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Curriculum-Based Measurement: Investigating the Relationship between Oral and Silent Reading Comprehension and Words Correct per Minute

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Abstract

Students referred for school psychology services often have reading skills deficits and experience difficulty in other academic areas. There are no procedures, strategies, or programs that can be used to remedy reading skills deficits across *all* children. Therefore, the effects of remediation procedures must be assessed. For this assessment to be useful (e.g., allow educators to alter ineffective programs quickly) these assessment procedures must be efficient and allow for multiple forms. This assessment must also be reliable and sensitive enough to detect small changes in behavior over a brief period of time. Curriculum-based measurement (CBM) procedures were designed to allow for frequent and efficient evaluation of intervention effects (Deno, 1985).

Researchers have repeatedly shown that there are strong positive correlations between words correct per minute (WCPM) and standardized tests of reading (Fuchs & Deno, 1992). However, researchers have also found a decreasing correlational trend between WCPM and standardized reading achievement tests as student grade level increases (Jenkins & Jewell, 1993).

CBM procedures measure oral reading fluency (WCPM) in an attempt to indirectly measure general reading skills. Rate of comprehension is a measure in which comprehension and fluency are both directly measured. Rate of comprehension may provide the sensitivity needed to detect small changes in reading growth as student grade level increases (Skinner et al., 2002).

The current study was designed to extend research on CBM reading assessment procedures. Specifically, researchers compared the effects of oral and silent reading on the number of questions participants answered correctly across elementary and secondary

students. Additionally, researchers compared the effect reading mode (oral versus silent) had on comprehension rates across elementary and secondary students. Finally, the relationships among oral and silent reading comprehension rate and WCPM and oral and silent reading comprehension level and WCPM were analyzed.

Participants were assessed in two sessions. In one session, each student read three passages silently and answered comprehension questions. In the other session, each student read three passages orally and answered comprehension questions. The passages and questions used were selected from the *Timed Readings Series* (Spargo, 1989). For both reading conditions, the investigator recorded the number of seconds required for the student to read each passage, the number of questions the student answered correctly, and the student's rate of comprehension. For the oral reading condition, the experimenter recorded errors and the number of words read correctly in 1 minute.

The results of this study support the validity of WCPM as a measure of comprehension rate, but not comprehension level. The results also indicate that oral reading does not hinder reading comprehension, but may actually enhance comprehension relative to silent reading. Thus, the current results suggest that during CBM, asking students to answer questions after reading aloud is appropriate, but measures obtained from the comprehension questions are only useful if converted to rates. The current results support the use of WCPM as a measure of reading comprehension rates. Although the current results support oral reading comprehension rate as a possible measure of general reading skills, future research is needed to establish the reliability, validity, and sensitivity of that measure.

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Chapter 1

Review of the Literature

Students with reading skills deficits are often referred for school psychology services (Reschly & Ysseldyke, 1995). Reading skills deficits may be the most frequent and serious academic skills problem that students face (Lentz, 1988). Students require reading comprehension to access facts and concepts in various curriculum areas (Brown-Chidsey, Davis, & Maya, 2003). Therefore, students with poor reading skills are likely to experience difficulty in other academic areas including history, geography, and economics (Espin & Deno, 1993).

There is a general consensus that student academic performance, as an outcome of instruction, should be routinely evaluated. However, there is no general consensus concerning how to evaluate student aca-demic performance (Deno, 1985). Perhaps because of their strong psychometric properties, standardized tests are often used to assess student academic performance. However, these instruments were not intended to be administered on a frequent basis. Therefore, standardized tests have limited use for evaluating the effects of specific interventions. Curriculum-based measurement (CBM) procedures were developed in an attempt to address some of the concerns of standardized and norm-referenced tests (Deno, 1985). CBM procedures are time efficient, sensitive, have multiple forms, and therefore can be administered more frequently than standardized tests (Marston, 1989).

Reading Accuracy and Reading Fluency

Reading fluency is defined by two components: reading accuracy and reading speed (Shinn, Good, Knutson, Tilly, & Collins, 1992). Reading accuracy is an essential

skill in reading and has traditionally been emphasized by educators in the assessment of students' skills (White & Haring, 1980). Reading fluency is as important as reading accuracy, and for more advanced students, it is perhaps more important (White & Haring, 1980).

Several theories of reading development and achievement incorporate reading fluency. Laberge and Samuels' (1974) model of information processing is based upon the premise that as decoding the written word becomes more automatic (i.e., rapid and accurate), fewer cognitive resources are spent on these tasks, leaving more cognitive resources available to apply towards reading comprehension. Increasing the cognitive resources available for comprehension, presumably, also increases the amount of text that can be comprehended. Therefore, reading fluency is an essential skill for comprehension (Anderson, Hiebert, Scott, & Wilkinson, 1985).

Chall's (1996) model of reading development also emphasizes decoding and reading fluency. Under Chall's model, a student must first master letter recognition and decoding. The student then must become fluent in letter recognition and decoding before the student can successfully comprehend reading material. According to Chall (1996), reading cannot become a tool for learning until the fundamental reading decoding skills are mastered and reading fluency has become habitual (automatic).

CBM: A Current Measure of Reading Fluency

Curriculum-based measurement procedures were developed at the University of Minnesota through the Institute for Research on Learning Disabilities (Pottre & Wamre, 1990). CBM procedures are used to assess the basic skills of students in the following areas: reading, spelling, writing, and math (Brown-Chidsey et al., 2003). Words correct

per minute (WCPM) is a measure of oral reading fluency used in CBM procedures designed to assess reading (Shapiro, 1996). The standard CBM procedure used to calculate WCPM begins with the examiner having the student read from a selected passage for 1 minute. The examiner marks various errors including omissions, substitutions, mispronunciations, and skipped lines. The examiner then calculates WCPM and errors per minute (Shapiro, 1996). CBM is often used by teachers to monitor student progress, or lack of progress, in reading (Crawford, Tindal, & Stieber, 2001), and it is frequently used to evaluate the effectiveness of interventions designed to enhance reading skills (Hintze, Daly, & Shapiro, 1998).

CBM versus Standardized Tests

CBM procedures address many concerns about using standardized tests to assess students' reading level and progress. Chall (1996) and Laberge and Samuels (1974) provide reading development theories that indicate the importance of reading fluency in the development of reading comprehension. The Commission on Reading (1985) reported the following concerning reading fluency: “Readers must be able to decode words quickly and accurately so that this process can coordinate fluidly with the process of constructing the meaning of the text” (p. 11); additionally, "Standardized tests do not provide a deep assessment of reading comprehension and should be supplemented with observations of reading fluency…” (p. 101) (Anderson et al., 1985). However, standardized tests of reading achievement often exclude measures of reading fluency (Shinn et al., 1992), whereas the WCPM component of CBM is a measure of oral reading fluency (Shapiro, 1996).

Another criticism of standardized tests is that they may be limited in content overlap with students' curriculum. In measuring acquisition of academic skills, it is important to assess the same skills that have been taught in the student's curriculum. In CBM, assessment material is often taken directly from the student's curriculum (Fuchs & Deno, 1992). Deriving CBM probes from the student's curriculum allows for assessment of the same skills that the student has been taught (Shapiro, 1996).

Standardized tests have also been criticized because they may not be sensitive to small changes in student academic performance. Also, standardized tests typically contain a limited sample of subskills as well as a limited number of items; therefore, the sensitivity of these measures is limited. Additionally, when given frequently, the validity of the test is compromised. Therefore, standardized tests are limited in the frequency in which they can be administered and in their ability to detect small increases in skill development (Shapiro, 1996). CBM procedures can be used to assess academic progress, in part, because the CBM probes can be given frequently. CBM probes can also be represented in multiple forms (Marston, 1989). Finally, CBM produces a rate measure that is sensitive to small changes in reading skill development (Skinner, Neddenriep, Bradley-Klug, & Ziemann, 2002).

CBM Validity Studies

CBM procedures also have strong psychometric properties. CBM is considered a valid and reliable measure for the assessment of reading (Marston, 1989). Correlational studies have been conducted to investigate the possible relationship of WCPM (oral reading fluency) with established norm-referenced tests of reading (Deno, Mirkin, & Chiang, 1982; Espin & Foegen, 1996; Fuchs, Fuchs, & Maxwell, 1988; Hintze, Shapiro,

Conte, & Basile, 1997). Deno et al. (1982) conducted the first of many CBM validity studies in readings. The researchers investigated five measures of reading. One of these measures involved students reading aloud from their basal reader for 1 minute and the experimenters calculating WCPM. The criterion measures selected for use in this study were the Stanford Diagnostic Reading Test and the Woodcock Reading Mastery Test. Correlation coefficients from this study ranged from .73 to .91 with most coefficients in the .80's.

Deno et al. (1982) also investigated whether varying the grade level of the stimulus materials would alter the correlations between the simple word recognition measures and the comprehension measures. The correlation coefficients between third- and sixth-grade materials on the three word recognition measures (words in isolation, words in context, and oral reading) were consistently in the .80's to .90's. The correlation coefficients between the word recognition measures and the Cloze measure (words are deleted from sentences and students are asked to guess a word to complete the sentence) ranged from .76 to .87. The correlation coefficients between the word recognition measures and the word meaning measure were .56 to .75. The authors concluded that within certain limits the difficulty of the stimulus material does not affect the validity of the data on word reading.

Fuchs et al. (1988) conducted a study designed to assess the criterion, construct, and concurrent validity of four CBM reading comprehension measures: question answering tests, recall measures, oral passage reading tests, and Cloze techniques. The correlations between these informal reading comprehension measures and commercial norm-referenced measures of reading (Word Study Skills and Reading Comprehension

subtests of the Stanford Achievement Test, 7th edition) were calculated. Results indicated that oral reading fluency (WCPM) had the strongest criterion validity of all reading comprehension measures used in this study. Specifically, the oral passage reading tests (WCPM) resulted in a correlation of .89 with the Stanford Achievement Test subtests (Word Study Skills and Reading Comprehension). Fuchs et al. (1998) concluded that oral reading fluency was a psychometrically valid method of monitoring and evaluating overall reading growth.

Kranzler, Brownell, and Miller (1998) used multiple regression analyses to investigate construct validity of CBM measures. The researchers investigated whether differences in cognitive ability could explain the relationship between oral reading fluency and reading comprehension. Specifically, the researchers considered the possibility that some children have higher rates of oral reading because they have greater overall cognitive ability. The researchers included measures of general cognitive ability, processing speed, and efficiency in the multiple regression analyses. The results indicated that the contribution of oral reading fluency to the prediction of reading comprehension was significant even though measures of general cognitive ability, processing speed, and efficiency were included in the simultaneous multiple regression analyses. The results of this study provide support for the construct validity of CBM oral reading fluency as an index of reading comprehension (Kranzler et al., 1998).

CBM Limitations

Comprehension of text is the primary goal of reading (Rowell, 1976; Salasoo, 1986; Sindelar & Stoddard, 1991). Therefore, when assessing a student's reading skills it is important to assess comprehension (Shapiro, 1996). Even though CBM procedures

include an oral reading measure shown to positively correlate with measures of reading comprehension (Deno et al., 1982; Fuchs & Deno, 1992; Fuchs et al., 1988; Marston, 1989; Shinn et al., 1992), researchers recommend that examiners develop five to eight comprehension questions to administer after CBM probes (Shapiro, 1986). Shapiro (1996) indicates that students who read fluently may also have reading comprehension problems; therefore, the administration of comprehension questions after a CBM probe can give the examiner important additional information about the student's reading skills.

CBM probes require the student to read the passage orally (Shapiro, 1996). A possible limitation of CBM procedures, including the administration of comprehension questions, is that the method in which students read--either aloud or silently--may have an effect on comprehension.

There are several theories that support the superiority of silent reading over oral reading. Some researchers contend that the process of oral reading requires the reader to allocate a portion of his or her cognitive resources to pronunciation, intonation, and emphasis of words. The result of the reader's cognitive resources being focused, in part, on the dynamics of reading aloud, reduces cognitive resources available for comprehension (Jones & Lockhart, 1919). Theorists expound on this viewpoint by holding the position that the nerve currents needed to stimulate thought processes are inhibited by the necessary innervations to the vocal organs during oral reading (Jones & Lockhart, 1919).

Juel and Holmes (1981) contend that oral reading may follow a "bottom up" process, meaning that readers may stop processing after achieving phonological recodings. If the reading process stops directly after achieving phonological recodings,

then lexical access or comprehension processes never have the opportunity to occur. This phenomenon may occur more often with young readers who do not have sufficient automatic decoding skills. Because of the "bottom up" nature of oral reading there may be less "top-down" processing involved, indicating that there is less use of syntactic and semantic information. Therefore, because the reader's cognitive resources are focused on the individual pronunciation of words, there may be less available cognitive resources that can be allocated to the process of reading comprehension.

There is also theoretical support for oral reading in aiding one's reading comprehension. It has been hypothesized that the auditory modality in oral reading can aid in reading comprehension. Specifically, theorists have suggested that poor readers may benefit more than good readers from the experience of hearing themselves read as well as benefit from the required concentrated attention needed to read orally (Levin, 1979; Swalm, 1973).

Research has been conducted investigating whether there is a significant difference between the amount of information retained after reading silently compared to reading orally. The research on oral reading comprehension versus silent reading comprehension is equivocal (Fuchs & Maxwell, 1988; Juel & Holmes, 1981; McCallum, Sharp, Bell, & George, 2004). Some researchers have found evidence that individuals comprehend more information after reading silently when compared to reading aloud (Jones & Lockhart, 1919; Mead, 1915, 1917; Pinter, 1913). Other research findings indicate that individuals comprehend more information after reading orally when compared to reading silently (Collins, 1961; Duffy & Durrell, 1935; Rowell, 1976). Other researchers found no significant difference in the comprehension level after reading

silently when compared to reading orally (Jones, 1932; McCallum et al., 2004; Poulton & Brown, 1967).

Researchers have also compared oral reading comprehension level to silent reading comprehension level, in readers with varying degrees of reading proficiency. Kragler (1995) found that beginning readers comprehend better after reading aloud compared to reading silently. Miller and Smith (1990) also indicate that the reading proficiency of the individual may play a role in the reading mode that best facilitates comprehension.

A second concern associated with administering comprehension questions following CBM probes involves the use of examiner-constructed comprehension questions. CBM probes require students to read for 1 minute. Researchers indicate that such a small amount of reading time typically does not allow for the creation of enough comprehension questions to adequately assess the student's comprehension. This limits the sensitivity of the measure (Daly, Chafouleas, & Skinner, 2004).

Another limitation of constructing comprehension questions for each CBM passage is the difficulty in writing questions of equal difficulty across passages. Thus, when evaluating intervention effectiveness, changes from baseline to treatment may be caused by differences in question difficulty (Daly et al., 2004).

A final limitation of CBM procedures is that researchers have found a decreasing correlational trend between WCPM and standardized measures of reading as students progress past the third-grade reading level (Skinner et al., 2002). Researchers have shown that there are strong positive correlations between oral reading fluency and measures of reading comprehension (Deno et al., 1982; Fuchs & Deno, 1992; Fuchs et al., 1988;

Marston, 1989; Shinn et al., 1992). However, other researchers have found that when correlations are computed, in reference to grade level, the results are variable (Jenkins & Jewell, 1993).

Jenkins & Jewell (1993) administered three separate reading tasks: 1) oral reading passage task, 2) maze task, and 3) selected subtests from two norm-referenced achievement tests (Gates-MacGinitie Reading Tests and the Metropolitan Achievement Test) to 355 students ranging from second to sixth grade. The correlation between the Gates-MacGinitie Reading Test and oral reading fluency resulted in correlations of .83, .88, and .86 established in grades 2, 3, and 4, respectively. At grade 6, the correlation between the Gates-MacGinitie Reading Test and oral reading fluency resulted in a correlational coefficient of .67. The correlations between oral reading fluency and the Metropolitan Achievement Tests also declined across grade levels (from .87 at 2nd grade to .60 at 6th grade). The results of this study show a negative trend between oral reading fluency and reading achievement tests correlations as students' reading skills increase (Jenkins & Jewell, 1993). The authors suggest that this negative trend could be due to a lack of measurement sensitivity. Specifically, the authors indicate that tests of reading achievement are designed to measure and reflect growth in reading proficiency even at the intermediate grades. Oral reading fluency measures may not have the sensitivity to measure this same growth in reading proficiency (Jenkins & Jewell, 1993).

Hintze and Shapiro (1997) also conducted a study that showed a difference in growth by age when using the CBM measure WCPM. Participants in this study were 160 students from second, third, fourth, and fifth grades. This study showed that student performance increased linearly as a function of grade level until fifth grade. At the fifth

grade student performance leveled off. Skinner et al. (2002) indicate that this decreasing trend seen in the relationship between WCPM and reading comprehension, as students' reading proficiency increases, suggests that CBM may be a less sensitive measure of reading skills with more advanced readers.

WCPM does have limitations when used to assess students who are more skilled readers (e.g., students past the third-grade reading level). WCPM may not have the degree of sensitivity needed to detect small changes in a student's reading. Reading comprehension rates may have the sensitivity to detect these small changes (Skinner et al., 2002).

Reading Comprehension Rate

Several studies have shown a positive correlation between WCPM (oral reading fluency) and reading comprehension (see Marston, 1989; Shinn et al., 1992). WCPM simply measures speed and accuracy during aloud reading. Reading aloud rapidly and accurately is a skill that is limited in its functional use (Freeland, Skinner, Jackson, McDaniel, & Smith, 2000). The more functional skill in reading is comprehension (Mead, 1915; Rowell, 1976; Salasoo, 1986; Sindelar & Stoddard, 1991). Individuals reading with the primary purpose of comprehending the material also tend to read silently as opposed to reading aloud (Freeland et al., 2000). Therefore, WCPM is an indirect measure of functional reading skills (Skinner, 1998).

Even though the function of reading is primarily to comprehend material, the rate of reading is still important. For example, if two students both read an identical 200 word passage, and each retains 20 bits of information, then both students' comprehension levels are the same. However, under these same conditions, one student (Alan) takes one

minute to read the passage and the other student (Chris) takes 10 minutes to read the passage. Alan is gaining 20 bits of information per minute while Chris is gaining only two bits of information per minute. Alan reads more efficiently than Chris, indicating that he will acquire information at a faster rate and expend less effort to read and comprehend the material (Freeland et al., 2000).

CBM procedures are focused on rate measures, in particular, WCPM. Researchers investigating CBM emphasize the importance of reading comprehension as well as reading fluency. However, in CBM, comprehension fluency is not measured. Reading comprehension rate does provide a measure of comprehension fluency. Reading comprehension rate is calculated by multiplying the number of comprehension questions answered correctly by 60 seconds. This total is divided by the number of seconds the student spent reading and then multiplied by 100. This formula converts the percentage of comprehension questions correct into a rate measure. Converting comprehension data to rate measures should increase the sensitivity of these measures. Reading comprehension rate may provide the sensitivity needed to better assess students at higher reading levels (Skinner et al., 2002).

Silent and Oral Reading Comprehension Rate

Several studies have been conducted that investigate whether there is a significant comprehension difference between reading a passage silently and reading the passage aloud (Collins, 1961; Jones, 1932; Jones & Lockhart, 1919; Mead, 1915, 1917; Pinter, 1913; Rowell, 1976). Few researchers have investigated the rate of oral reading comprehension compared to the rate of silent reading comprehension. Pinter and Gilliand (1916) conducted a study investigating reading speed in association with reading silently

and reading orally. The authors also investigated the amount of information the students retained when reading silently and reading orally. The participants in this study ranged from elementary age students to college students. The authors compared oral and silent reading with the purpose of investigating which was most economical for time, for reproduction, and for overall general results. The "reading value" was calculated by dividing the number of correct ideas reproduced by the number of seconds required to read the passage. This equation results in a percent that indicates the number of ideas gained per second.

For college students, the reading value was higher under the silent reading condition when compared to the oral reading condition. Students in high school also had a higher reading value for silent reading when compared to oral reading; however, this difference was not as large as it was for the college students. Students in grades five through eight showed only a slightly higher reading value under the silent reading condition compared to the oral reading condition. Students in grades three through four exhibited equal reading values for silent and oral reading. The authors conclude that as individuals grow older there is an increasing reading value for silent reading when compared to oral reading.

McCallum et al. (2004) also investigated the possible difference in reading efficiency when reading silently compared to reading orally. Seventy-four students participated in the study ranging from 6 to 13 years of age. Students were randomly assigned to either the silent reading condition or the oral reading condition. In each condition the students read and then answered comprehension questions. There was no significant difference between the mean reading comprehension scores of students who

read silently compared to students who read orally. However, the average reading time for students reading silently was significantly lower than for students who read orally. Students reading the same passages took approximately 50% longer to read the passage orally than the students who read the passage silently.

Rationale for Current Study

The purpose of educational assessment is often to measure a student's current ability level and/or the student's progress. The purpose of assessing the student's ability level and progress is often to provide information that can be used to aid in the development of academic interventions, or to evaluate the effect, if any, an implemented intervention has had on a student's academic progress (Ysseldyke & Marston, 1982). The academic progress of students often needs to be assessed frequently. Standardized tests are not designed to be given frequently; therefore, informal testing procedures could provide an avenue for assessing student progress that can be conducted frequently (Jenkins, Deno, & Mirkin, 1979).

Measures that can be given frequently and that are sensitive to discrete academic growth can aid educators in helping students develop their academic skills. CBM procedures are short in duration allowing for frequent repeated assessment, inexpensive, and sensitive to students' academic progress over time (Marston, 1989). Research has also been conducted investigating the use of CBM by teachers. Fuchs, Fuchs, and Stecker (1989) conducted a study investigating the differences between teachers who used CBM to monitor student progress and teachers who monitored student progress toward Individualized Education Programs at their discretion. The teachers using CBM procedures used more objective data sources for determining the adequacy of student

progress than the teachers in the contrast group who did not use CBM procedures. Teachers in the CBM group also modified student programs more often.

Several studies have indicated that oral reading fluency (WCPM) is positively correlated with measures of reading comprehension (Deno et al., 1982; Fuchs & Deno, 1992; Fuchs et al., 1988; Marston, 1989; Shinn et al., 1992). However, studies have also shown that WCPM does have limitations when used to measure the performance of more skilled readers (e.g., students at the fifth-grade level or above). WCPM may lack the sensitivity needed to effectively evaluate small changes in the reading ability of more skilled readers. Reading comprehension rates may provide the sensitivity needed to assess small changes in student academic progress (Skinner et al., 2002).

Assessing reading comprehension is important because the comprehension of reading text is the primary goal of reading (Rowell, 1976; Salasso, 1986, Sindelar & Stoddard, 1991). Several studies have been conducted investigating under what conditions, reading silently or reading orally, individuals typically comprehend and recall more information (Collins, 1961; Mead, 1915, 1917; McCallum, et al., 2004; Pinter, 1913; Rowell, 1976). The research on oral reading comprehension compared to silent reading comprehension is equivocal (Fuchs & Maxwell, 1988; Juel & Holmes, 1981; McCallum et al., 2004).

Statement of Purpose

There are several strengths and limitations in the use of CBM procedures to assess the reading level and progress of students. Some researchers recommend administering examiner-created comprehension questions after the administration of CBM probes (Shapiro, 1996). CBM procedures require that students read the passage aloud (Shapiro,

1996). Several studies indicate that reading mode (oral or silent) does have an effect on reading comprehension (Collins, 1961; Duffy & Durrell, 1935; Jones & Lockhart, 1919; Mead, 1915, 1917; Pinter, 1913; Rowell, 1976.) However, the research findings are equivocal; there is no clear distinction as to whether reading aloud enhances or hinders comprehension when compared to reading silently (Fuchs & Maxwell, 1988; Juel & Holmes, 1981, McCallum et al., 2004).

The first purpose of the current study was to extend this research by comparing students' reading comprehension level under both oral and silent reading conditions. If the results indicate that students' comprehension level is significantly different when reading silently, the administration of comprehension questions after CBM probes may not be appropriate or necessary.

A second purpose of this study was to further investigate whether there is a significant difference between oral reading comprehension rate and silent reading comprehension rate. McCallum et al. (2004) reported that silent reading was a significantly more efficient way to comprehend material than oral reading.

A third purpose of this study was to investigate possible correlations between oral and silent reading comprehension rate and WCPM and oral and silent reading comprehension level and WCPM. When researchers look only at reading comprehension level the speed of the reader is not taken into account. Because reading comprehension rate accounts for comprehension and speed, reading comprehension rate may be a more sensitive measure than reading comprehension level (Skinner et al., 2002).

Chapter 2

Method

Purpose

There were three specific purposes of this study. The first purpose was to further evaluate whether there was a significant difference between students' oral reading comprehension level and silent reading comprehension level. The second purpose was to extend this line of research by determining whether there was a significant difference between students' oral reading comprehension rate and silent reading comprehension rate. The third purpose was to evaluate the criterion-related validity of reading and reading comprehension level (oral and silent) and comprehension rate (oral and silent) by determining the degree of correlation between a) reading comprehension level (oral and silent) and WCPM and b) rate of comprehension (oral and silent) and WCPM.

Participants

Participants were recruited from one elementary school and one secondary school located in eastern Tennessee. Specifically, general education fourth and fifth-grade students from a rural elementary school participated. This school serves approximately 290 kindergarten through fifth-grade students. Participants were also recruited from an urban high-school. These students were in 10th, 11th, and 12th grade general education classes. This school serves approximately 981 ninth through twelfth-grade students.

Students were categorized into one of three reading groups based upon data collected during the study. Criteria used to categorize students were based on Shapiro's (1996) definition of three levels of student reading proficiency: mastery, instructional,

and frustrational. Shapiro (1996) defines the mastery level at greater than 100 WCPM and six or fewer errors. The instructional level is defined as 70-100 WCPM and six or fewer errors. The frustrational level is defined at less than 70 WCPM and more than six errors. These criteria provided by Shapiro (1996) were used to determine the number of students, from each grade level, that could be classified into each group. For elementary students, nine were classified as frustrational, 17 were classified as instructional, and 25 were classified as mastery. For secondary students, zero students were classified as frustrational, six students were classified as instructional, and 36 students were classified as mastery.

Initially, approval was sought and granted by the appropriate authority at the county board of education. Upon approval from the county board of education, the primary investigator met with each principal and explained the general goals and procedures associated with the proposed study. Each principal was given a copy of the approval letter from the board of education, a copy of the proposal submitted to the board of education, and a letter from the primary investigator. Each principal agreed for his or her school to participate in the study and signed the letter from the principal investigator granting approval. The primary investigator also requested and received approval from the internal review board from the university where the primary investigator was enrolled.

The primary investigator personally visited teachers for 4th, 5th, 10th, 11th, and 12th grade classes in the two approved schools. The primary investigator explained the general procedures, answered any questions the teachers asked, and requested permission to

recruit students from each class. A time was scheduled to talk with each class and present them with the parental consent forms (See Appendix A). Students who returned a consent form indicating parental consent for participation were presented with a student assent form (See Appendix B). The parental consent and student assent forms contained requests for permission for data collection not used in this study. These additional data were used in a separate research project.

At the scheduled time, the primary investigator visited each class. The primary investigator explained the time commitment and general procedures involved with the study. The primary investigator then explained that parental consent was required for participation. The parental consent forms were passed out to the class. The students were encouraged to give the form to their parents and return it to their teacher the following day. Upon receipt of the signed consent forms, the primary investigator talked with the students whose parents gave informed consent. The primary investigator explained the general procedures and answered any questions the students had. The primary investigator also emphasized to the students that their participation was completely voluntary and that they could withdraw from the study at any time without penalty. Each student was given an assent form. This form was read aloud to the student. The students were also given ample time to read the document silently. The primary investigator then explained that if the student wanted to participate, he or she simply needed to sign the form. The students were also informed that if they did not want to participate, they would not sign the form and simply turn it back in to the primary investigator.

Setting

Procedures were conducted in a quiet area of the school separate from the students' classrooms (e.g., a quiet hallway, conference room, computer room). For elementary students procedures were conducted from October through December. For secondary students procedures were conducted from October through February. Twenty-two secondary students were assessed between October and December. The remaining 20 secondary students were assessed in February. Data collection for secondary students was extended two months past the data collection for elementary students in order to recruit enough secondary students to have similar number of students in each group. Independent sample *t*-tests were conducted to determine if there were significant differences between the scores for secondary students assessed between October through December and students that were assessed in February. The results indicated that there were no significant differences between these two groups on WCPM, oral and silent comprehension level, and oral and silent comprehension rate (see Appendix J).

Materials

Selected passages from the *Timed Readings Series* (Spargo, 1989) were used. This series contains 50 passages for each grade level, beginning with grade four. The Fry (1968) readability formula was used to determine the grade level of the reading passages. Passages were designed to be slightly more difficult (e.g., increase approximately 1 grade level across the 50 passages) as students progress through each book. Each passage contains 400 words and provides information across a variety of subjects (e.g., planets, cars, presidents). Ten comprehension questions follow each passage and are printed on the opposite side of the passage. Five of the comprehension questions were factual, and

five questions were inferential. Questions were in multiple-choice format, and students were asked to select the correct answer from the three options. The primary researcher selected passages from books 1, 2, 7, 8, and 9.

The researchers only used the first 12 passages, from each book, to limit the range of increasing reading difficulty for each grade level. The primary experimenter divided the group of 12 passages into sets of three based upon the passage difficulty level. Thus, passages one, two, three, and four were in the first set. A repeated measures design was used so that each participant was exposed to both the oral and silent reading conditions. For each student, a passage from each of the three sets was assigned to the oral condition. Three different passages, one from each set, were assigned to the silent condition. Assignment of passages to conditions was counterbalanced across students to ensure that each passage was used approximately the same number of times in both the aloud and silent conditions. Counterbalancing procedures were also implemented to control for possible prior student knowledge of passage content and sequence effects and to control for the slight difference in reading difficulty among the passages.

After passages where assigned to conditions, folders were put together for each student. The folders consisted of an oral condition packet and a silent condition packet. Experimenters constructed packets for each session using photocopies of passages and questions. For both conditions the first page of each packet was the condition data form (See Appendices C and D). This data form indicated whether the packet was to be used for the oral or silent conditions and also provided space for recording of data (e.g., time spent reading, WCPM, and errors). The passages in the packets were arranged from less difficult to more difficult to more closely resemble the typical presentation of progressive

difficulty levels in basal readers. Each passage was followed by the corresponding questions. The oral condition folder included a stapled packet and a paper-clipped packet. This stapled packet was comprised of the examiner copies of the passages. These passages were used by the researchers to follow along with the student as he or she was reading. These passages were also used by the researchers to mark errors, WCPM, and the number of seconds the student took to read the passage. The paper-clipped packets included the student copies of the reading passages and the corresponding questions.

Battery powered audio-recorders were used by the researchers to tape each session. These tapes were marked with the student's code and the condition which had been taped (oral or silent). Each researcher was supplied with a recorder, blank tapes, and batteries. Researchers were also supplied with stopwatches. These stopwatches were used by all researchers to time each student reading.

Experimenters and Training

Four graduate school psychology students and one undergraduate student administered and scored participants' performance on probes. All of the graduate students had prior training in administration of CBM probes. Three of the graduate students had progressed through their assessment practicum, and therefore their training was somewhat different than the less experienced students. The primary experimenter used Shapiro (1996) as a reference for information given during training. Each experimenter was provided with a guide to scoring oral reading probes (Appendix E) and a procedural instruction sheet for both oral and silent reading conditions (See Appendices F and G). The primary investigator trained the graduate students by first discussing in detail the procedures (e.g., how to use the packets, when to give the student each passage,

reviewing the directions that were to be read to the student). The primary investigator then answered any questions about the procedures. The primary investigator then reviewed the criteria for scoring errors. The three graduate students who had the same training as the primary investigator were allowed to administer the probes to the students after a review of the procedures. The primary investigator listened to the tapes of these initial sessions to insure that their training was sufficient. These graduate students implemented procedures correctly; therefore, no additional training was needed.

The other, less experienced graduate student and the undergraduate student received more intensive training. This graduate student did have prior experience with administration of CBM probes; however, because her training was somewhat different, she and the undergraduate student, who had no prior experience, were trained in the following manner. Initially, the primary investigator supplied reading for both trainees detailing the procedures. The primary investigator then discussed these procedures and modeled them for the trainees. The trainees then practiced the implementation of the procedures with the primary experimenter acting as the student. When the primary investigator determined that the trainee had become proficient (e.g., was able to implement procedures fluidly and accurately) the trainee was then allowed to administer probes to the students. During each trainee's first administration of the CBM probes the primary investigator observed the session. The primary investigator scored and timed each probe independently so a comparison of the trainee's data and the primary investigator's data could be conducted. The trainees were instructed to administer the probes as if the primary investigator was not present. The primary investigator also communicated that no questions could be asked of her during the administration of the

CBM probes. After the CBM probes had been administered and the student had been dismissed, the primary investigator compared WCPM, errors, and the number of seconds the student took to read the passage. The trainees were required to vary not more than two seconds from the primary investigator's recorded time for each passage. The trainees' record of errors and WCPM were required to be exactly the same as the primary investigators on all three passages. The trainee was also required to follow procedural instructions accurately (e.g., reading instructions as written, giving out the passages in the correct sequence, not answering any questions concerning the content of the passage). When the trainees met these criteria, and indicated that they were comfortable administering the procedures alone, they were then allowed to administer CBM probes independently. Both trainees met the above mentioned criteria on their first observation. However, one trainee expressed a desire to be observed one more time before administering the procedures independently. Because the silent reading condition procedures were similar to the CBM probes, the primary investigator observed the administration of these passages once for each trainee. Each trainee administered procedures accurately and efficiently and were then allowed to administer the silent reading passages to students.

General Procedures

For each student, assessment data were collected across two sessions. Scheduling was done in conjunction with the participants' teachers in order to minimize disruptions. For the elementary students, these sessions were held on two separate school days. This was done to reduce fatigue and frustration. For the high school students, sessions were typically held on two separate days. However, in order to accommodate special situations

(e.g., student leaving early for a school scheduled break, school wide achievement testing, end of the school semester) four students were tested on the same day with sessions separated by at least 30 minutes.

During school days when sessions were conducted, an experimenter would enter the student's classroom and escort the student to the area of the school where data were collected. The student was seated at a table or desk with a writing surface. The experimenter was seated next to or across from the student with packets and a tape recorder. During five sessions (three oral and two silent) a second experimenter was also present during assessments. This experimenter recorded procedural integrity and treatment integrity data. Additionally, sessions were audio-taped to collect permanent product data that could be used to further evaluate interobserver agreement and procedural integrity.

After a bit of small talk to establish or re-establish rapport, the experimenter implemented either the oral reading or silent reading conditions. Each condition required the student to read three passages and answer the comprehension questions immediately after he or she finished reading each passage.

Oral Reading. After the investigator escorted the student into the experimental room, seated him or her, set the tape recorder to record, and stated the student's code number, the following instructions were read:

> I am going to give you a reading passage. When I say begin, I want you to read the passage aloud. Read the passage aloud at your normal pace. When you have finished reading the passage aloud, I will take up the passage and give you comprehension questions to answer. I cannot answer any questions about the

content of the passage. Do your best to answer each question correctly. Do you have any questions? Ok, here is the passage. The title of the passage is _____. You can now begin.

The investigator then started the stopwatch. The investigator had a copy of the passage being read. As the student read aloud, the experimenter recorded the number of errors (e.g., mispronunciations, substitutions, omissions, additions, and skipped lines) that occurred within the first minute of reading. The following criteria, derived from Shapiro (1996), were used. An error of omission was marked when a student omitted an entire word. An error of omission was also counted if a student skipped an entire line. On this occasion, the experimenter redirected the student as soon as possible and marked one error of omission. An error of substitution was marked when a student substituted an incorrect word for the correct one. On the occasion that a student mispronounced a proper noun, the experimenter counted the first mispronunciation as an error. Repetitions of the same proper noun error were not counted after the first occurrence. An error of addition was counted if a student added a word, or words, not located in the passage. Errors were not counted if student deleted suffixes such as "-ed" or "-s", if the student self-corrected an error, or if the student repeated a word. The experimenter supplied the correct word at the end of a five-second pause and counted this pause as an error. At the 1 minute mark, the experimenter indicated that the minute had been reached by marking a slash at the appropriate point in the text. If a student finished the entire passage before the minute had expired, the following formula was used: number of words (correct or errors) were divided by the number of seconds read. This answer is multiplied by 60, which equals the words correct (or errors) per minute. Experimenters used a form (See Appendices C and

D), derived from Shapiro (1996), to record the data collected during the oral and silent CBM conditions (e.g., words correct per minute, median words correct per minute).

After the participant finished reading the entire passage the investigator collected the passage, distributed the comprehension questions, and read the following instructions:

> Please answer the questions I have given you by circling the answer you think is right. You may not know the answers to all of the questions but try your best on each one. You may begin. Please tell me when you have finished.

When the participant finished answering the questions the investigator collected the answer sheet. The same procedures were followed for the remaining two oral reading passages. On rare occasions, the remaining passages were not given on the same day. For example, one student read quite laboriously and slowly. This student took approximately 10 minutes to read the passage and approximately five minutes to answer the questions. The researcher was concerned that having this student read all three passages would overly frustrate the student, and there was also concern about missing one large block of time from class. The researcher discussed the option of taking the student from class in shorter intervals resulting in more than two sessions. The teacher indicated that this action would be more beneficial for her and for the student. Other variations occurred if the student had to change classes and the student would not have enough time to finish the condition. These occurrences happened rarely, and the majority of students participated in two conditions, reading three passages in each condition on separate days.

Silent Reading. After the investigator escorted the student into the experimental room, seated him or her, set the tape recorder to record, and stated the student's code number, the following instructions were read:

> I am going to give you a reading passage. When I say begin, I want you to read the passage silently. Read the passage silently at your normal pace, and only read the passage through once. When you have finished reading the passage silently, say "finished." I will take up the passage and give you comprehension questions to answer. I cannot answer any questions about the content of the passage. Do your best to answer each question correctly. Do you have any questions? Ok, here is the passage. The title of the passage is _____. You can now begin.

The investigator then started the stopwatch. After the participant indicated that he or she was finished with the passage, the investigator recorded the number of seconds it took the participant to read the passage, collected the passage, distributed the comprehension questions, and read the following instructions:

> Please answer the questions I have given you by circling the answer you think is right. You may not know the answers to all of the questions but try your best on each one. You may begin. Please tell me when you have finished.

When the participant finished answering the questions the investigator collected the answer sheet. The same procedures were followed for the remaining two silent reading passages. Again, on rare occasions and under special circumstances (e.g., student read extremely slowly, classes changed) a condition was finished on another day.

Dependent Variables

Five dependent variables were obtained during the current study. The first dependent variable, WCPM (oral reading fluency), was obtained by counting the number of words read correctly by the student on each passage within a 1 minute time frame. The second dependent variable, oral reading comprehension level, was defined as the total

number of comprehension questions answered correctly during the oral reading condition. The third dependent variable, silent reading comprehension level, was defined as the total number of comprehension questions answered correctly during the silent reading condition. The fourth dependent variable, oral reading comprehension rate, was calculated by taking the number of comprehension questions answered correctly, multiplying that number by 60, dividing that number by the number of seconds required to read the passage orally, and multiplying the answer by 100. The fifth dependent variable, silent reading comprehension rate, was calculated by taking the number of comprehension questions answered correctly, multiplying that number by 60, and dividing that number by the number of seconds required to read the passage silently, and multiplying the answer by 100.

For each dependent variable, three different scores were obtained for each condition (one for each passage). To reduce the effects of extreme scores, median WCPM, comprehension level (oral and silent), and reading comprehension rate (oral and silent) scores were analyzed (Shapiro, 1996).

Design and Data Analysis

Data were analyzed to answer the following five questions. Question one: Is there a significant difference between students' median comprehension levels (i.e., number of comprehension questions answered correctly) under the oral and silent reading conditions? This question was addressed by using a 2(participants: elementary and secondary) X 2(reading comprehension level: oral and silent) repeated measures mixed model ANOVA. Analysis of main effects indicated whether there was a statistically significant difference in reading comprehension level across the oral and silent reading

conditions. Analysis of interaction effects determined if comprehension level is significantly different under the oral and silent reading conditions across elementary and secondary students. Differences were considered significant at the $p \leq .05$ level of significance.

Question two: Is there a significant difference between students' median oral reading comprehension rate and silent reading comprehension rate? Again, this question was answered by using a 2(participants: elementary and secondary) X 2(reading comprehension rate: oral and silent) repeated measures mixed model ANOVA to test for main and interaction effects. Analysis of main effects indicated whether reading condition (oral or silent) significantly affected reading comprehension rate. The interaction effect will determine if condition (oral or silent) had significantly different effects on reading comprehension rate across elementary and secondary students. Differences were considered significant at the $p \leq .05$ level of significance.

Additionally, three other questions were asked. Question three: What is the relationship between reading comprehension rate and WCPM and reading comprehension level and WCPM for both the oral and silent reading conditions? Pearson Product Moment Correlations were conducted for a) elementary students (4th and 5th), b) secondary students (10th, 11th, 12th), and c) elementary and secondary students combined (4th, 5th, 10th, 11th, and 12th).

Question four: Do the correlations for comprehension level and WCPM significantly differ between grade levels, and do the correlations for comprehension rate and WCPM significantly differ between grade levels for both the oral and silent reading conditions? A Fisher *z*-test was used to determine if the correlations for comprehension

level and WCPM for elementary and secondary students were significantly different for both the oral and silent reading conditions. A Fisher *z*-test was also used to determine if the correlations for comprehension rate and WCPM across grade levels was significantly different for both the oral and silent reading conditions. Differences were considered significant at the $p \leq .05$ level of significance.

Question five: Are the correlations for comprehension level and WCPM and rate of comprehension and WCPM significantly different within each grade level for both the oral and silent reading conditions? A Hotelling's *t*-test was used to determine if the difference in correlations between WCPM and comprehension level and WCPM and comprehension rate were statistically significant for each grade level for both the oral and silent reading conditions. Differences were considered significant at the $p \leq .05$ level of significance.

Interobserver Agreement and Procedural Integrity

Oral reading and silent reading assessment sessions were audio-taped. A second independent observer listened to the tapes for the oral reading condition in order to establish interobserver agreement for WCPM and errors per minute. For both the oral and silent reading conditions, the independent observer listened to the tapes to monitor treatment integrity. The independent observer also listened to the tapes to record the number of seconds it took the student to read each passage. For the oral condition, the independent observer simply listened to the student's voice to determine when to start and stop timing. For the silent reading condition, the independent observer began timing when the experimenter said "begin" and stopped timing when the participant said "finished". The silent reading condition was also audio-taped for the purpose of making

the oral and silent conditions as similar as possible. The independent observer used the participants' written responses for the multiple-choice questions to independently score number of questions answered correctly across both oral and silent passages.

To establish interscorer agreement, WCPM, oral and silent reading comprehension level, and oral and silent reading comprehension rate were calculated independently by two experimenters for 20% of the calculations. Pearson Product Moment Correlations were conducted to determine the strength of the relationship between the researchers' recorded scores for WCPM, number of seconds student required to read the passage, comprehension level, rate of comprehension, and the interobservers' scores on the same variables. Correlations between dependent variables ranged from .957 to 1.00 (see Appendix I).

Procedural integrity was checked by having an independent observer listen to 20% of the oral and silent reading sessions and complete a form (Appendix H) indicating whether or not the experimenter performed the defined experimental procedures (e.g., were instructions given as written, did the experimenter answer any questions concerning passage content). For the both the oral and silent reading conditions experimenters accurately followed procedures for 100% of the sessions observed.

Chapter 3

Results

Means and standard deviations for all measures are reported in Table 1. Data were analyzed to answer several questions. Repeated measures mixed model ANOVAs were used to determine if reading mode and/or grade level influenced comprehension levels and rates. Pearson Product Moment Correlations, Fisher *z*-tests, and Hotelling's *t*-tests were conducted to answer questions concerning the relationships between reading mode and grade level and WCPM.

ANOVA Results

Data analyses were conducted to determine whether there was a significant difference between students' median comprehension levels under the oral and silent reading conditions for elementary and secondary students. Results of the repeated measures mixed model ANOVA (see Table 2) indicated a significant within-subjects main effect for reading mode, $F(1, 91) = 11.509$, $p \leq .001$. Comprehension level was significantly higher when students read aloud ($M = 7.75$, $SD = 1.40$) compared with their comprehension level when they read silently ($M = 7.19$, $SD = 1.76$). This indicates that participants, regardless of grade, answered significantly more comprehension questions correctly under the oral reading condition than they did under the silent reading condition.

Between-subject analysis of comprehension level revealed a significant main effect, $F(1, 91) = 19.269$, $p \leq .001$. Elementary students' comprehension levels

Table 1

Mean and Standard Deviation Reading Scores for Elementary Students, Secondary Students, and Elementary and Secondary Students Combined

Grade level	Oral reading comp. level Mean (SD)	Silent reading comp. level Mean (SD)	Oral reading comp. rate Mean (SD)	Silent reading comp. rate Mean (SD)	WCPM Mean (SD)
Elem. (*n*=51)	8.33 (1.14)	7.77 (1.73)	203.07 (67.55)	258.38 (114.98)	99.31 (31.97)
Sec. (*n*=42)	7.17 (1.43)	6.62 (1.61)	243.08 (77.65)	298.12 (110.29)	140.57 (29.04)
Total (*N*=93)	7.75 (1.40)	7.19 (1.76)	223.07 (74.61)	278.25 (114.02)	117.95 (36.85)

Note. WCPM = Words correct per minute.

Table 2

Analysis of Variance for Reading Condition Comprehension Levels

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*p*
Between subjects					
Intercept	10284.349	1	10284.349	3218.384*	.000
Grade	61.575	1	61.575	19.269*	.000
Error	290.791	91	3.196		
Within-subjects					
Mode	14.349	1	14.349	11.509*	.001
Mode * Grade	.005	1	.005	.004	.949
Error (mode)	113.457	91	1.247		

Note. N=93.
*Correlations significant at $p \leq .001$.

(M = 8.05, SD = 1.49) were significantly higher than the secondary students' comprehension levels, (M = 6.89, SD = 1.54). These results show that elementary students answered more comprehension questions correctly than the secondary students.

Analysis of interaction effects indicate that there was no significant interaction between grade level and reading mode, F(1, 91) = .004, p = .949.

Analysis of variance was conducted to determine whether there was a significant difference between students' median comprehension rates under the oral and silent reading conditions for elementary and secondary students. Results from a repeated measure mixed model ANOVA (see Table 3) indicated a significant within-subjects main effect $F(1, 91) = 33.854$, $p \leq .001$). Silent reading comprehension rate (M = 278.25, SD = 114.02) was significantly higher than oral reading comprehension rate (M = 223.07, SD = 74.61). This result indicates that silent reading was a significantly more efficient mode of reading for comprehension than oral reading.

Between-subject analysis revealed a significant main effect for reading comprehensions rate, $F(1, 91) = 5.298$, $p \leq .05$). Reading comprehension rate was significantly higher for secondary students (M = 270.60, SD = 98.76) when compared to elementary students (M = 230.72, SD = 97.85). Therefore, the secondary students retained more information in less time than the elementary students under both reading conditions (oral and silent).

Analysis of interaction effects show that there was no significant interaction between grade level and reading mode, $F(1, 91) = .000$, $p = .989$.

Table 3

Analysis of Variance for Reading Condition Comprehension Rates

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*p*
Between-subjects					
Intercept	11577048.740	1	11577048.740	837.396**	.000
Grade	73244.947	1	73244.947	5.298*	.024
Error	1258080.537	91	13825.061		
Within subjects					
Mode	140243.851	1	140243.851	33.854**	.000
Mode * Grade	.795	1	.795	.000	.989
Error (mode)	376979.849	91	4142.636		

Note. N=93
*Correlations significant at $p \leq .05$.
**Correlations significant at $p \leq .001$.

Summary and Integration of ANOVA Results.

The ANOVA results indicate that elementary and secondary students combined answered significantly more comprehension questions under the oral reading condition when compared to the silent reading condition. Elementary students answered significantly more comprehension questions than the secondary students. Results also indicated that the rate of comprehension, for elementary and secondary students combined, was higher under the silent reading condition. These results indicate that silent reading was a more efficient mode of reading for comprehension than oral reading. Secondary students' rate of comprehension was significantly higher than the elementary students' rate of comprehension. These results indicate that while elementary students answered more comprehension questions correctly than the secondary students; secondary students retained more information in less time. Therefore, secondary students read more efficiently than the elementary students.

Relationships with WCPM

Pearson Product Moment Correlations were conducted to determine the relationship between comprehension level (oral and silent) and WCPM (see Table 4), and comprehension rate (oral and silent) and WCPM (see Table 4). Fisher *z*-tests were conducted to determine if correlations between comprehension level (oral and silent), comprehension rate (oral and silent), and WCPM were significantly different across elementary and secondary students.

Table 4

Pearson Product Moment Correlation Coefficients for Oral and Silent Reading Comprehension Level, Oral and Silent Reading Comprehension Rate and WCPM across All Grade Levels

Grade Level	Oral Level and WCPM	Silent Level and WCPM	Oral RCR and WCPM	Silent RCR and WCPM
Elementary (*n*=51)	.457**	.415**	.875**	.617**
Secondary (*n*=42)	.247	.340*	.697**	.645**
Total Students (*N*=93)	.031	.119	.779**	.610**

Note. RCR = Reading comprehension rate, WCPM = Words correct per minute. Elementary students were comprised of fourth and fifth grade students. Secondary students were comprised of tenth, eleventh, and twelfth grade students. Total students included both elementary and secondary students of the above mentioned grades.

*Correlations significant at $p \leq .05$ (2-tailed).

**Correlations significant at $p \leq .01$ (2-tailed).

Correlations for WCPM and Oral Comprehension Level.

Results from Pearson Product Moment Correlations (see Table 4) revealed small to moderate correlations between oral comprehension level and WCPM. The correlation coefficients for elementary and secondary students combined (r = .031) and for secondary students only (r = .247) were small. The correlation coefficient for elementary students was moderate (r = .457). It is important to note the decreasing correlation when elementary and secondary students' scores were combined. This may be an indication that the correlation between WCPM and oral comprehension level may have been affected by the restricted range of oral comprehension level scale. Only 11 scores are possible on this comprehension measure. Numerous scores are possible for WCPM. Therefore, the restricted range of the comprehension scale may have resulted in the diminished correlation for elementary and secondary students combined. A Fisher z-test (see Table 5) was conducted to determine if the correlation coefficients for elementary and secondary students were significantly different. Results from this data analysis indicate that there is no significant difference of correlations based on grade level, p = .263

Correlations for WCPM and Silent Comprehension Level.

Results from Pearson Product Moment Correlations (see Table 4) indicate a small correlation between silent comprehension level and WCPM for elementary and secondary students combined (r = .119). The correlation coefficients for the elementary students only and secondary students only were moderate (r = .415 and .340, respectively). The decreased correlation when elementary and secondary students were combined may be attributed to the restricted range of the comprehension scale. A Fisher z-test (see Table 5)

Table 5

Fisher's r to z Transformation: Tests for Significant Differences between Two Correlation Coefficients

Correlation Variables	Elementary	Secondary	*z*	*p* (2-tailed)
Oral Level and WCPM	*r* = .457	*r* = .247	+1.12	.263
Silent Level and WCPM	*r* = .415	*r* = .340	+0.41	.682
Oral RCR and WCPM	*r* = .875	*r* = .697	+2.28	.023
Silent RCR and WCPM	*r* = .617	*r* = .645	-0.22	.826

Note. RCR = Reading comprehension rate, WCPM = Words correct per minute, *N*=93
*Correlations significant at $p \leq .05$ (2-tailed).

was conducted to determine whether there was a significant difference between the correlation coefficients for elementary and secondary students. The results of the Fisher *z*-test (see Table 5) indicated that there was no significant difference between these correlation coefficients, $p = .682$.

Correlations for WCPM and Oral Comprehension Rate.

Results from the Pearson Product Moment Correlations revealed moderate to large correlations between WCPM and oral comprehension rate (see Table 4). The correlation coefficient for secondary students only was moderate ($r = .697$). The correlations for elementary students only and elementary and secondary students combined were large ($r = .875$ and .779, respectively). A Fisher *z*-test (see Table 5) was conducted to determine if there was a significant difference between the correlation coefficients across grade levels. Results of this analysis indicate that there was a significant difference between grade levels ($p \leq .05$). These results indicate that while all correlations between oral reading comprehension rate and WCPM were strong; the correlation for elementary students was significantly stronger than the correlation for secondary students. Therefore, there is a stronger relationship between oral reading comprehension rate and WCPM for elementary students than there is for secondary students.

Correlations for WCPM and Silent Comprehension Rate.

Pearson Product Moment Correlations were conducted to determine the relationship between WCPM and silent comprehension rate. Results from the Pearson Product Moment Correlations revealed moderate correlations (see Table 4). The correlations for elementary and secondary students combined, elementary students only,

and secondary students only were moderate (r = .610, .617, and .645, respectively). A Fisher z-test (see Table 5) was conducted to determine if there was a significant difference between the correlation coefficients across grade levels. Results of this analysis show no significant difference between these correlations, p = .826.

Correlations with WCPM: Significant Differences

Data analysis were conducted to investigate possible significant differences between the correlations for oral comprehension level and WCPM and oral comprehension rate and WCPM, and silent comprehension level and WCPM and silent comprehension rate and WCPM, and oral comprehension rate and WCPM and silent comprehension rate and WCPM. Correlations for elementary students only, secondary students only, and elementary and secondary students combined were analyzed.

Oral Comprehension Level and Oral Comprehension Rate.

A Hotelling's t-test was used to determine whether there was a significant difference between the correlations for oral comprehension level and WCPM (r = .031) and oral comprehension rate and WCPM (r = .779) for elementary and secondary students combined (see Table 6). The results of the Hotelling's t-test revealed that the correlation between oral comprehension rate and WCPM was significantly stronger than the correlation for oral comprehension level and WCPM, $t(90) = 17.42$, $p \leq .001$.

Data analyses were then conducted for elementary students only and secondary students only (see Table 6). Hotelling's t-tests were conducted to investigate possible significant differences between correlation coefficients. For elementary students only, the correlations for elementary students' oral comprehension level and WCPM (r = .457) and oral comprehension rate and WCPM (r = .875) were significantly different, $t(48) = 7.87$,

Table 6

Hotelling's t-test: Testing for Significant Differences between Correlations for Oral Comprehension Level and Oral Reading Comprehension Rate (RCR), and WCPM

Participant Groups	Oral Level and WCPM	Oral RCR and WCPM	Hotelling's *t*
Total (*N*=93)	*r* = .031	*r* = .779	17.42*
Elementary (*n*=51)	*r* = .457	*r* = .875	7.87*
Secondary (*n*=42)	*r* = .247	*r* = .697	9.46*

*$p \leq .001$

$p \leq .001$. Therefore, the correlation between elementary students' oral comprehension rate and WCPM was significantly stronger than the correlation between elementary students' oral comprehension level and WCPM. For secondary students only, the correlations for secondary students' oral comprehension level and WCPM ($r = .247$) and oral comprehension rate and WCPM ($r = .697$) were significantly different, $t(39) = 9.46$, $p \leq .001$. Therefore, the correlation between secondary students' oral comprehension rate and WCPM was significantly stronger than the correlation between oral comprehension level and WCPM.

Silent Comprehension Level and Silent Comprehension Rate.

A Hotelling's *t*-test was used to determine whether there was a significant difference between the correlations for silent comprehension level and WCPM ($r = .119$) and silent comprehension rate and WCPM ($r = .610$) for elementary and secondary students combined (see Table 7). The results of the Hotelling's *t*-test show the correlation between silent comprehension rate and WCPM was significantly stronger than the correlation for silent comprehension level and WCPM, $t(90) = 6.09$, $p \leq .001$.

Data analyses were then conducted for elementary students only and secondary students only (see Table 7). Hotelling's *t*-tests were conducted to investigate possible significant differences between correlation coefficients. For elementary students only, the correlations for silent comprehension level and WCPM ($r = .415$) and silent comprehension rate and WCPM ($r = .617$) were significantly different. Therefore, the correlation between elementary students' silent comprehension rate and WCPM was significantly stronger than the correlation between elementary students' silent comprehension level and WCPM, $t(48) = 1.82$, $p \leq .05$. For secondary students only, the

Table 7

Hotelling's t-test: Testing for Significant Differences between Correlations for Silent Comprehension Level and Silent Reading Comprehension Rate (RCR), and WCPM

Participant Groups	Silent Level and WCPM	Silent RCR and WCPM	Hotelling's *t*
Total (*N*=93)	*r* = .119	*r* = .610	6.09**
Elementary (*n*=51)	*r* = .415	*r* = .617	1.82*
Secondary (*n*=42)	*r* = .340	*r* = .645	3.37**

*$p \leq .05$. **$p \leq .001$

correlations for silent comprehension level and WCPM (r = .340) and silent comprehension rate and WCPM (r = .645) were significantly different. Therefore, the correlation between secondary students' silent comprehension rate and WCPM was significantly stronger than the correlation between silent comprehension level and WCPM, $t(39) = 3.37$, $p \leq .001$.

Oral and Silent Comprehension Rate.

A Hotelling's t-test was used to determine whether there was a significant difference between the correlations for oral comprehension rate and WCPM (r = .779) and silent comprehension rate and WCPM (r = .610) for elementary and secondary students combined (see Table 8). Results from the data analysis revealed no significant differences between these two correlations, $t(90) = 3.01$, $p \leq .05$.

Data analyses were conducted for elementary students only and secondary students only (see Table 8). Hotelling's t-tests were conducted to investigate possible significant differences between correlation coefficients. For elementary students' only, the correlations between oral comprehension rate and WCPM (r = .875) and silent comprehension rate and WCPM (r = .617) were significantly different, $t(48) = 4.45$, $p \leq .001$. Therefore, the correlation between elementary students' oral comprehension rate and WCPM is significantly stronger than the correlation between silent comprehension rate and WCPM. For secondary students only, the correlations between oral comprehension rate and WCPM (r = .697) and silent comprehension rate and WCPM (r = .645) were not significantly different, $t(39) = .053$, $p = 0.30$.

Table 8

Hotelling's t-test: Testing for Significant Differences between Correlations for Oral and Silent Reading Comprehension Rate (RCR), and WCPM

Participant Groups	Oral RCR and WCPM	Silent RCR and WCPM	Hotelling's *t*
Total (*N*=93)	*r* = .779	*r* = .610	3.01*
Elementary (*n*=51)	*r* = .875	*r* = .617	4.45**
Secondary (*n*=42)	*r* = .697	*r* = .645	0.53

*$p \leq .05$. **$p \leq .001$

Summary and Integration of Relationship Analysis.

Correlations between oral comprehension level and WCPM were moderate for elementary students and small for secondary students. There was no significant difference between these two correlations. The correlations for silent comprehension level and WCPM were moderate for both elementary and secondary students. There was no significant difference between these two correlations.

Correlations between oral reading comprehension rate and WCPM were moderate for secondary students and large for elementary students. The correlation between oral reading comprehension rate and WCPM was significantly stronger for elementary students than for secondary students. Correlations between silent reading comprehension rate and WCPM were moderate for both elementary and secondary students. There was no significant difference between these two correlations.

Data were further analyzed to determine if any of the above correlations were significantly different. The correlation between oral comprehension rate and WCPM was significantly stronger than the correlations between silent comprehension rate and WCPM and oral comprehension level and WCPM. When the data were broken down into two groups (elementary and secondary) the same results were found with one exception. For secondary students, the correlations between oral comprehension rate and WCPM and silent comprehension rate and WCPM were not significant.

Data analysis indicated that the correlation between silent comprehension rate and WCPM was significantly stronger than correlations between silent comprehension level. When the data were broken down into two groups (elementary and secondary) the findings were the same.

The correlations between WCPM and comprehension level (oral and silent) were smaller compared to the correlations between the same variables when the scores were analyzed for elementary and secondary students separately. This may indicate that the correlations between WCPM and comprehension level (oral and silent) were affected by the possible restricted range of the comprehension measure. However, when the data were analyzed separately (elementary and secondary) the results were the same. The correlations between reading comprehension rate (oral and silent) and WCPM were significantly stronger than correlations between comprehension level (oral and silent) and WCPM for elementary students, secondary students, and elementary and secondary students combined.

Chapter 4

Discussion

The current study was designed, in part, to further investigate the effect of reading mode (oral and silent) on comprehension. The results from previous research are equivocal (Fuchs & Maxwell, 1988; Juel & Holmes, 1981; McCallum et al., 2004). Researchers have found no significant difference in the reading comprehension level of students under aloud and silent reading conditions (Jones, 1932; McCallum et al., 2004; Poulton & Brown, 1967). Other researchers have found that students score higher on comprehension measures under silent reading conditions compared to aloud reading conditions (Jones & Lockhart, 1919; Mead, 1915, 1917; Pinter, 1913).

Other researchers have found that students comprehend more information when reading orally compared to reading silently (Collins, 1961; Duffy & Durrell, 1935; Rowell, 1976). The results of the current study support these research findings showing that students answered more comprehension questions correctly under the oral reading condition than under the silent reading condition. Current results indicate that reading orally did not hinder, and may actually enhance, reading comprehension.

The current study was also designed to investigate the relationships between the criterion variable (WCPM) and dependent variables (i.e., oral and silent comprehension level and oral and silent comprehension rate). WCPM has repeatedly been shown to correlate strongly with norm-referenced measures of reading (Deno et al., 1982; Fuchs et al., 1988; Kranzler et al., 1988). Even though there are strong correlations between WCPM and standardized reading measures, researchers still recommend that examiners develop five to eight comprehension questions to be administered after CBM probes to

identify students who read fluently but have difficulty comprehending the reading text (e.g., Shapiro, 1996). CBM procedures require the student to read aloud. Therefore, the student answers comprehension questions after reading aloud.

A possible limitation of CBM procedures is related to students reading orally as opposed to silently. If comprehension is hindered by reading orally then asking comprehension questions after reading aloud may not provide the most valid information concerning the student's reading comprehension ability. The results of the current study indicate that elementary and secondary students combined answered more comprehension questions correctly under the aloud reading condition compared to the silent reading condition. Looking at these results alone, the conclusion could be made that the administration of comprehension questions after CBM probes could provide useful information concerning students' reading comprehension abilities.

However, there are other concerns with the use of comprehension questions. One concern is the limited ability of examiners to write questions of equal difficulty. If the difficulty level of questions is not approximately the same, it then becomes difficult to use this information to monitor student progress. Since comprehension questions are recommended to identify students who may read fluently (have a relatively high score for WCPM) but who have a problem solely with reading comprehension, it stands to reason that comprehension level should correlate strongly with the criterion variable (WCPM). However, results of this study indicate that the correlation between oral reading comprehension level and WCPM is .457 for elementary students. For secondary students the correlation is .247. The correlations between WCPM and comprehension level are moderate to small. The moderate to small correlations between these two measures

(comprehension level and WCPM) may indicate that comprehension level may not correlate strongly with standardized measures of reading. If comprehension level does not correlate strongly with standardized measures of reading it may be unnecessary to develop and administer these questions.

CBM procedures were developed to address several concerns with the use of standardized tests of reading. The primary concern addressed by CBM procedures is academic progress monitoring. The reliability and validity of standardized tests of reading achievement are compromised when given repeatedly over short periods of time (Deno, 1985). Additionally, standardized tests of reading achievement lack the sensitivity needed to detect small changes in skill development. Because multiple-equivalent forms are easily produced from reading curricula, curriculum-based measures (i.e., reading probes) can be given frequently without compromising reliability or validity (Deno, 1985). CBM procedures also measure reading rate (WCPM), and therefore are sensitive enough to detect small changes in skill development (Skinner et al., 2002).

The results of the current study indicate that elementary students had significantly higher scores on the comprehension questions than the secondary students. This result does not mean that secondary students had inferior general reading skills or comprehension skills, as they were reading material that was more advanced than the elementary students. However, this result does show that comprehension level cannot be used to measure reading skill growth. Even if secondary students did score higher on the comprehension level measure, because there were only ten questions, this measure lacks sensitivity (a 10% increase in comprehension is required to detect any change in skill),

and therefore may not be useful for measuring small changes in general reading skills over brief periods of time.

The criterion variable (WCPM) has been shown to correlate strongly with standardized tests of reading achievement. Although, there is a decreasing correlational trend between WCPM and scores on standardized tests of reading, as students' reading skills improve (Skinner et al., 2002), WCPM is still considered a valid measure of student reading ability (Marston, 1989). However, because of the decreasing trend between WCPM and scores from standardized reading measures as students' reading skills improve, it is important to look at alternative measurement procedures. WCPM is sensitive to changes in academic ability, in part, because it is a rate measure. Rate measures often are more sensitive to academic change. Rate of comprehension is a rate measure which includes both comprehension level and rate of reading (Skinner, et al., 2002).

This study investigated rate of comprehension as a measure of reading ability. The results of the current study support previous research findings showing that reading silently is a more efficient mode of retaining information than oral reading (e.g., Pinter & Gilliand, 1916; McCallum et al., 2004). Although the results of the current study show that silent reading was a more efficient method of reading for comprehension for elementary and secondary students combined; secondary students' rates of comprehension were significantly higher than the elementary students' rates of comprehension. This finding indicates that secondary students read at a faster rate than elementary students and consequently obtained more information in less time.

These results support previous research which showed that, as students increase in grade level their speed of reading also increases (Pinter & Gilliand, 1916). Secondary students' oral and silent comprehension rates and WCPM mean scores were significantly higher than the mean scores for the elementary students. The mean differences between elementary and secondary students on three rate measures (oral reading comprehension rate, silent reading comprehension rate, and WCPM) were similar. The mean difference for oral reading comprehension rate, silent reading comprehension rate, and WCPM are 40.1, 39.7, and 41.3, respectively. This data suggests that rate of comprehension measures may, at least, be as sensitive for measuring reading growth as WCPM. Future researchers should measure progress across grade levels (e.g., 4th, 5th, 6th, and 7th grades) and within grade levels (e.g., 4th grade students at the beginning, middle, and end of the year) to further evaluate the sensitivity of this measure.

Differences among dependent variables (oral and silent comprehension rate and oral and silent comprehension level) were addressed across three levels (elementary, secondary, and elementary and secondary students combined). However, it is also important to investigate the relationships between the dependent variables and the criterion variable (WCPM). Looking at these relationships is the first step in evaluating other possible reading proficiency measures.

When data for both elementary and secondary students were combined, correlations between reading comprehension rate (oral and silent) and WCPM were stronger than correlations between reading comprehension level (oral and silent) and WCPM. When data were analyzed separately for elementary and secondary students the results were the same. Reading comprehension rate, regardless of reading condition, has

significantly stronger correlations with WCPM than does reading comprehension level. These data suggest that reading comprehension rate may be a more valid measure of reading ability than reading level.

The results of the data analysis indicate that reading comprehension rate correlates more strongly with WCPM than reading comprehension level. Further data analysis was conducted to determine the effect of reading mode on the correlations between reading comprehension rate (oral and silent) and WCPM. The results indicate that when elementary and secondary students' scores were combined, the correlation between oral reading comprehension rate and WCPM was significantly stronger than the correlation between silent reading comprehension rate and WCPM. These results show that oral reading comprehension rate should be further investigated as a CBM measure.

The data were also analyzed by separating the scores into elementary students only and secondary students only. The results from this data analysis were largely consistent with the previously reported results. Only one discrepancy was apparent. The correlation between secondary students' oral reading comprehension rate and WCPM was not significantly stronger than the secondary students' correlations between silent comprehension rate and WCPM.

However, for both elementary students only and elementary and secondary students combined, the correlations between oral comprehension rate and WCPM were significantly stronger than the correlations for silent reading comprehension rate and WCPM. Because WCPM is considered a valid measure of reading, and is often used to monitor reading progress, any measure that correlates strongly with WCPM should be further investigated.

Limitations and Directions for Future Research

There are several limitations associated with the current study. These limitations provide direction for future researchers. The first limitation concerns the silent reading condition versus the oral reading condition. When students read orally, the experimenter can be assured that the student is actually reading the passage. However, when the student reads silently the examiner has no true way of knowing if the student is actually reading. Therefore, the differences between oral and silent reading comprehension (in favor of oral) could be attributed to the students attending to and reading the entire passage under the oral condition, but skipping portions of the passage under the silent condition. Future researchers could use various procedures to control for this type of concern. Having the students wear eye-movement goggles could help determine if the student actually read the passage silently (Neddenriep, 2003).

The procedures outlined in the current study required the examiner to provide the correct word to the student if the student paused for more than 5 seconds. The examiner did not provide unknown words to the student under the silent reading condition. Providing words during the oral reading condition may have enhanced the students' comprehension under the oral reading condition. Future research should be done to investigate whether providing students with correct words significantly affects comprehension level.

The population sample did not provide an equal distribution of levels of reading proficiency as defined by Shapiro (1996). For example, there were no secondary students in the frustrational category and there were nine elementary students in the frustrational category. The reading proficiency of the individual could have affected the results of the

current study. Because there was not an approximately equal distribution of proficiency groups, and due to the small number of participants, additional data analysis was unable to be conducted. However, future researchers should investigate the possible effects reading proficiency has on oral and silent reading comprehension level and rate, and WCPM. Researchers should look specifically at the correlations between the listed dependent variables and the criterion variable.

Researchers did not investigate the relationship between WCPM and a standardized measure of reading. Researchers also did not investigate the relationships between reading comprehension level and a standardized measure of reading, or correlations between reading comprehension rate and a standardized measure of reading. It is possible that comprehension rate correlated more strongly with WCPM than comprehension level because comprehension rate and WCPM are both rate measures. Investigating correlations between WCPM, comprehension rate, and comprehension level with a standardized reading achievement score would help address this concern.

Conclusion

The results of the current study suggest that WCPM is a valid measure of comprehension rate. Additionally, the results of the current study suggest that comprehension is not reduced, and may actually be enhanced, when students read aloud. Therefore, the current results support the use of collecting WCPM data as students read aloud and then asking comprehension questions based on that reading (Shapiro, 1996). However, comprehension level (number of comprehension questions answered correctly) does not appear to be a valid or sensitive measure of reading skills. While oral reading comprehension rate appears to be a valid measure of reading skills across students, this

measure should be correlated with standardized measures of reading to further establish the validity of oral reading comprehension rate. Additionally, within-subjects studies are needed to establish the sensitivity of oral reading comprehension rate.

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APPENDIX

Appendix A

Parental Consent Form

Dear parent or guardian,

My Name is Andrea Hale, and I am currently a graduate student in the School Psychology Ph.D. program at the University of Tennessee. I am conducting research for my dissertation and I am requesting permission for your child to participate. I will be working with a group of graduate students and Dr. Christopher H. Skinner, who is a professor from the University of Tennessee, and will supervise this study.

We would be working with your child individually on various reading tasks. Your child would be administered a portion of the Woodcock-Johnson Test of Achievement (Third Edition). Your child would also be asked to read passages aloud and answer comprehension questions and also read silently and answer comprehension questions. Your child would be taken out of class at a convenient time for the teacher and the child. We would work with your child for three sessions lasting approximately 20 minutes each. All sessions would be audio-taped to ensure that all procedures are implemented correctly. Your child's name will be replaced with a code so that your child's name will not be associated with the information gathered.

We will also need access to your child's TCAP reading score. Again, your child's name will be removed and replaced with a code. A member of our research team will record the TCAP reading score on a data sheet with a code number. Once the researcher has recorded your child's test score your child's name will no longer be associated with the score. This procedure will be implemented to keep your child's information confidential.

If you and your child agree to help with this research it is important for you to understand that this participation is voluntary. You child can choose to withdraw at anytime without penalty. He/she would just simply need to inform his/her teacher or myself that he/she wants to discontinue his/her participation.

It is important to understand that your child's performance would not affect his/her grades in the classroom. The information collected from this study will be kept confidential. No reference will be made in oral or written reports that could link your child to the study.

I would greatly appreciate your and your child's help with this research. If you would be willing to let your child participate please sign and date this form and return it to your

child's teacher. If you have any questions you may contact me at 974-8194 and I would be happy to answer any questions you may have.

Thank you for your time and consideration,

Andrea D. Hale

I have read the above information and give permission for my child to participate in this study. I have received a copy of this form.

Signature of Parent of Legal Guardian: _____ Date: _____

Child's Name: (Please Print) _____

Appendix B

Student Assent Form

Dear Student,

My name is Andrea Hale and I am a graduate student in the School Psychology Ph.D. program at the University of Tennessee. I am conducting research on reading and would greatly appreciate your help. You would be asked to take a portion of the WJ-III Achievement Test. You would also be asked to read aloud and answer comprehension questions as well as reading silently and answer comprehension questions. Your participation would involve three sessions lasting approximately 20 minutes each. Your performance on these tasks will in no way affect your grade in your classroom. We would also record your TCAP reading score. However, none of this information will be associated with your name.

It is important to understand that if you agree to participate in this project you can decide to stop your participation at any time without any penalty. Your participation is completely voluntary.

The information collected from this study will be kept confidential. Data will be stored securely and will be made available only to people conducting the study. No reference will be made in oral or written reports that could link you to the study.

Please sign and date below if you would like to participate in this project. Please fill in your name in the space provided and return the form to your teacher or myself.

Sincerely,

Andrea D. Hale

974-8194

I have read the above information and agree to participate in this study. I have received a copy of this form.

Signature of Participant:_____ Date:_____

Participant's Name (Please Print):_____

Appendix C

Oral Reading Condition Data Form

Child's code number: _____ Date:_____

CBM passages: code_____ Grade: _____

Results of passages administered:

Passage		# of Comp. ? Correct	Words Correct Per Min. (WCPM)	Errors /Min (ER)	Oral Comp. Rate (ORCR)	Median scores				Level (M, I, F)
#	Sec.					WC/M	# of ? Corr.	ER	ORC R	

Calculations:

- Words correct per minute (WCPM)
  The number of words read correctly in the one-minute sample
  Passage # _____ WCPM= _____

  Passage # _____ WCPM= _____

  Passage # _____ WCPM= _____

- Errors per minute

The number of errors in the one-minute sample

Passage # _____: # of errors = _____
Passage # _____: # of errors = _____
Passage # _____: # of errors = _____

- Oral Rate of comprehension (ORCR)

[(# of comp. questions correct X 60)/ # of seconds required to read passage] X 100

Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (ORCR)
Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (ORCR)
Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (ORCR)

Appendix D

Silent Reading Condition Data Form

Child's code number: _____ Date:_____

CBM passages: code _____ Grade: _____

Results of passages administered:

Passage #	Time spent reading (in seconds)	# of Comp. Questions Correct	Silent reading comp. Rate (SRCR)	Median	
				SRCR	# of ? correct

Calculations:

- Silent Rate of comprehension

[(# of comp. questions correct X 60)/ # of seconds required to read passage] X 100

Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (SRCR)
Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (SRCR)
Passage # _____: [(_____ X 60)/ _____] X 100 = _____ (SRCR)

Appendix E

Scoring of Oral Reading Probes

As the student reads, the experimenter should mark the following errors on the sheet:

A. Errors of Omission
   1. An error should be marked if the student leaves out an entire word.
   2. If the student skips a line, the experimenter should redirect the student and score one error. If the student cannot be redirected, the experimenter counts the omission as one error.

B. Errors of Substitution
   1. An error should be marked if the student says the wrong word.
   2. An error should be counted if a student mispronounces a proper noun on the first reading of the word. If the same proper noun is subsequently mispronounced it should not again be counted as an error.

C. Errors of Addition
   1. An error should be marked if the student adds a word or words not in the passage.

D. Errors of Unknown Words
   1. An error should be marked if a student pauses for five seconds. The experimenter should supply the unknown word after five seconds and count the pause as an error.

As the student reads, the experimenter should not count the following occurrences as errors.

A. An error should not be counted if the student deletes suffixes such as "-ed" or "-s" in speech patterns.

B. An error should not be counted if the student repeats a word.

C. An error should not be counted if the student self-corrects a word

Appendix F

Oral Reading Procedural Instruction Sheet

After you have seated the student, start the audio-tape, state the student's code number, and read the following directions verbatim.

I am going to give you a reading passage. When I say begin, I want you to read the passage aloud. Read the passage aloud at your normal pace. When you have finished reading the passage aloud, I will take up the passage and give you comprehension questions to answer. I cannot answer any questions about the content of the passage. Do your best to answer each question correctly. Do you have any questions? Ok, here is the passage. The title of the passage is _____. You can now begin.

After the student has finished reading the passage, collect the passage and give the student the corresponding multiple-choice questions. Read the following directions verbatim.

Please answer the questions I have given you by checking the answer you think is right. You may not know the answers to all of the questions but try your best on each one. You may begin. Please tell me when you have finished.

Appendix G

Silent Reading Procedural Instruction Sheet

After seating the student, start the audio-tape, state the student's code number, and read the following directions verbatim.

I am going to give you a reading passage. When I say begin, I want you to read the passage silently. Read the passage silently at your normal pace, and only read the passage through once. When you have finished reading the passage silently say, "finished." I will take up the passage and give you comprehension questions to answer. I cannot answer any questions about the content of the passage. Do your best to answer each question correctly. Do you have any questions? Ok, here is the passage. The title of the passage is _____. You can now begin.

After the student has finished reading the passage, collect the passage and give the student the corresponding multiple-choice questions. Read the following directions verbatim.

Please answer the questions I have given you by checking the answer you think is right. You may not know the answers to all of the questions but try your best on each one. You may begin. Please tell me when you have finished.

Appendix H

Procedural Integrity/Interobserver Agreement Form

Students Code Number _____ Experimenters name _____

Condition (silent or oral) _____

Did the experimenter read instructions as written for all three passages?

Did the experimenter answer any questions pertaining to passage content?

Record the following student reading times in seconds and circle the median time:
Passage One _____

Passage Two _____

Passage Three _____

Calculate comprehension level and circle the median score:
Passage One _____

Passage Two _____

Passage Three _____

Calculate rate of comprehension and circle the median score:
Passage One _____

Passage Two _____

Passage Three _____

Calculate WC/M and Errors/Min for oral reading passages and circle the median scores:
Passage One: WC/M _____ Errors/Min _____

Passage Two: WC/M _____ Errors/Min _____

Passage Three: WC/M _____ Errors/Min _____

Appendix I

Interobserver Agreement Table

Pearson Product Moment Correlation Coefficients for Interobserver Agreement on Comprehension Level, Rate, Number of Seconds Student Read, and WCPM

Reading Condition	Comp. Level	Comp. Rate	Number of Seconds	Words Correct per Minute
Oral	1.00**	.974**	.957**	.999**
Silent	1.00**	.999**	.998**	N/A

Note. Comp. Level = Number of comprehension questions answered correctly.
**Correlations significant at $p < .001$

Appendix J

Independent Samples *t*-tests for Secondary Students

Independent Samples T-test for Secondary Students Assessed in October through December and Secondary Students Asses in February all Dependent Variables (Oral and Silent Comprehension Level, Oral and Silent Comprehension Rate, and WCPM)

Dependent Variable	*df*	*M* (Oct.-Dec.)	*M* (Feb.)	*SD* (Oct.-Dec.)	*SD* (Feb.)	*t*	*p*
Oral Level	40	7.18	7.15	1.50	1.39	.071	.94
Silent Level	40	6.59	6.65	1.76	1.46	-.118	.91
Oral RCR	40	250	235	89	65	.644	.52
Silent RCR	40	304	292	120	100	.341	.74
WCPM	40	149	132	33	22	1.95	.06

Note. *RCR=Reading Comprehension Rate, WCPM=Words Correct per Minute,* n=*22 (Oct.-Dec.),* n=*20 (Feb.)*

Vita

Andrea Dawn Hale was raised in Richmond, KY, and graduated from Madison Central High School in 1996. After graduating, she attended Eastern Kentucky University where she received a B.S. degree in Psychology with minors in American Sign Language and English. She is currently completing her predoctoral internship in school psychology through The May Institute in Norwood, Massachusetts. Upon completion of her internship she will complete her requirements for a Ph.D. in Education with a concentration in School Psychology at the University of Tennessee, Knoxville.