide students with a variety of instructional alternatives that build word recognition, reading rate, and comprehension through regular practice of connected text (Homan, Klesius, & Hite, 1993). Reading tasks that are purposeful and relevant like reading to younger children, having students chart their own reading rate progress, and having students make audio tapes for the listening center keep students motivated and more engaged in getting the practice required to reach instructional goals. While repeated readings have been demonstrated to be effective, students are further supported in fluency growth by combining such practices as sound/word boxes, phrase drill error correction, and listening passage review in a direct instruction format (Devault & Joseph, 2004; Martens et al., 2007).

Besides understanding how fluency develops and what instructional practices best support fluency growth, teachers need to find ways to integrate the necessary practice required to help students develop their fluency and comprehension abilities into the busy and tightly scheduled school day. In addition, teachers need instructional systems that allow them to monitor student progress and allow students to observe and monitor their own reading. One way to do this efficiently is to integrate the use of computer technology.
The final section of this literature review looks at studies that have incorporated the use of computer technology into the instruction and practice of reading skills.

**Incorporating Computer Technology into Reading (Fluency) Instruction**

With the rapidly changing nature of computer technology, it is difficult to find current studies on the use of computer technology in reading instruction. There is a great need to do more research to support the effective use of computer technology as teachers face increasing constraints in time and resources, and must find reliable ways to cover their students’ diverse needs. Computer technology offers students opportunities to gain additional, structured practice of reading skills independently of teaching staff (Macaruso & Rodman, 2009). The studies in this section investigate the effect of computer technology on reading achievement. The first study, Knezek and Christensen (2007) took a look at the effect of technology-based programs on the reading achievement of first and second grade students. The second study, Macaruso and Rodman (2009) examined the benefits of computer-assisted instruction for struggling readers in middle school. The third study, Lewandowski, Begeny, and Rogers (2006) compared the effects of human tutoring and computer-assisted word recognition training on third grade students. Finally, the fourth study, Savage, et al. (2010) explored how teacher variations in the use of web technology affected student growth in literacy.

Knezek and Christiansen (2007) utilized data gathered from the Key Instructional Design Strategies (KIDS) project, a five-year, federally funded study conducted from 1999 – 2004 that was aimed at integrating computer technology into the elementary school
curriculums of fifty Texas school districts. The data used was collected during the fourth year of the project and focused on the effect the Early Reading Center portion of the KIDS technology had on K – 3 reading achievement. The independent variable in this study was the implementation of the Early Reading Center technology including teacher training and the installation of necessary computer technology components at the participating school districts. The dependent variables consisted of scores obtained from the Texas Primary Reading Inventory (TPRI), a state assessment already given each year at Texas elementary schools to measure individual student growth in reading achievement in the areas of phonemic awareness, word reading, reading fluency, and reading comprehension. Fall and spring TPRI scores were used as pre and post test results.

The sample was chosen from the pool of Texas school districts that met the criteria of having 42% of students receiving free or reduced lunches, having a student population of 1000 or fewer, and having a Texas Education Agency rating of below “Recognized”. Eligible schools were then randomly assigned to 18 treatment school districts and seven control school districts. Due to the small number of kindergarten classes participating in the KIDS grant, only first and second grade data were included in the sample.

Each participating school district in the treatment group received professional development for its teachers, access to the necessary hardware/software, and use of the Early Reading Center modules. Each treatment district sent a five member training team to a summer institute that immersed them in workshops that trained them on how to use the technology, helped them plan what technology they needed to purchase for their district
with the allotted grant money, and guided them in writing a plan of action for implementing the Early Reading Center technology into their district. Prior to the start of the school year, the team trained fellow educators in implementing the Early Reading Center modules and technology enhanced tools. Schools received additional support from KIDS project staff members who visited and communicated regularly with the schools throughout the year. Skills addressed by the Early Reading Center included oral language development, awareness of sound, symbol, and structure, skill integration, reading comprehension strategies, vocabulary, spelling, and writing. Upon completing the TPRI as a pretest in all participating schools, students in the treatment group schools worked on completing the high-interest technology-based reading modules. Students in the control group schools received regular non-technologically based reading instruction. The study concluded with the spring administration of the TPRI to all treatment and control school participants.

TPRI data was gathered by mailing forms to the participating districts where each classroom teacher or district representative filled in the participating children’s TPRI raw scores. A spreadsheet was created from the completed forms based on a coding scheme previously designed by the researchers. For the pretest, completed forms were received from 40 first-grade classrooms and 41 from second-grade classrooms. For the posttest, 33 completed forms were received from first-grade classrooms and 33 from second-grade classrooms. Pretest and Posttest data were aligned to match 434 first-grade students and 453 second grade students.
Results for the first grade analysis show that the students in the treatment group that received the technology enhanced instruction made significant gains over the control group in the areas of whole classroom reading level, word lists, reading accuracy, and story level. There was no significant difference found between the two groups in the area of answering implicit and explicit comprehension questions. Results for the second-grade students showed a significant gain in reading accuracy for the treatment group. Whole classroom reading level scores were significantly higher for the second grade treatment group also. In addition, comprehension of implicit and explicit comprehension questions was also significantly greater for the treatment students. In comparing the findings for first grade with second grade, the results show reading accuracy gains similar for both first and second grade with treatment students gaining more than the control students. In comparing raw score means and standard deviations for each group at the pretest and posttest time frame, it was noted that each group made moderate to very large gains, but that the pre-post effect was greater for the treatment group. Knezek and Christensen (2007) concluded that the Key Instructional Strategies (KIDS) professional development and the technology enhanced learning activities successfully promoted gains in reading accuracy for both first and second grade students and reading comprehension at the second grade level.

Knezek and Christensen (2007) demonstrated that implementing intensive, high interest computer based instruction with adequate professional development can be effective in promoting reading accuracy and comprehension for primary aged students. The next
study takes a look at how computer-assisted instruction can benefit middle school students.

In this study, Macaruso and Rodman (2009) wanted to find out if the use of computer-assisted instruction (CAI) could be effective as a supplement to a language-based literacy skill program for struggling older readers. The independent variable was a CAI program that provided structured, multisensory activities designed to develop word identification skills in older readers. The dependent variables consisted of an assessment battery taken from the Woodcock-Johnson III Tests of Achievement (Woodcock, McGrew, & Mather, 2001) that was given as a pre and posttest. The subtests used included Word Attack, Letter-Word Identification, Reading Fluency, Reading Vocabulary, Passage Comprehension, Oral Comprehension, and Spelling.

Participants for the study were 47 sixth and seventh grade students enrolled in a remedial program at a middle school in St. George, Utah. Students were referred to the program through teacher referral or by receiving a low score on the Developmental Reading Assessment (Beaver & Carter, 2003). Each student was randomly placed in one of three of the remedial classes with 27 students (15 male, 12 female) in the treatment group and 15 students (7 male, 8 female) in the control group. Both groups had comparable IQ scores, similar ethnic profiles, and were of low to middle range in socioeconomic status.

After giving all students the pretest, all received whole class instruction using a comprehensive, language-based literacy skills program and fluency instruction. The treatment group received the fluency instruction in small group format to allow time to
rotate use of the CAI program that focused on developing phonological awareness and phonics skills. CAI sessions for the treatment group occurred 2 to 3 times a week and lasted for 20-30 minutes. For these sessions students were instructed to work quietly and independently and were allowed the freedom to choose the activities within the level they were on. Treatment and control groups all received the same amount of direct instruction time. Treatment groups received an average of fifty CAI sessions per student over the school year. All students were then given the posttest at the end of the school year.

Macaruso and Rodman (2009) found that the treatment and control groups both had significant gains for Passage Comprehension. The treatment group also made significant gains on Word Attack and Letter-Word Identification. When mean gain scores on the subtests where compared using analyses of covariance, the treatment group showed a significantly more improvement on the Word Attack subtest over the control group. Significant correlations were found between the pretest scores and the gain scores for the Word Attack and Letter-Word Identification subtests. Negative correlations for this comparison reveal that students with lower pretest scores made greater gains on the Word Attack and Letter-Word Identification subtests. There were no significant correlations found for the control group. The researchers concluded that the treatment students’ gains were due to the CAI program with the lower performing students showing the greatest gains. Benefits of CAI programming are contingent upon choosing programming that supports student growth in the areas of weakness as this program did in the area of phonics. Struggling students can make significant gains through the use of CAI
programming when it is appropriately implemented and utilized as a key part of reading instruction.

Successful utilization of computer technology requires professional training and careful planning to make sure students are receiving instruction and practice of skills in their areas of weakness. In the next study, the authors looked at whether word list training is better when done with computers or with human tutoring.

Lewandowski, Begeny, and Rogers (2006) discussed the importance of helping students to develop automaticity in word recognition. Interventions for this problem have been studied and debated as to whether whole word approaches or phonic, alphabetic approaches are best. Research suggests that word recognition growth can be achieved with direct instruction methodology that provides multiple opportunities to see, hear, and say the words being taught. The purpose of this study was to compare the effects of using human tutors vs. computer assisted instruction to provide direct instruction in word identification and fluency building. In addition, the researchers looked at whether these training conditions would show transfer to a non-target list and to reading passages containing the target words. Independent variables included three treatment conditions where students studied a list of 100 words with a tutor, with a computer, or by themselves with no help. There were three dependent variables. The first consisted of having the participants read the 100 word-training list and scoring for time and accuracy. The second dependent variable was to have the students read a total of ten graded passages that contained words from the word-training list and scoring words read correctly per minute.
The third dependent variable had the participants read from a generalized word list where they were scored for time and accuracy.

The sample consisted of 66 third grade students who attended an elementary school in central New York that was enrolled in a reading project. The average age of students in the sample was 9.3 years, and there were 37 females and 29 males. The ethnic distribution included 19 Caucasian, 28 African American, 6 Asian, 4 Hispanic, and 9 mixed. Special Education Services were provided to 14 of the participants and 59 were eligible for free or reduced cost lunch. Following the pretesting, students were randomly assigned to one of the three treatment conditions. The three groups were comparable in distribution of age, sex, race, and socioeconomic status and did not show any differences at pretest in word recognition or reading fluency.

For the study, the researchers had prepared ten reading passages (two from each grade level) from a basal reading series with an average length of 127.9 words. Using readability scores the pairs of passages were graded at the following levels: 1.5, 2.3, 3.4, 4.4, and 5.3. A training word list was developed by choosing 5-10 words ranging in length from 4 – 12 letters. The generalization word list consisted of 100 words chosen for their similarity to the 100 words on the training word list.

To start the study each participant was pretested by a trained graduate student. Students read the training word list, each of ten passages for one minute each in randomized order, and the generalized word list. Participants were assigned to one of the three conditions and were given a total of three sessions of exposure to the trained word list. In each
condition the student went through the list two times and then had an oral timed reading of the list. For the computer condition, the students saw a word in a textbox and heard the computer pronounce the word. The student was guided to work at his/her own pace, see and hear the word, and say it silently. For the tutoring condition, the tutor read each word and scrolled down the list with a finger. Students were also guided to look at each word, listen to the tutor pronounce it, and say it silently. For the control condition, the experimenter did not help the student to read the words, but scrolled down the list as the student practiced each word. The three training sessions lasted ten minutes per participant and occurred over a three-week period. Post testing was completed following the training sessions.

To insure reliability, each experimenter received training in curriculum-based measurement reading procedures and was able to demonstrate a 95% proficiency at inter-rater scoring. A percentage of the testing sessions were recorded and re-scored and found to be 98.7% for inter-rater reliability. Procedural integrity was found to be 99.6%. Results for the training list showed significant improvement for the computer and tutor groups, but not for the control group. There was not a significant difference between the tutoring and the computer groups. All groups were able to reduce the time it took to read through the trained word list from pretest to post test. None of the groups made any significant improvement from pretest to post test for the generalized word list. Results of the passage reading show significant improvement from pretest to post test for the tutor and the computer over the control group. There were no significant differences between the tutor
and computer groups. Lewandowski, Begeny, and Rogers (2006) concluded that human tutoring and computer training provided better support for word recognitions gains over the control condition where students read the words to themselves. Tutoring provided the advantages of direct instruction, human attention, error-free modeling, and attention focusing. Computer assisted practice provided error-free sight and sound word associations in an interesting and efficient format for both teachers and students. The authors mentioned the small and limited nature of this study and recommended more research to explore the effects of tutor and computer assisted word training over a longer period.

Although this study was of a small, limited nature, it is interesting that there were no significant differences found between the word recognition training being done with the computer or the human tutor. These results support computer-assisted practice as a reasonable option to help students practice such fluency skills as word recognition (Lewandowski et al. 2006). The last study reviewed in this section took a close look at the impact of teacher variations of implementing computer technology on the outcomes of student reading achievement.

With the ever-increasing implementation of computer and information technology into the classroom setting there is limited information available on how computer technology can be best used by teachers to maximize student learning. Sandholtz, Ringstaff, and Dwyer (1997) found that teachers pass through developmental stages as they learn to integrate technology into their classrooms. The first three stages
they described are entry, adoption, and adaption. During the entry stage teachers are less familiar and tend to make time-consuming mistakes sometimes leading to minimal or ineffectual use of the technology. As teachers reach the stage of adoption, they become more familiar with the technology and begin to implement it more systematically into classroom practice. The adaption stage is where the teacher achieves more mastery and is able to implement and extend the technology more fully into the school curriculum. The authors of this study wanted to find out if a well researched web-based literacy program known as *A Balanced Reading Approach for Canadians Designed to Achieve Best Results for All* (ABRA; http://abralite.concordia.ca) could show similar results in supporting reading achievement when administered teachers in a regular classroom setting. They also wanted to find out if there were differences in reading achievement when classroom teachers who were at different learning stages of technology implementation administered the ABRA program.

The independent variable was the ABRA intervention given between pre- and post tests. One dependent variable was a measure of letter-sound knowledge where students were asked to identify the sound that goes with each of the 26 letters in the alphabet. Other dependent variables included the skills of listening comprehension, word reading, sentence comprehension, and passage comprehension, which were assessed with a standardized reading test called the *Group Reading Assessment and Diagnostic Evaluation* (GRADE; Williams, 2001). In addition, spelling was assessed with a spelling test taken from the *Wide Range Achievement Test* (Wilkinson, 1993), word attack skills were assessed with a
subtest from the *Woodcock Johnson III Test of Achievement* (Woodcock, McGrew, & Mather, 2001), and elision and word blending were assessed with subtests from the *Comprehensive Test of Phonological Processing* (Wagner, Torgesen, & Rashotte, 1999). The Arithmetic subtest from the *Wide Range Achievement Test* (Wilkinson, 1993) was given as a control task. Besides these reading skills, triangulation data was collected from four different observations of the teachers as they implemented the ABRA technology in their classrooms.

The sample consisted of four first grade classrooms from three English-speaking schools in a suburban school district in Quebec, Canada. Four teachers volunteered for the study after a school board request for participation in the study. Sixty students, 32 boys and 28 girls, were recruited through parental letters. The mean age of participants was six years, five months.

To implement the study one teacher was randomly assigned to the control condition that engaged in literacy programming that did not involve computer technology. The other three teachers received a one-day training on how to implement the ABRA program into their classrooms. The teachers were presented with sample lessons and teacher materials to support them in using ABRA as part of a balanced literacy program. Following the two-week pretesting period, the teachers implemented the ABRA web based literacy program for two hours a week for eight consecutive weeks. The three teachers had access to an ABRA facilitator to provide technical support in implementing the ABRA program. The teachers were entirely responsible for all teaching and lesson planning in the classrooms. Throughout the eight-week period, four different types of observations were done to
evaluate the teachers’ performance and quality of instruction as they used the ABRA program. First researchers conducted hour-long observations twice in each classroom. Two other members of the research team independently rated these written narratives to insure reliability. Another source of observation data was submitted in the form of weekly written observations by the ABRA facilitators as they gave technical support in the classrooms. The third source of data came from a focus group meeting where the ABRA teachers, facilitators, and two research coordinators discussed their experiences with the ABRA program. Finally, the last source of observational data came from researcher evaluations of sample lessons the teachers were asked to present at the focus meeting. After eight weeks, the three intervention classes and the control class were given the posttests.

Results of the teacher observations revealed that there were differences in the ways that the teachers implemented the ABRA program that fit into the technology implementation stages described by Sandholtz et al, 1997. One teacher, identified as in the entry stage appeared to show signs of frustration at using the technology, had difficulty working out the technical problems in implementing the program, and tended to provide instruction that was student directed rather than teacher directed. One teacher fit the characteristics of the adoption stage by demonstrating more comfort with using the technology, assigning the students to work in groups with precise directions on what to do, and spending 15 – 20 minutes collaboratively working on computer activities with the whole class using the big screen. The third teacher was identified as functioning at the adaption stage. In addition to
having the students work together in centers, giving whole group demonstrations on the big screen, the third teacher was able to link and extend the ABRA content to other parts of the literacy curriculum.

After running an Analysis of Covariance (ANCOVA) on the pre-test scores, it was found that there were no statistically significant pre-test differences between the students in each of the three intervention classrooms and the one control classroom. A series of ANCOVAs done on the post testing showed significant effects between the three identified technology integration stages and the scores for Word Reading, Word Meaning, the Combined Vocabulary composite, and the elision task. There was an advantage found for the adoption group in the areas of Word Meaning and the Vocabulary composite over the control and the entry groups. In all cases there was a significant advantage over all the other groups for the Adoption group. Results of the GRADE test showed significantly higher scores for students in the adaptive teacher’s group in the areas of Sentence comprehension, the Comprehension composite score, and the Total Test score. The adoption group did not differ from the entry group on the comprehension measures in this test. There were no significant differences found between any of the three treatment groups or the control group for the measures of Letter-Sound knowledge, Listening Comprehension, Passage Comprehension, Spelling, Word Attack, Blending, or Arithmetic. The researchers concluded that the ABRA web-based literacy program could support the growth of students in standard measurements of reading achievement. Computer technology promotes literacy growth most effectively when teachers have expert level
technology skills, have well thought out lesson plans, and can extend skills covered by computer technology to the larger curriculum. Students benefit the most when teachers provide frequent feedback and act as facilitators in the intervention. Teachers are successful in providing help to students when they receive training and have ongoing support in implementing the technology. Savage et al. (2010) acknowledges limitations of this study due to the small sample size of three teachers and 60 students. This study highlights the need for larger scale studies that explore the relationships between teachers’ mastery of technology and student learning outcomes.

In summary, Knezek and Christensen (2007) reported that despite the conservative effect size in their study, computer assisted technology that is implemented with professional development and provides high interest literacy learning activities can successfully support growth in reading accuracy for first and second grade children and in reading comprehension in second grade children. Macaruso and Rodman (2009) found computer assisted instructional programming supported the greatest gains in the lowest performing middle school students, but observed that it was necessary to customize the computer instruction to support the areas of greatest need. Although Lewandowski, Begeny, and Rogers (2006) found no significant differences in word training done with computers over tutors, the study demonstrates computer technology as a reasonable option to help students improve word recognition skills. Finally, Savage et al. (2010) found that despite their small sample size, teachers who can expertly integrate and extend
COMBINING FLUENCY INSTRUCTION WITH GARAGEBAND

computer technology into the larger literacy curriculum support greater gains in overall reading achievement.

Summary

It is evident from the literature review that fluency is a vital part of exemplary reading instruction. Research shows that fluency development differences show up as early as first grade with at-risk children performing half as well as their not-at-risk peers (Speece & Ritchey, 2005). There are strong causal relationships between phonics knowledge, word recognition, and fluency (Eldredge, 2005). Furthermore, fluency and the understanding of word meanings develop simultaneously from broad and frequent experiences with words (Tannenbaum, Torgesen, & Wagner, 2006). The relationship between fluency and comprehension is complex. Teachers should not assume fluency instruction covers comprehension and be sure to also include practices that develop critical thinking of what is read (Applegate, Applegate, & Modla, 2009). The literature review also shows that fluency and comprehension are best supported by a variety of practices including repeated reading and non-repetitive strategies like unison reading (Homan, Klesius, & Hite, 1993; Rasinski, 1990;). In addition, combining fluency building practices into intensive training sessions that include some explicit word recognition strategies like word/sound boxes and repeated reading can help students with severe reading delays (Devault & Joseph, 2004; Martens et al, 2007). Finally, the literature review provides some evidence that teachers can effectively promote fluency skills like word recognition and accuracy with expert implementation of computer technology that is matched to students’ areas of need (Knezek
Finding ways of supporting intermediate aged students in becoming fluent readers is of high priority as the 2014 proficiency deadline set by the No Child Left Behind Act of 2001 approaches. The research reviewed clearly establishes the importance of including fluency-building instruction in a balanced reading program. More research is warranted in the future to investigate how to include computer technology in reading instruction that promotes fluency development. This study will contribute to the need for research on using such computer applications as GarageBand audio recording to help students practice repeated readings in conjunction with explicit fluency building instruction. In chapter three, the methodology utilized for the current study will be presented.
The purpose of this study was to develop an after school tutoring intervention that focused on providing intensive fluency training and gave students a motivating way to practice newly learned skills by making computer audio recordings of themselves practicing repeated readings. This chapter presents the methodology used to answer the research question, “What is the effect of combining explicit fluency instruction with computer audio recording of repeated readings on the fluency and comprehension growth of intermediate aged students?” The chapter will start with a description of the research setting and the participants. Next details will be given about the materials used and the procedure that was followed. Then there will be an explanation of how the data was collected. Finally, the chapter will conclude with a summary of the main points.

The Research Setting and Participants

The study took place at the researcher’s private learning center created to provide an additional afterschool and Saturday morning tutoring option for struggling students in the community. The center is located in a growing suburban Wisconsin community with a school district that serves about 7000 students having seven elementary schools, two middle schools, an upper middle school, and one high school. Located on the main street and near three of the elementary schools, the office was set up as a small student friendly resource/classroom with a variety of leveled reading materials, a small table for one on one instruction, and a desk set up as a computer station. Participants for the study were recruited through private advertisement and e-mail communication sent to area
elementary teachers and reading specialists. Parents that were interested in having their child participate in the study were then referred to the researcher.

The recruitment efforts yielded three Caucasian male students – one-third grader and two fourth graders, which will be identified as Student A, Student B, and Student C.

**Student A**

Student A was nine years old and in 3rd grade. His mother had been looking for extra help for her son outside of school. She communicated that it was hard to get her son motivated to practice reading and completing homework on his own at home. His mother reported he was reading at Level M the 3rd quarter of the year. According to school district expectations, third graders should be reading between levels N – P at the 2nd interval assessment done in February. This indicated Student A was performing below grade level expectations and in need of intervention. The initial sessions with Student A revealed him to be an easygoing young man who worked cooperatively and eagerly on all tasks given to him. His slow word identification and reading accuracy stood out as contributors to his slower reading rate and comprehension abilities. He was very motivated to use the Garageband program to audio record his reading.

**Student B**

Student B was in fourth grade and was ten years old. His parents had been looking for a private tutor for additional support and were concerned that their son’s reading difficulties were related to Attention Deficit Disorder. He had been referred and was currently being assessed at school for special education services. His parents reported him as reading at
Level M. According to district expectations, fourth graders should be reading between Levels Q and S after the 2nd interval assessment done in February, showing a strong need for intervention. Currently Student B was receiving intervention services from the reading specialist at his school. During the first sessions with Student B, it became apparent that he had a short attention span and needed the lessons to be well structured. He worked very well one on one and was motivated to make the audio recordings of his reading. His weak vocabulary knowledge and inattention to detail appeared to contribute greatly to his fluency and comprehension abilities.

Student C

Student C was also in fourth grade and was ten years old. His parents reported that reading difficulties ran in their family and that their son did not like reading on his own at home. His parents reported him as reading at Level R, which according to district expectations indicated he was meeting grade level expectations for fourth grade. Student C had been going to the reading specialist at his school to work on issues of slow, non-fluent reading. Initial sessions with Student C showed him to be a very conscientious student that was able to focus carefully on what he was reading, however he struggled with automaticity in word identification and tended to slow himself down with frequent repetitions. Lack of automaticity, word identification difficulties, and frequent repetition all contributed to his non-fluent reading and lowered comprehension.

The following section will continue with a description of the materials used for the intervention and the procedure that was followed.
**Materials and Procedure**

The study was designed to work one on one with each student for a total of 16 one-hour sessions, which included two pretest sessions, 12 instructional sessions, and two posttest sessions. After completing the pretest assessments, each student received the intervention. Each of the intervention sessions began with a fluency mini lesson that focused on different fluency skills and concluded with a practice portion where the student used the computer to audio record himself doing repeated readings of the passage used in the mini lesson.

The materials used for the reading passages and mini lessons were taken from *Increasing Fluency with High Frequency Word Phrases* (Knoblock, 2007) and *Read-Aloud Passages and Strategies to Model Fluency* (Mann, 2007). Each lesson included a short 150 to 200-word passage, several vocabulary and comprehension questions, and an explanation of a specific fluency skill such as watching for punctuation or learning to find the natural breaks in sentences. All the lessons that were taken from *Increasing Fluency with High Frequency Word Phrases* (Knoblock, 2007) had a CD recording of the passage for the students to listen to. For the lesson that was taken from *Read Aloud Passages and Strategies to Model Fluency* (Scholastic, 2007), the researcher read the passage while the student listened. Other materials used for the practice portion of the lesson included a MacBook computer with the Apple GarageBand program installed, a Snowball USB microphone, student-monitoring sheets, and teacher feedback sheets. In addition, there was a Student Oral Reading Rubric designed by the researcher to help guide the students in critiquing
Each new intervention lesson began with the researcher and student listening to the passage being read from the CD or the researcher reading while the student listened to the passage. For the second reading the researcher and the student used the technique of partner reading to read the passage. Following the reading, the researcher and student discussed and answered the comprehension and vocabulary questions to insure that the student understood what the passage was about. Next, the student was instructed on the particular fluency skill that was included with the lesson. When the mini lesson was completed, the student moved over to the computer station to practice incorporating the skill taught using the repeated reading technique with the same reading passage used in the mini lesson. The student was trained on how to make computer audio recordings using the Apple software program, GarageBand. The training included learning how to hook up the microphone, how to start up the GarageBand program and prepare for recording, how to label, number, and save each reading, and how to replay each recording. The goal was to audio record the passage at least two times using the Apple GarageBand program during the practice portion of the session.

At the beginning of the practice portion, the student was asked to state a goal for his reading practice, which he recorded on his student sheet. The researcher also recorded the student’s goal on a teacher sheet. After playing back and listening to the first recording, the researcher and student had a discussion on how the reading sounded and what the student
could do to improve it. The student revised his goal and recorded the reading a second time. After listening to the second recording, the student rated his reading performance, and evaluated whether he successfully incorporated the new skill. The researcher also rated the reading and gave the student feedback. The student and researcher recorded this information on their respective monitoring sheets and concluded the session. Following each session, the researcher reviewed the recordings, graphed the reading rate and errors for the set of repeated readings, recorded observations about the student’s lesson and reading, and planned the next lesson. Subsequent sessions began with a discussion of what the student remembered from the previous mini lesson and repeated reading practice. Students were progressed to the next lesson/passage after one or two intervention sessions. As each student completed twelve intervention sessions, he was given the posttest assessments concluding his participation in the study.

The next section will give a description of the assessments and other data that was collected before, during, and after the intervention.

**Data Collection**

Data collected from this study included pre and posttest administration of *The Qualitative Reading Inventory – 4* (QRI-4; Leslie & Caldwell, 2006). The QRI-4 is a comprehensive, research-based reading inventory that assesses reading skills from elementary through high school. The inventory provides leveled word lists and reading passages that reflect the narrative and expository reading materials used in schools and covers word identification, reading fluency, and comprehension. Students read graded
word lists and four leveled passages, were asked to retell what they read, and answered implicit and explicit comprehension questions.

In addition to the QRI-4, the study participants were given the interest inventory, *Tell Me What You Like* (McKenna & Stahl, 2009). The inventory asked students to assign a letter grade from A to F as a teacher gives letter grades to the different topics listed (i.e. sports, spiders). The study participants were also given *The Reader Self-Perception Scale* (RSPS; Henk & Melnick, 1995). The RSPS is a 33-item assessment of self-esteem and motivation in reading. Students are asked to indicate how strongly they agree or disagree with each statement on a five point scale (5 = strongly agree and 1 = strongly disagree). Both of these assessments were given at pretest and posttest.

During the intervention, the data collected included the computer audio recordings of the repeat readings that were reviewed after each session to determine Word Per Minute rate (WPM) and errors. The student monitoring sheets and teacher feedback sheets provided an ongoing record of student goals, fluency ratings, and teacher feedback to the student.

**Summary**

In conclusion, this chapter describes the methodology used to investigate the research question, “What is the effect of combining explicit fluency instruction with computer audio recording of repeated readings on the fluency and comprehension growth of intermediate aged students?” Three intermediate age male students received a total of 16 one-hour sessions of tutoring each, which included two pretest sessions, 12 instructional sessions,
and two posttest sessions. The intervention began with a mini lesson where the student practiced reading a 200-word passage using the techniques of listening while reading and partner reading. The mini lesson also included comprehension discussion and instruction in specific fluency skills. The second half of the intervention included practice of repeated readings using computer audio recording with the researcher and student critiquing the student’s reading performance. Data collected included pre and posttest results of the QRI-4, an interest inventory, and a self-perception reading assessment. Records of ongoing growth were collected in the form of WPM rates and errors from the repeated readings, student responses on the student monitoring sheets, and researcher responses on the teacher’s feedback sheets. The next chapter will report the results of the assessments and summarize the data.
CHAPTER 4

This chapter will report the results of the study that investigated the research question, “What is the effect of combining explicit fluency instruction with computer audio recording of repeated readings on the fluency and comprehension growth of three intermediate aged students?” First, the pretest and posttest results of the Qualitative Reading Inventory - 4 (QRI-4; Leslie & Caldwell, 2006) from each of the participants will be presented. Next the results from the interest inventory, Tell Me What You Like (McKenna & Stahl, 2009) will be presented. Then the results of the The Reader Self-Perception Scale (RSPS; Henk & Melnick, 1995) will be presented. The chapter will continue with a report of the participants reading speeds measured in Correct Words Per Minute (CWPM) for the repeated readings done during the intervention. Finally, a synopsis of the student responses and teacher observations collected during the intervention will be reported. The chapter will conclude with a summary of the main points.

QRI-4 Results

Student A showed slight gains in his reading of the third and fourth grade word lists from pretest to post test. As indicated in Table 1, Student A scored in the independent range for both the first grade and second grade word lists. He read 95 % of the first grade words automatically with a total score of 100%. He read 90% of the second grade words both automatically and totally. At the third grade level, Student A scored in the instructional range, identifying 70% of the words both automatically and totally. Student A scored in the frustration range at the fourth grade level, identifying 50% of the words in the
list automatically and 60% totally. After the intervention, Student A maintained the same score of 95% for automatic, but lost 5% on his total word identification. At the second grade level, he read 5% less automatically, but gained 5% more in the total score. At the third grade level, he had a 5% gain for both the automatic and total scores. Finally, at the fourth grade level, Student A maintained his 50% automatic score, but gained 10% for his total score.

Table 1

**QRI-4: Student A’s Word List Accuracy**

<table>
<thead>
<tr>
<th>Level</th>
<th>% Automatic Pretest</th>
<th>% Automatic Posttest</th>
<th>+/-</th>
<th>% Total Pretest</th>
<th>% Total Posttest</th>
<th>+/-</th>
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<td>50</td>
<td>0</td>
<td>60</td>
<td>70</td>
<td>+10</td>
</tr>
</tbody>
</table>

Student A’s passage reading results showed positive gains from pretest to posttest on all four passages in the area of accuracy. As indicated in Table 2, Student A’s pretest passage reading scores showed that his total passage level for the first grade narrative passage was at the instructional level with a score of 96% for total accuracy, a CWPM rate of 75, a recall of 56%, and a comprehension score of 100%. Student A also read the second grade expository passage at the instructional level reading with 94% accuracy, a CWPM rate of 63, a recall of 45%, and a comprehension score of 100%. Student A read the third grade
passage at the frustration level with 95% accuracy, a CWPM rate of 63, a recall of 49%, and a comprehension score of 62%. The fourth grade narrative passage was also in his frustration range with an accuracy score of 92%, a CWPM rate of 28, a recall of 10%, and a comprehension score of 38%.

Posttest results on Student A’s reading of the first grade narrative passage showed a 3% gain in accuracy, a 34 word increase in CWPM rate, and a 12% increase in recall. Student A gained 2% in accuracy on the second grade expository passage, but had decreases of 9 words for CWPM, 2% for recall, and 46% in comprehension. For the third grade passage he had increases of 2% for accuracy and 38% for comprehension, but decreases of 5 words for CWPM rate and 7% for recall. Lastly, Student A showed improvement in all areas for the fourth grade passage with increases of 3% in accuracy, 23 words in CWPM rate, 30% in recall, and 25% in comprehension.

Table 2

<table>
<thead>
<tr>
<th>Level</th>
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<td>N</td>
<td>% A</td>
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<td>94</td>
<td>95</td>
</tr>
<tr>
<td>E</td>
<td>77</td>
<td>63</td>
<td>64</td>
<td>28</td>
</tr>
<tr>
<td>% R</td>
<td>56</td>
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<tr>
<td>% C</td>
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<td>100</td>
<td>38</td>
</tr>
</tbody>
</table>

Table 2: QRI-4: Student A’s Passage Reading

N = Narrative, E= Expository, A= Accuracy, CWPM= Corrected Words Per Minute, R=Recall, C= Comprehension
Student B made positive gains from pretest to post test in his word list accuracy for the first, second, and fourth grade word lists. As indicated in Table 3, he scored in the instructional range, receiving a score of 85% both automatically and totally on the first grade word list. For the remaining three word lists he scored in the frustration range. He read 45% of the second grade words automatically and 60% totally. At the third grade level, Student B identified 50% of the words automatically and 55% totally. At the fourth grade level, Student B identified 40% of the words in the list both automatically and totally.

After the intervention, Student B read the first grade list in the independent range with a score of 90% both automatically and totally. He read the second grade level in the instructional range with 75% read automatically and 80% read totally showing gains of 30% and 20% respectively. At the third grade level he had a 5% loss for both the automatic and total scores. Finally, at the fourth grade level, Student B gained 10% with his automatic score and 15% with his total score.

Table 3

<table>
<thead>
<tr>
<th>Level</th>
<th>% Automatic Pretest</th>
<th>% Automatic Posttest</th>
<th>+/-</th>
<th>% Total Pretest</th>
<th>% Total Posttest</th>
<th>+/-</th>
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</tbody>
</table>
Student B’s passage reading results showed the most consistent growth in the area of CWPM rate from pretest to posttest. As indicated in Table 4, Student B’s pretest passage reading scores showed that his total passage level for the first grade narrative passage was at the independent level with a score of 97% for total accuracy, a CWPM rate of 69, a recall of 56%, and a comprehension score of 100%. Student B read the second grade expository passage at the instructional level with a score of 93% for accuracy, a CWPM rate of 59, a recall of 46%, and a comprehension score of 50%. He was able to bring his comprehension score up to 100% with look backs for that passage. Student B also read the third grade narrative passage at the instructional level with 91% accuracy, a CWPM rate of 32, a recall of 49%, and a comprehension score of 88%. He also increased his comprehension score to 100% with look backs on this passage. Student B read the fourth grade narrative passage at the frustration level with an accuracy score of 91%, a CWPM rate of 27, a recall of 17%, and a comprehension score of 75%.

After the intervention, Student B’s accuracy score on the first grade narrative passage stayed the same, but his CWPM rate increased by 9 words. He scored 11% lower for recall and 17% lower for comprehension on the first grade passage. On the second grade expository passage, Student B had a 3% gain on his accuracy score and an 11 word increase in his CWPM rate. His recall score was 17% less, but his comprehension score showed a 25% gain. On the third grade narrative passage, Student B gained 5% on his accuracy score and 29 words for his CWPM rate. His recall was 15% less and his comprehension score stayed the same. On the fourth grade narrative passage, Student B’s accuracy, recall, and
comprehension scores stayed the same, while his CWPM rate increased by 17 words. He increased his comprehension scores to 100% on all the passages with look backs.

Table 4

QRI-4: Student B’s Passage Reading

<table>
<thead>
<tr>
<th>Level</th>
<th>1 N</th>
<th></th>
<th>2 E</th>
<th></th>
<th>3 N</th>
<th></th>
<th>4 N</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>% A</td>
<td>97</td>
<td>97</td>
<td>93</td>
<td>96</td>
<td>91</td>
<td>96</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>CWPM</td>
<td>69</td>
<td>78</td>
<td>59</td>
<td>70</td>
<td>32</td>
<td>61</td>
<td>27</td>
<td>44</td>
</tr>
<tr>
<td>% R</td>
<td>56</td>
<td>45</td>
<td>46</td>
<td>29</td>
<td>60</td>
<td>45</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>% C</td>
<td>100</td>
<td>83</td>
<td>50</td>
<td>75</td>
<td>88</td>
<td>88</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>

N = Narrative, E = Expository, A = Accuracy, CWPM = Corrected Words Per Minute, R = Recall, C = Comprehension

Student C showed gains in his reading of the first, third, and fourth grade word lists from pretest to post test. As indicated in Table 5, Student C scored in the independent range for the first grade word list with an automatic score of 90% and a total score of 100%. He performed at the instructional level on both the second and third grade passages. On the second grade word list he received an automatic score of 85% and a total score of 90%, and on the third grade word list he scored at 80% both automatically and totally. Student C scored in the frustration range for the fourth grade list with an automatic score of 45% and a total score of 55%. After the intervention, Student C increased his score to 100% both automatically and totally on the first grade list. He scored 10% less automatically and 15% less totally on the second grade list. On the third grade list, he...
gained 5% on his automatic score and 10% on his total score. Finally, on the fourth grade list, Student C showed a 25% increase automatically and a 30% increase totally.

Table 5

QRI-4: Student C’s Word List Accuracy

<table>
<thead>
<tr>
<th>Level</th>
<th>% Automatic Pretest</th>
<th>% Automatic Posttest</th>
<th>+/-</th>
<th>% Total Pretest</th>
<th>% Total Posttest</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>100</td>
<td>+10</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
<td>75</td>
<td>-10</td>
<td>90</td>
<td>75</td>
<td>-15</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>85</td>
<td>+5</td>
<td>80</td>
<td>90</td>
<td>+10</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>70</td>
<td>+25</td>
<td>55</td>
<td>85</td>
<td>+30</td>
</tr>
</tbody>
</table>

Student C’s passage reading showed slight improvements in all areas for the first grade narrative passage and in the area of accuracy for the second grade expository passage. As indicated in Table 6, Student C’s pretest passage reading scores show that he read the first grade narrative passage in the independent range with an accuracy score of 98%, a CWPM rate of 57, a recall score of 48%, and a comprehension score of 100%. Student C read the second grade expository passage in the instructional range with an accuracy score of 84%, a CWPM rate of 67, a recall score of 35%, and a comprehension score of 100%. He also read the third grade narrative passage in the instructional range with an accuracy score of 97%, a CWPM rate of 56, a recall of 66%, and a comprehension score of 88%. Student C scored in the frustration range for the fourth grade narrative passage with a score of 97% for accuracy, a CWPM rate of 56, a recall of 15%, and a comprehension score of 88%.
He increased his comprehension score to 100% on the third grade passage with look backs.

After the intervention, Student C showed a 1% gain in accuracy, a 13-word increase in CWPM rate, and a 22% increase in recall on the first grade narrative passage score. On the second grade expository passage he gained 13% in accuracy, but decreased in CWPM rate by 14 words, in recall by 9%, and comprehension by 12%. On the third grade narrative passage, Student C maintained the same scores from pretest to posttest for both accuracy and comprehension. However, he read the third grade passage 9 words slower and recalled 36% less of the passage. Finally, for the fourth grade narrative passage, Student C scored 7% less for accuracy and 27 words less for CWPM rate. Student C showed a 25% increase in recall and increased his comprehension scores on all four passages to 100% with look backs.

Table 6

QRI-4: Student C’s Passage Reading

<table>
<thead>
<tr>
<th>Level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>E</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>% A</td>
<td>98</td>
<td>99</td>
<td>84</td>
<td>97</td>
</tr>
<tr>
<td>CWPM</td>
<td>57</td>
<td>70</td>
<td>67</td>
<td>53</td>
</tr>
<tr>
<td>% R</td>
<td>48</td>
<td>70</td>
<td>35</td>
<td>26</td>
</tr>
<tr>
<td>% C</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>88</td>
</tr>
</tbody>
</table>

N = Narrative, E= Expository, A= Accuracy, CWPM= Corrected Words Per Minute, R=Recall, C= Comprehension
A comparison of the QRI-4 results for all three students indicated some growth but in different areas for each student. As indicated in Figure 1 and Figure 2, all students either maintained or slightly improved their word list accuracy scores in both the automatic and total scores.

*Figure 1. Comparison of Word List Accuracy (Automatic Score)*
Figure 2. Comparison of Word List Accuracy (Total Score)

All three students showed growth from pretest to post test in their Accuracy % scores on the passages. As indicated in Figure 3, Student A showed gains on his reading of all four passages. Student B showed growth on his reading of the second and the third grade passages, and Student C showed growth on his reading of the first and second grade passages.
Figure 3. Comparison of % Accuracy on the passages

In the area of CWPM, Student B showed gains on all four passages. As indicated in Figure 4, all students showed gains from pretest to post test on the first grade passage. Student A showed growth on the first and fourth grade passages.

Figure 4. Comparison of CWPM rates on the passages
Finally, the students showed some improvement in the areas of recall and comprehension. As indicated in Figures 5 and 6, Students A and C improved on their recall for both the first grade and the fourth grade passages. Student A showed gains on his comprehension score for both the third and fourth grade passages, and Student B showed a gain on the second grade passage. The next section will report the data collected from the interest inventory, *Tell Me What You Like* (McKenna & Stahl, 2009) for each participant.

*Figure 5. Comparison of % Recall from the passages*
This data was collected for the purpose of getting to know the participants and to help in selecting high-interest reading passages for the intervention. Students were given a list of 32 topics and asked to assign letter “grades” from A to F for each topic with A indicating it was a favorite topic and F indicating it was a least favorite topic. Table 7 shows the A topics chosen by each of the participants.
Table 7

*Results of “Tell Me What You Like” Survey*

<table>
<thead>
<tr>
<th>A Topics</th>
<th>A Topics</th>
<th>A Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports</td>
<td>Animals</td>
<td>Sports</td>
</tr>
<tr>
<td>Sharks</td>
<td>Sharks</td>
<td>Camping</td>
</tr>
<tr>
<td>Camping</td>
<td>UFO's</td>
<td>Drawing</td>
</tr>
<tr>
<td>Spiders</td>
<td>Snakes</td>
<td>Friendship</td>
</tr>
<tr>
<td>Snakes</td>
<td>Fishing</td>
<td>Fishing</td>
</tr>
<tr>
<td>Fishing</td>
<td>Dogs</td>
<td>Love</td>
</tr>
<tr>
<td>Monsters</td>
<td>Cats</td>
<td>Countries</td>
</tr>
<tr>
<td>Ghosts</td>
<td>Families</td>
<td>Dogs</td>
</tr>
<tr>
<td>Ocean</td>
<td>Computers</td>
<td>Families</td>
</tr>
<tr>
<td>Music</td>
<td></td>
<td>Computers</td>
</tr>
<tr>
<td>Cats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Families</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each student displayed a range of interests with all three indicating interests in the topics of Families and Computers. The next section continues with a report of the results obtained from *The Reader Self-Perception Scale*.

**Results of the Reader Self-Perception Scale (RSPS)**

The RSPS is designed to assess how children perceive themselves as readers. The results of this assessment did not indicate much change in the students' self-perceptions of their reading from pretest to posttest. As indicated in Table 8, Student A received a score of 40 in the area of Progress, which is in the high average range. His Observational Comparison score of 21 and his Social Feedback score of 35 were both in the average range. His Physiological States score of 29 fell into the low average range. After the intervention,
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Student A’s scores remained in the high average range for Progress, moved to the low average range for Observational Comparison and Social Feedback, and moved to the low range for Physiological States.

Table 8

*The Reader Self Perception Scale Pre and Post test results*

<table>
<thead>
<tr>
<th></th>
<th>Progress</th>
<th>Observational Comparison</th>
<th>Social Feedback</th>
<th>Physiological States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
<td>T</td>
<td>P</td>
<td>T</td>
</tr>
<tr>
<td>Student A</td>
<td>40</td>
<td>42</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>Student B</td>
<td>35</td>
<td>31</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Student C</td>
<td>36</td>
<td>45</td>
<td>16</td>
<td>25</td>
</tr>
</tbody>
</table>

P = pretest    T = Posttest

Student B scored 35 for Progress, 18 for Observational Comparison, and 30 for Social Feedback. All of these scores were in the low average range. He scored a 21 in the area of Physiological States, which is in the low range. At posttest he scored 4-points lower for Progress and 1-point lower for Observational Comparisons. His Social Feedback score of 30 remained the same and his Physiological State score increased by 4-points.

Student C scored 36 for Progress, 16 for Observational Comparison, 28 for Social Feedback, and 21 for Physiological States. These scores were in the average to low range. Student C’s posttest scores showed gains in all areas with a 9-point gain for Progress, a 9-point gain for Observational Comparisons, a 3-point gain for Social Feedback, and a 3-point gain for Physiological States.
In summary, results for the RSPS showed that Student A’s self perception stayed in the high average range from pretest to posttest in the area of Progress. In the areas of Observational Comparison, Social Feedback, and Psychological State, his scores were slightly lower after the intervention. Student B’s posttest scores were slightly lower in the areas of Progress and Observational Comparison, stayed the same for Social Feedback, and increased slightly for Physiological States. Student C showed the most consistent improvement from pretest to posttest in all areas with 9-point gains in the areas of Progress and Social Feedback. The next section will continue with a report of the reading rates the participants received on the repeated readings done during the intervention.

**CWPM Rates of Repeated Readings**

As indicated in Figure 7, Student A’s CWPM scores showed improvement from the first to the second recorded readings with the exception of the third repeated reading where he scored the same each time. His average gain for the nine repeated readings he recorded during the intervention was 11.2 CWPM.
Figure 7. CWPM rates of Student A’s GarageBand repeated readings

As indicated in Figure 8, Student B’s CWPM scores showed positive gains with the exception of the third reading, where he also scored the same CWPM score for both recordings. Student B was only able to record eight repeated readings during the intervention. He had an average gain of 12.9 CWPM on his recorded readings.
As indicated in Figure 9, Student C showed greater CWPM gains as he completed his fifth recording, losing 14 CWPM on the third reading and scoring the same score for the fourth reading. His average gain on the 9 readings he recorded during the intervention was 9.6 CWPM.
In summary, all three students made positive CWPM gains from the first to the second repeated readings that were computer audio recorded during the intervention. The third reading appeared to be a challenge for all three students with Students A and B scoring the same on both readings and Student C scoring lower on the second reading. The next section will continue with a synopsis of the student responses and teacher observations recorded during the intervention for each participant.

**Student Responses and Teacher Observations of the Intervention Lessons**

During the intervention sessions, the students listened to 150 to 200 word passages that were either read from a CD or by the researcher. The passage was read a second time with the researcher using the technique of partner reading. The lessons continued with a comprehension discussion about the passage and a specific teaching point about reading fluency such as reading with expression or watching for punctuation. For
the last 30 minutes of the intervention, the student practiced the passage as a repeated reading and audio recorded himself using the Apple GarageBand program on the researcher’s computer. Prior to recording, the students were asked to record in their own words what they just learned and their goal for reading that day. After listening to their recordings, they were asked to rate their fluency according to the fluency rubric that was explained to them at the beginning.

While both students and researcher did their best to rigorously cover all the steps in this intervention, there were a few occasions where the student sheets were overlooked or filled out quickly. What was recorded added some insight into the thinking processes of the student after receiving the direct fluency instruction and as he practiced the new skill. For example, Student A recorded after Lesson 1 that you should “make your voice go up when you see a period or comma.” On the rubric for that lesson he recorded, his rate, expression, and phrasing to be a 3 and his punctuation to be a 4. The researcher recorded that the student “had some expression and is enthusiastic about the reading” and recorded a 3 for rate, phrasing, and punctuation, and a 4 for expression. Later during Lesson 5, he wrote, “I want to sound like a real reporter.” The researcher recorded that Student A “seemed more confident and sounds like he’s talking directly to listeners.”

In another example from the first lessons, Student B recorded, “Reading is fun, and it is not hard.” He recorded 3 for rate, 2 for expression, 4 for phrasing, and 2 for punctuation. The researcher recorded, “You read it so you could follow the story too,” and rated the reading as 3 for both rate and phrasing, and 2 for both expression and punctuation. During
lesson 5, Student B recorded, “in a story with a dialogue, you can use your voice to show something like teasing.” He recorded a 4 for his expression in that reading. The researcher recorded, “student is starting to relax and use his voice to help tell the story.”

Finally, Student C wrote during Lesson 4 that “you need to think about what is going on in the story.” He gave himself a 3 for rate, and 2’s for expression, phrasing, and punctuation. For Lesson 4, the researcher recorded that Student C had “very accurate reading, made up good voices for the characters, and followed the punctuation.” Teacher ratings for that reading included a 2 for rate, and 3’s for expression, phrasing, and punctuation. Later in Lesson 6, Student C wrote that “paying attention to punctuation” was his goal. He recorded a 2.5 for rate, a 3 for expression and phrasing, and a 3.5 for punctuation. The researcher recorded that “Student C is following punctuation, is adding much more feeling/mood, and is reading with more confidence.”

To summarize, the student responses and teacher observations provided evidence that the students were engaged and thinking carefully about how to make their reading sound more fluent throughout the intervention. The students were able to articulate several of the main teaching points covered during the first part of their intervention such as “adjusting your voice when you see punctuation”, “making your voice sound like a reporter”, “adjusting your voice for characterization”, and “paying attention to what is going on in the story”. The researcher’s observations also revealed evidence that the students were attempting to make their reading more fluent while still following the
meaning of the passage, and that the students were reading with more confidence. The next section will summarize the results for the whole chapter.

Summary

In conclusion, results from the QRI-4 showed some positive gains from pretest to post test in the areas of accuracy for Students A, B, and C. Student A showed some gains in comprehension. Student B also showed improvement in the area of comprehension, while Student C showed some improvement in recall. The results of the Tell Me What You Like Survey revealed that all three students had a range of interests with Families and Computers being in common for all three. The results of The Reader Self-Perception Scale did not reveal a change in the students self-perceptions of their reading from pretest to post test. The CWPM rates of the readings recorded during the intervention indicated ongoing positive growth during the intervention with Student A gaining an average of 11.2 CWPM, Student B gaining an average of 12.9 CWPM, and Student C gaining an average of 9.6 CWPM. Finally, student responses and teacher observations provided evidence of ongoing reading growth during the intervention as students were able to articulate in their own words key ideas learned about reading fluently, like adjusting your voice and watching for punctuation. The teacher observations identified examples of target reading behaviors such as “the student is using his voice to help tell the story” and “the student is watching for punctuation.” The findings presented above showed that an after school tutoring intervention with a focus on intensive fluency training combined with GarageBand audio recording of repeated readings resulted in positive growth in fluency and comprehension.
in intermediate-aged students. A discussion of the findings is presented in the next chapter.
Intermediate-aged students that struggle with reading fluency issues such as difficulty with word recognition, slow reading rate, and inability to read with expression are at high risk for academic failure. A 1995 National Assessment of Educational Progress (NAEP) report on oral reading found that 44% of fourth graders in the sample scored at the lowest fluency ratings and read grade level text at word per minute rates of 89 or below (Pinnell et al., 1995). Research has identified a relationship between low fluency ratings and lower scores on general measures of reading achievement (Pinnell et al, 1995). In the report of the National Reading Panel, fluency was listed as one of five critical components of reading alongside phonemic awareness, phonics, vocabulary, and comprehension (National Reading Panel, 2000). Wisconsin Common Core Standards (2010) list fluency as a foundational skill with the expectation that students will “read with sufficient accuracy and fluency to support comprehension.” With ever-increasing pressure to narrow achievement gaps and insure that all children reach proficient levels in reading, it is essential that teachers step up their efforts to provide differentiated instructional strategies that support the development of adequate levels of fluency for the students they teach. This chapter will first include a summary of the intervention. Then there will be a discussion of the findings of this study. Next there will be a discussion of the strengths and limitations of the study. Following that will be a discussion of implications for future research. Finally, the chapter will end with a conclusion and closing reflections for the entire study.

**Summary of the Intervention**

The purpose of this study was to find out if a one hour after school reading intervention that
included explicit fluency instruction and computer audio recording of repeated readings would improve the fluency and comprehension skills of intermediate aged struggling readers. The researcher met individually with one third grader and two fourth grade struggling readers for twelve one-hour sessions after school that were paced at one to two sessions per week from April - June 2011. Each session started with a fluency mini lesson that included a short 150 to 200-word passage, several vocabulary and comprehension questions, and an explanation of a specific fluency skill such as watching for punctuation or learning to find the natural breaks in sentences. The second part of the session included a practice portion where the student used the Apple software application GarageBand to computer audio record the same passage as a repeated reading. The student made two recordings of each passage. The student monitored his reading by recording reading goals, listening to his repeated readings, and rating his fluency. The researcher also listened to the repeated readings and gave feedback to the student. The research-based practices that were incorporated into the intervention included listening while reading, partner reading, direct instruction, repeated reading, corrective feedback, student monitoring, and computer audio recording. Many research studies have shown that fluency and comprehension growth are successfully supported when teachers provide students with a variety of instructional alternatives, (Devault & Joseph, 2004; Homan, Klesius, & Hite, 1993; Martens et al. 2007; Rasinski, 1990;). In the next section there will be a discussion of the findings of the study.

**Findings of the study**

The QRI-4 pre/posttest results showed improvement in the areas of accuracy and
reading rate, for all three students. There were slight improvements in the area of comprehension for two of the students. Student A, who was a third grader, showed growth in the area of accuracy for both the word lists and passages. He also improved his reading rate on the first and fourth grade passages. His recall increased on the first and fourth grade passages. His comprehension stayed at 100% for the first grade passage and improved for the third and fourth grade passages. Student A’s parent described him as not being interested in reading and having a tendency to do as little school work as possible on his own. During the intervention, Student A responded well to the one to one instruction and especially enjoyed using the computer to make recordings of his reading and then playing them back. He really got into the whole process when the researcher suggested he imagine he was a radio announcer making a radio show. Student A worked diligently on making his recordings and was very interested in making each one sound better.

Student B, who was in fourth grade, showed improvement in the area of accuracy for both the word lists and passages. He was able to improve his reading rate on all the passages. Student B maintained his recall and comprehension scores with a slight increase for the second grade passage. Student B’s parents described him as having attention problems in school and were in the process of having him tested for Attention Deficit Disorder. In working with Student B, it was evident that he had a short attention span and frequently needed refocusing. The one to one format helped him to stay focused, but it was important to have the steps clearly listed on a card and the materials laid out ready to go to support him in staying on task. Student B also enjoyed imagining he was making a “radio
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recording” and worked to use the skills discussed in the lessons. While his reading rate and accuracy did improve, his ability to concentrate may have affected his ability to retell and answer the comprehension questions on the QRI-4.

Student C, who was also in fourth grade, also showed improvement in the area of accuracy on the word lists and passages, but continued to struggle with low reading rate on all of the QRI-4 passages. He was able to show an increase in recall on the first and fourth grade passages. Student C was referred to the study by his school’s reading specialist for difficulties with slow reading rate. His parents also mentioned that reading difficulties ran in their family, but that he had never been diagnosed as having a learning disability. He tended to slow himself down with lots of repetitions and decoding errors, but was able to self-correct. While he did not show a gain from pretest to posttest in the area of comprehension, he did maintain a 100% score on the first grade passages and 88% for the other passages. Student C was aware that his reading was slow and worked hard on trying to improve. He was the last student to join the study and started his intervention sessions a bit later in the school year. Unfortunately, due to end of the year school activities, Student C’s sessions were spread out with more time in between sessions. This may indicate the importance of concentrating interventions sessions closer together over a shorter period of time. Homan, Klesius, and Hite (1993) found that reading growth occurred as a result of the students’ focus on connected text reading for three 20-minute sessions over a seven-week period. Martens et al. demonstrated that an intervention that combined fluency
building strategies with student self monitoring and rewards can effectively support growth of up to two grade levels in three 30 minute sessions over a five week period.

The results for the “Tell Me What You Like” survey were only administered at the beginning of the study to help the researcher get to know the students and to help in selecting materials. Each student showed a variety of interests with all three indicating an interest in computers. Lessons for the students were chosen based on their interests from Increasing Fluency with High Frequency Word Phrases, Grade 3 (Knoblock, 2007) and Read-Aloud Passages and Strategies to Model Fluency, Grades 3-4 (Mann, 2007). For example, one lesson called, “A Glass of Milk” was about eating dairy foods. The fluency skill focused on in the lesson was breaking up sentences into “chunks” or phrases. After completing the lesson, the student was asked to read the passage as though it were a commercial for a grocery store. Another lesson was an excerpt from the story, “Charlotte’s Web”. The students used this passage to practice reading dialogue and adding expression. All three students appeared very motivated to read and practice the passages that were selected.

The Reader Self-Perception Scale (RSPS) was given to assess the students’ perceptions of themselves as readers before and after the intervention. There was no change in the results of this assessment from pretest to posttest suggesting that the intervention did not change the way the students perceived themselves as readers.

During the intervention, two students made two recordings each of 9 passages, and one student made two recordings each of 8 passages. Student A gained an average of 11.2 words on his second recordings, Student B gained an average of 12.9 words on his second
recordings, and Student C gained an average of 9.6 words on his second recordings. Throughout the intervention it was emphasized that good readers read at a rate they can follow the meaning. It was emphasized that they learn to monitor the quality of their reading over reading speed. For example, during the reading of the “Charlotte’s Web” passage, the students had to follow the meaning of the passage to know where to add the correct characterization. Applegate, Applegate, and Modla (2009) found that it is important to support the development of fluency and comprehension by providing activities that stimulate thinking about the reading. The combination of repeated reading and audio recording helped the students to listen to and critique their own reading. This in turn helped them to focus on the meaning of the story and to figure out where to add the voices of the characters.

The student responses and teacher observations recorded during the intervention provide evidence that the students were thinking about what they had learned from the mini lessons and were trying to incorporate this learning into their computer recordings. The process of setting up the computer and microphone, recording, listening, critiquing, and then repeating the process a second time was fun and engaged the students. Asking them to imagine they were making a radio show, allowing them to manipulate the computer technology, and having them rate their recordings gave them an authentic purpose for practicing their reading. With the addition of the researcher’s feedback, the students began to listen carefully to their readings and were able to articulate what would help to make the next reading better. Research has found that reading tasks that are
purposeful and relevant such as having students chart their own reading rate and having students make their own recordings can keep students motivated and more engaged in getting the practice required to reach instructional goals, (Homan, Klesius, & Hite, 1993; Martens et al. 2007).

In summary, the QRI-4 results indicated reading growth for all three students in the areas of accuracy and reading rate. Two of the students showed a slight improvement in the retell and comprehension portions of the QRI-4. The results of the “Tell Me What You Like” survey were given at pretest only and assisted in planning lessons that were motivating for the students. The results of the RSPS did not indicate a change in the student’s self-perceptions of themselves as readers, however the computer audio recordings, student’s responses, and the researcher’s observations provide evidence that the students were thinking carefully about the fluency skills covered in the mini-lessons, attempting to incorporate these skills into their repeated readings, and were enthusiastically engaged in the process of audio recording their repeated readings. The next section will continue with a discussion of the strengths of this study.

**Strengths of this Study**

One strength of this study was the finding that struggling students benefited from a carefully designed intervention that combined multiple strategies to support fluency and comprehension growth. It has been found in current research that struggling students benefit from one to one support and supervision of oral reading practice to help them achieve necessary levels of fluency (Conderman & Strobel, 2008; Vadas, Sanders, & Peyton, 2005). Furthermore, a targeted
fluency program that is closely matched to students’ instructional levels can produce significant gains in oral reading fluency (Martens et al., 2007).

Another key finding was that students benefited from combining computer audio recording with repeated readings. Teachers need to find ways to integrate the necessary practice required to help students develop their fluency and comprehension abilities into the busy school day. Macaruso and Rodman (2009) found that struggling students using Computer Assisted Instructional programming could make significant gains when it was appropriately implemented and utilized as a key part of reading instruction. Using computer audio recording with the repeated readings was an appropriate way to help students to practice the skills following the direct instruction they had received in the first part of the session. In addition, the computer audio recordings also had the advantage of allowing the students to listen to their own readings and to evaluate their own performance. Martens et al. demonstrated that combining fluency-building strategies with student self-monitoring and rewards could effectively support reading growth.

In summary, this study supports the findings of other studies that struggling readers benefit from interventions that combine multiple strategies to support fluency and comprehension growth. In addition, the findings of this study also suggest that computer audio recording of repeated readings is a motivating option for fluency practices with the added benefit of helping students to self-monitor their own reading. The chapter will continue with a discussion of the limitations of the study.
Limitations of this Study

Although the intervention was successful in helping the students achieve reading growth, there were some limitations to the study. One limitation was the small sample size of three students. Other limitations that may have affected the results were that the intervention was conducted after school, that it took place at a site separate from the school, and that it did not take place in the context of a typical school day. The intervention also took place in the last months of the school year when there were many special activities that took place after school, such as the spring music program and baseball practices. This resulted in only being able to meet with the individual students once a week for some of the sessions. Therefore, there was a lot of time between sessions where students may not have been able to retain what they had gained from the previous session.

Another limitation was the inexperience the researcher had in designing the steps to the intervention. With so much to get done, it was found that the student monitoring sheets that asked the students to record a reading goal and rate their reading on a scale of 1 – 4 were too complex and took too long to fill out. In addition, it was very difficult for the students to rate their own reading using the fluency scale. An improvement would have been something simpler, like having a checklist or having students respond to yes/no statements.

In summary, some limitations to consider for this study were that it had a small sample size of three students, the intervention did not take place in the context of a normal school day, and scheduling conflicts resulted in gaps of up to one week between sessions. There
were also difficulties found with the design of the student monitoring sheets that suggest a more simplified version for future applications of this intervention. The chapter will continue with some recommendations for future research.

**Recommendations for Future Research**

The focus of this study was to develop an afterschool intervention that supported intermediate aged students in developing reading fluency. One of the challenges teachers face in helping students who are deficient in reading fluency is motivating them to practice. This study was successful in showing that computer audio recording of repeated readings could successfully motivate students to practice their fluency skills. It is recommended that future studies explore the advantages of integrating computer technology into the practicing of fluency skills. Despite the documented success of the repeated reading strategy, many struggling readers are unmotivated to read the same passage over and over. In addition, repeated readings and other practices like partner reading and choral reading require time for teachers to work individually with students or require extra time set aside for students to work together. Setting up a fluency practice center that integrates computer audio recording with repeated readings could offer the advantages of a more efficient and motivating way of allowing students to self correct and monitor their own reading.

An additional benefit of making the computer audio recordings was having a permanent record of the students’ fluency growth. This record proved to be useful for planning individual lessons and tracking each student’s progress throughout the intervention. More
research is needed to explore the benefits of using computer audio recordings as assessment tools for teachers in the monitoring of fluency growth.

More research is also needed to explore the possible benefits of other applications of computer audio recording such as podcasting. Existing studies on integrating computer technology into the reading curriculum have shown that specific computer programs that focus on phonics and word identification skills can promote reading fluency for children at the elementary and middle school levels (Knezek & Christiansen, 2007; Lewandowski, Begeny, & Rogers, 2006; Macaruso & Rodman, 2009;). In addition, Savage et al. (2010) found that teachers who can expertly integrate and extend computer technology into the larger literacy curriculum support greater gains in overall reading achievement. Making classroom podcasts, where students are engaged in the process of making a recorded program where they present favorite book passages, poetry, reader’s theater, or news articles would provide authentic opportunities for students to practice their oral reading skills. Students could be involved in all aspects of podcast production such as planning, writing scripts, and recording with finished podcasts being shared with the larger school community.

In summary, the findings of this study support the integration of computer applications like Garageband audio recording into a balanced reading curriculum. More research is needed to explore the advantages of using computer audio recording for such purposes as motivating struggling readers to practice fluency, to provide convenient assessment records for teachers, and to further extend oral reading into the larger reading curriculum.
through the vehicle of classroom podcasts. The next section will continue with a conclusion for the chapter.

**Conclusion**

Reading research has found that fluency is multidimensional and develops gradually from the early grades on. Speece and Ritchey (2005) found that disparities in fluency development are present as early as the end of first grade with at-risk students performing at half the levels of not-at-risk students. Therefore it is very important for teachers to support fluency development early on in the reading curriculum. Fluency must be developed alongside comprehension using activities that help students to critically think about their reading (Applegate, Applegate, & Modla, 2009). The findings of this study concur with the findings of other studies that support the use of multiple strategies like repeated reading, corrective feedback, and student monitoring to support the development of fluency (Devault & Joseph, 2004; Homan, Klesius, & Hite, 1993; Martens et al. 2007; Rasinski, 1990). This study also found that students benefited from using the Apple application, GarageBand to make computer audio recordings of repeated readings. Using the computer technology was motivating and helped to students to become more aware of how to make their reading more fluent. While more research needs to be done specifically on using computer audio recording to support student’s fluency growth, other studies using computer technology have found that students show greater overall gains when teachers expertly integrate computer technology into the reading curriculum to support the areas of weakness (Knezek & Christensen, 2007; Lewandowski, Begeny, &
In this study, computer technology was specifically used to assist students in the practice of newly learned fluency skills and to promote awareness of fluent reading. This integration targeted the students’ areas of weakness and was found to be successful in helping them to achieve reading growth. Combining explicit fluency instruction with Garageband audio recording of repeated readings is recommended as an efficient option for building reading fluency.
REFERENCES


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