2018

Reading Comprehension in Two Accommodated Reading Tasks with College Students with Reading Disabilities

Catherine Wharton

Reading Comprehension in Two Accommodated Reading Tasks with

College Students with Reading Disabilities

By:

Catherine Wharton, Ed.D.

A Dissertation Submitted to the Graduate Faculty

of Lynn University of Boca Raton in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Education

Boca Raton, Florida

APPROVED BY:

ABSTRACT

CATHERINE WHARTON: Reading Comprehension in Two Accommodated Reading Tasks with College Students with Reading Disabilities

Most K-12 post-secondary schools have shifted to exclusively providing a reading comprehension accommodation through assistive technology because it outweighs the burden of a tutor/reader. However, very little research has been conducted to examine the effects of assistive technology accommodations on reading comprehension and, of research conducted, there appears to be significant discrepancy of what accommodations are provided for specific diagnoses and how much these accommodations benefit the student. Hence, students are regularly provided accommodations that are not beneficial to them. Thus, a need exists to provide some structure in appropriately accommodating students with reading disabilities in a post-secondary setting. This study examined reading comprehension in three conditions using a quasi-experimental (ABC/BCA/CAB) alternating treatment design. The three conditions investigated subject reading to self (Condition A, baseline), using a person-reader (Condition B), and using text to speech technology (Condition C). Fourteen college students with independently diagnosed reading disabilities, participated in the study investigating the following research questions: How do different accommodations (reader, text to speech) influence college students with reading disabilities performance on reading comprehension tasks? What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension? How does student preference or experience impact accommodation efficacy? A within subjects ANOVA yielded no statistically significant difference between comprehension tasks ($F(2,26) = 1.808$, $MSE = 3.016$, $p. = 184$). A

Pearson correlation coefficient indicated a statistically significant result in ($r(12) = .76$, $p = .002$) for reader and text to speech conditions, demonstrating a trend in performance in those conditions. A Pearson correlation coefficient was calculated for the relationship between participants IQ indices, passage comprehension subtests, and each of the three conditions (read to self, using a reader, using text to speech). A statistically significant correlation was found ($r(13) = .665$, $p = .013$) between PRI and reading to self. A statistically significant correlation was found ($r(13) = .726$, $p = .005$) between VCI and performance in the text to speech condition. Results regarding the impact of preference and experience indicated that students were not particularly adept at determining how best to accommodate their reading disability and that their experience did not influence reading comprehension. The author argues for individually specific accommodations, educating students what accommodation(s) work best for them and the inclusion of an assistive technology single subject design incorporated into all psychological evaluations.

Order Number: _____

READING COMPREHENSION IN TWO ACCOMMODATED READING TASKS WITH COLLEGE STUDENTS WITH READING DISABILITIES

Wharton, Catherine, Ed.D.
Lynn University, 2018

ACKNOWLEDGEMENTS

I would like to thank President Kevin Ross, Dr. Gregg Cox, Mr. Shaun Exsteen, Ms. Laurie Levine, and Dr. Kathleen Weigel for providing me with the opportunity to receive a scholarship to pursue my doctorate. This has long been an aspiration of mine and I could not have started this journey without your support.

My dissertation committee members, Dr. Kelly Burlison, Dr. Melissa Lehman, and Dr. Jennifer Lesh, have pushed me intellectually and provided me with invaluable encouragement and insight.

The team in the Institute for Achievement and Learning has cheered me and donated their time to assist me in data collection. Specifically, I wish to thank Ms. Natalie Capiro, Ms. Amanda Evans, Ms. Honey Frydman, Ms. Paula Hyman, Ms. Melissa Knight, Ms. Jesse Tucker, and Ms. Melissa Wharton-Smith.

My doctoral cohort #9 provided me with the perfect balance of commiseration and motivation and are my lifelong friends.

My son, Bobby Wharton-Puscheck has been an invaluable support. He did not complain about my time away from him, encouraged me every step of the way, and even did laundry and regularly kept the floors clean from cat and dog fur. He is my "shining star" and throughout his life has made me be the mother he deserves and keeps me moving toward a positive and productive life path.

Lastly, I have to thank the students that participated in this research. Your resilience, tenacity, and positivity while engaging in difficult tasks is an honor to observe and be a part of – you humble me and I so value my experience in knowing you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I: INTRODUCTION

Background

The United States differs from most countries in its legislation to provide free and appropriate education to all children; in fact, this is one reason why the U.S. lags behind other western countries' educational benchmarks like the Program for International Student Assessment (PISA) (IES: NCES, 2015). Other industrialized nations, such as Finland, which consistently performs best on the PISA, educate and evaluate their students differently. For example, while the United States requires all students to be in mainstreamed courses, unless there is substantial evidence to prove that the student is more supported in a different environment, other countries only recently begun discussing the inclusion of non-native speakers and/or students with disabilities from the general population of students (European Agency for Special Needs and Inclusive Education, 2015).

In 1975, the United States Congress passed the Education for All Handicapped Children Act of 1975, which provided the context of the current educational environment related to students with disabilities, identified underserved populations, and established the current threshold for state and federal obligation about education (U.S. Government Publishing Office). The facts pertinent to this research are:

- Eight million children in the United States' "special education needs…are not being fully met" (U.S. Government Publishing Office, p. 2).
- Four million children are not receiving "appropriate educational services which would enable them to have full equality of opportunity" (U.S. Government Publishing Office, p. 2).

- One million children are "excluded entirely from public school (and are not attending school with their) peers" (U.S. Government Publishing Office, p. 2).
- "Undetected handicaps" are preventing "some children" from "having a successful educational experience" (U.S. Government Publishing Office, p. 2).

Education for All Handicapped Children Act of 1975 stipulates that "effective special education (is available) to meet the needs" of these students, that financial resources are needed for this endeavor, and that "it is in the national interest that the government provide programs to meet the educational needs in order to assure equal protection of the law" (U.S. Government Publishing Office, p. 3). For the first time, the establishment of the right of Free and Appropriate Public Education (FAPE) was legislated. FAPE is defined as "a free appropriate public education which emphasizes special education and related services designed to meet their unique needs to assist States and localities to provide for the education of all handicapped children, and to assess and assure the effectiveness of efforts to educate handicapped children" (U.S. Government Publishing Office, p. 3). FAPE also discusses and defines:

> "children with specific learning disabilities (as) those children who have a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations" (U.S. Government Publishing Office, p. 22).

It also provides for the "establishment and operation of centers on educational media and materials for the handicapped, which will provide a comprehensive program to facilitate

the use of new educational technology in education programs for handicapped persons, including designing, developing, and adapting instructional materials" (U.S. Government Publishing Office, p. 23).

In 1975, The Education for All Handicapped Children Act laid the foundation for the Americans with Disabilities Act of 1990 (ADA) which is conceptualized as a civil rights law to ostensibly protect people with disabilities from discrimination in employment (U.S. Equal Employment Opportunity Commission, 2017). This lead to the Individuals with Disabilities Education Act of 2004, or IDEA (U.S. Department of Justice, 2009). The ADA act (1990) encompasses all disabilities and determines laws and policies specific to accommodations, whereas IDEA (2004) specifies regulations, policies, and laws specific to public schools (U.S. Department of Education, 2004). IDEA (2004), stipulates that "Disability is a natural part of the human experience and in no way, diminishes the right of individuals to participate in or contribute to society (Government Publishing Office, 2004, p. 850)." Hence, every child is entitled to a "Free and public education" (Government Publishing Office, 2004, p. 850). Public schools are required to identify and provide appropriate services to students with special needs as well as develop an Individualized Education Program (IEP), with "highly qualified teachers," continuous monitoring and evaluation of students' gains as well as provide procedural safeguards and due process to students and their families (U.S. Department of Education, 2004). With respect to accommodation students with the technology, IDEA (2004) stipulates: "the education of children with disabilities can be made more effective by supporting the development and use of technology, including assistive technology devices and assistive technology services to maximize accessibility for children with

disabilities (Government Publishing Office, 2004, p. 850). IDEA (2004) mandates that IEP teams "consider whether the child needs assistive technology devices and services" (Mittler, 2007, p. 83).

While the assistive technology discussed in IDEA (2004) is typically referring to a health condition, it also discusses reading technology accommodation for visually impaired students. While the specific mention of assistive technology stipulated in IDEA (2004), is not related to students with learning disabilities, researchers, teachers, parents, and students began to investigate the benefits (Parette, Peterson-Karlan, Smith, Gray, & Silver-Paculla 2006). Most states do not allow reading assistive technology for a standardized reading test, because of the notion that the accommodation provides an inaccurate picture of the readers' comprehension ability (Lai & Berkeley, 2012). Parette et al. (2006) state "technology may be driving decisions to implement technology in classrooms" rather than having the research drive the decision-making (p. 17). Education finds itself in a position where an "accommodation" is being used for a purpose in which it was not intended, i.e., audio text was created for people who are visually impaired and assistive technology reading accommodation research inarguably demonstrates mixed results regarding the benefit for those with reading disabilities (Lai & Berkeley, 2012).

The trend to use assistive technology for students with reading disabilities in K-12 settings has proliferated and higher education also receives student requests for reading accommodations. Indeed, college students with learning disabilities are attending post-secondary institutions at record rates (Lindstrom, 2007; Holmes & Silvestri, 2012); most schools are thought to have 10% of their student population receiving services, such as examination accommodations, as reported to the campus disability office (Samson,

2011). Stodden, Conway, & Chang report that there is a stronger correlation for students with disabilities to require a college education and/or workforce placement than for their neuro-typical peers (2003). Thus, Stodden et al. (2003) argue that students with disabilities may need higher education to adequately compete with their non-disabled peers.

Significance of the Study

Reading comprehension accommodations are typically institution-specific rather than student-specific. For example, if an institution has iPads, students use the text to speech software that is available on the iPad (Lai & Berkeley, 2012). Most K-12 public schools have shifted to exclusively providing a reading comprehension accommodation through assistive technology because it outweighs the burden of a tutor/reader (Lai & Berkeley, 2012). However, very little research has been conducted to examine the effects of assistive technology accommodations on reading comprehension (Raskind & Higgins, 1998; Thurlow, 2005; Lindstrom, 2007; Lai & Berkeley, 2012) and, of research conducted, there appears to be significant discrepancy of what accommodations are provided for specific diagnoses (Lai & Berkeley, 2012) and how much these accommodations benefit the student (Lai & Berkeley, 2012). Hence, students are regularly provided accommodations that are not beneficial to them (Lindstrom, Lai & Berkeley, 2012).

Rationale for the Study

Accommodations for learning disabilities are provided once a psychological assessment and a formal diagnosis have been obtained (Lindstrom, 2007). However, there do not appear to be general guidelines on what these accommodations are or how

they are implemented (Raskind & Higgins, 1998; Lindstrom, 2007). The most widely implemented accommodation is extended time, however, "benefits are usually larger for examinees with disabilities" as compared to students without disabilities," but this is not a consistent finding and it depends on the disabled examinees' ability levels and test characteristics" (Lovett, 2010, p. 624). While the extended time accommodation continues to be "controversial" (Lovett, 2010, p. 611), other accommodations, such as the use of assistive technology, have received much less attention, research, and scrutiny (Raskind & Higgins, 1998; Thurlow, 2005; Lindstrom, 2007; Lai & Berkeley, 2012).

Purpose of the Study

The purpose of this study is to inform best practices in determining appropriate and beneficial accommodations for students with reading disabilities in post-secondary educational settings; to determine the relationship among different accommodations and to read disability severity, and to elucidate if student preference for a specific accommodation positively impacts performance.

Research Questions

The research examined both quantitative and qualitative aspects of accommodations and text comprehension utilizing subjects with independently diagnosed reading disabilities. The following research questions were answered:

1. How do different accommodations (reader, text to speech) influence college students with reading disabilities performance on reading comprehension tasks?
2. What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?
3. How does student preference or experience impact accommodation efficacy?

Assumptions

The following assumptions are inherent in this study. First, all university students participating in the research are appropriately diagnosed as having a reading comprehension disability by an independent evaluator. Second, subjects are putting forth their best effort in each condition. Third, that students can select the assistive technology preference (dialect, pace) that will most benefit them. Finally, the study assumes that observation effects are randomly distributed through the three conditions.

Limitations and Delimitations

The generalizability of the study may be effected by several factors, such as the non-random sampling procedure and the relatively small sample size of 14 subjects. Additionally, subjects may experience fatigue by having to perform all three conditions in one day. Further, although it is desirable to have the same reader for all subjects, that was not feasible and, three different readers were used. This is examined further in Chapter 3.

Definition of Terms

Several terms are used that are specific to this paper, the following lists and provides the operational definition of each.

Accommodation. Accommodation is defined as "testing materials or procedures that enable students to participate in assessments in a way that assess abilities rather than disabilities" (National Center for Educational Outcomes, 2016). For this study, accommodation is used to include extended time of 100%, having a person read text to the student, and having the student use text to speech software to read text to the student.

Assistive Technology (A.T.). Can act as a "cognitive prosthesis" when it compensates for an ability that is either absent or impaired (Cavalier, Ferretti, & Okolo, 1994, p. 175). For this research, assistive technology refers to the use of a text to speech application that is available on Apple's iPad. This application reads and highlights the word as it is read aloud. Students are allowed to choose their preferences for voice (dialect, gender) and pace.

Extended Time. Extended time refers to allowing the student as much as time as they need to complete the reading task. The purpose of extended time is to allow "specific groups of individuals to accurately demonstrate understanding concerning the construct of interest" (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999, p. 75).

Experience. Experience refers to the response given by subjects in the survey which queries how they typically access text (reading to self, using a reader, or using text to speech).

Inaccurate Response Pattern. Subject response to Survey when describing inaccurately how they best access textual information. For example, a subject reports a preference and a perception that assistive technology best compensates for the reading disability when it does not.

Independently Diagnosed. Independently diagnosed refers to an external psychological evaluation that is not affiliated with the researcher or the university. In fact, the researcher is not acquainted with any of the evaluators. Participants with an independent psychological evaluation that denotes a reading disability, an

accommodation for text to speech or a reader, and/or a discrepancy between Verbal Comprehension Index (VCI) and passage comprehension or a similar subtest are eligible for participation.

IEP Team. IEP team consists of the student, the student's parent, regular education teachers, school system representative, special education teacher, a person who can explain assessment results, and others with special knowledge about the student (U.S. Department of Education, 2007).

Individual Education Plan or IEP. Individual Education Plan is the individualized educational goals written for a specific student that details the specific disability or disabilities (U.S. Department of Education, 2007).

Institutionally-Specific Accommodations. Institutionally-specific accommodations refer to the bias implementation in providing accommodations based on materials available rather than a different metric, such as prior student experience or student preference.

Intelligence Quotient (IQ). IQ refers to the IQ indices that compare one's performance with age-mates who have also been evaluated (American Psychiatric Association, 2013). For this research IQ indices are defined as reported by an independent psychologist in the context of diagnosing a student with a reading disability. Relevant IQ indices and achievement scores are reported in Chapter IV.

Learning Disability (LD). Learning disability refers to an unexpected academic underperformance (American Psychiatric Association, 2013; U.S. Department of Education, 2007).

Passage Comprehension Subtest. Refers to achievement subtest used in both the Wechsler Individual Achievement Test (WIAT) and Woodcock-Johnson-ACH (W-J-ACH). For the purposes of this study, the subtest of passage comprehension which is used in the WIAT and W-J-ACH is the achievement score that is utilized.

Performance. Performance refers to the raw score obtained by subjects in the reading comprehension task. This number is reported as number of questions correctly answered.

Preference. Preference refers to the response given by subjects in the survey which queries how they best comprehend text (reading to self, using a reader, or using text to speech).

Reading Comprehension Task. Reading comprehension task utilizes the College Board's SAT's publicly available reading comprehension tests. Permission has been obtained and is in the appendix of this document.

Reading Disability. Reading disability is defined as the student not achieving adequately for the child's age or to meet grade-level standards in basic reading skills, reading fluency skills, and/or reading comprehension skills (U.S. Department of Education, 2004).

Mild Reading Disability. Mild reading disability subsumes the above definition of underachievement but adds the qualifier that the student can "compensate or function well when provided with appropriate accommodations or interventions" (American Psychiatric Association, 2013, p. 67).

Moderate Reading Disability. Moderate reading disability subsumes the underachievement but denotes that the student is unlikely to become proficient

without "intensive intervention and accommodations" may be needed to "accurately and efficiently" accomplish specific academic tasks (American Psychiatric Association, 2013, pp. 67-68).

Severe Reading Disability. Severe reading disability is defined as the student requiring ongoing intensive individualized and specialized teacher for most of the school years and the student may not be able to complete home, school, or workplace tasks even with "an array of appropriate accommodations" (American Psychiatric Association, 2013, p. 68).

Reader. Reader describes the use of a native English speaker to read text to student. The student may request repetition of words, phrases, etc. but the reader cannot clarify—only the text is read.

Self-Modality. Self-modality refers to a student reading text independently. Students may use their strategy such as sub-vocalization.

Student Characteristics. Student characteristics include IQ indices, achievement scores, student self-reported preferences for a specific accommodation and student self-reported experience with a specific accommodation. Further diagnoses are indicated when applicable and a full list is given in the appendix.

Subjects. Subjects are recruited from a private, university campus. Only subjects with an independently diagnosed reading disability are selected for participation.

Text to Speech. Text to Speech is the use of the iPad text to speech application where the text is highlighted and read aloud to student via the application.

Wechsler Adult Intelligence Scale (WAIS). A paper and pencil test that is administered by a "highly qualified level of expertise in test interpretation." Practitioners

typically hold a doctoral degree (Pearson, 2018). For this research, subjects with reported WAIS indices scores were utilized. The WAIS indices are: Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), Processing Speed (PSI).

Woodcock-Johnson – ACH (W-J-ACH). "Evaluates learning problems…cluster scores enable comparisons to academic achievement, cognitive processing, and oral language measures" (Houghton Mifflin Harcourt, 2018).

Organization of the Remainder of the Study

The following chapters discuss a review of the related literature, methodology, results, and conclusions. Literature review topics include: Reading comprehension theory, reading comprehensions/reading disability, K-12/reading disability/accommodations, assistive technology/skill acquisition, and post-secondary accommodations. Chapter III discusses the methodology regarding research questions, setting, population, the quantitative and qualitative research design, as well as the data collection, data quality, data analysis, ethical considerations, and limitations of the research. Chapter IV answers to research questions and provides within subjects and groups analyses of the data. Chapter V discusses conclusions and implications for further research.

CHAPTER II: LITERATURE REVIEW

Reading Comprehension Theory

Reading comprehension theories typically focus on either the interdependency of skills or the independence of skills involved in reading. The skills typically discussed are decoding, fluency, rate, comprehension, and inference. Gough and Tunmer (1986) posited the Simple View of Reading arguing that decoding and comprehension are interdependent (Gough, Hoover, & Petersen, 1996), however, as early as 1974, LaBerge and Samuels argued that decoding and comprehension skills were independent. LaBerge and Samuels (1974) work found that when students with reading disabilities are given a listening while reading accommodation, they perform better. LaBerge and Samuels theorized that the students were able to focus their attention on comprehension rather than on decoding (1974).

In the theory of the Simple View of Reading, decoding and comprehension are interdependent constructs (Gough & Tunmer, 1986; Gough, Hoover, & Petersen, 1996). Decoding skills are defined as phonological awareness, letter and word recognition; whereas, comprehension skills are defined as "receptive vocabulary and listening comprehension" (McNamara & Kendeou, 2011, p.34). In Gough and Tunmer's (1986) model, these two skills are believed to construct the foundation of reading comprehension.

Regarding drawing inferences, Cain and Oakhill (1999) argue that drawing inferences is "not just a by-product of comprehension, but a plausible cause" (p. 501). Cain and Oakhill (1999) define inferencing as "the process of connecting information within the text or within the text and one's knowledge base and drawing a conclusion that

is not explicitly stated in the text" (p. 501). Cain and Oakhill (1999) contend that the more prior knowledge the reader has about the targeted written material, the richer the elaborations and coherence because the mental representation of the text is more readily integrated for the reader. McNamara and Kendeou (2011) discuss reader-text interactions, in which they posit that the unique prior experiences each reader has in regards to the text they are given influences comprehension. For example, low prior experience readers increase performance with textual cohesion, while high prior experience readers increase performance with cohesion gaps (MacNamara & Kendeou, 2011). MacNarmara and Kendeou (2011) argue that the low prior experience reader is not able to make the necessary inferences, whereas the high prior experience readers increase their comprehension because of their ability to inference.

McNamara and Kendeou (2011) make the distinction between product and process to clarify the components of reading comprehension but to also understand the "causal relationship" between the two. McNamara and Kendeou (2011) operationally define reading comprehension as "the construction of a coherent mental representation of the text in readers' memory' (p. 35). The "mental representation" then, is the product of reading comprehension. The process of reading comprehension "occurs moment-by-moment" as students' read (McNamara & Kendeou, 2011, p. 35). McNamara and Kendeou (2011) argue that it is important to understand whether a student is having difficulty with process or product in reading comprehension. Understanding a difficulty with process or product informs the intervention and will more successfully remediate the difficulty.

Current research substantiates that comprehension (product) and decoding (process) are separate constructs that contribute to the overarching construct of reading comprehension (Stothard & Hume, 1992; Spooner, Baddeley, & Gathercole, 2004; Cain, Oakhill, & Lemmon, 2005; Nation, 2005; Adolf, Cats & Little, 2006; McNamara & Kendeou, 2011). Some children are poor decoders but have adequate reading comprehension skills and vice versa (McNamara & Kendeou, 2011). Bolstering this position, McNamara and Kendeou (2011) report six studies that indicate that the development of decoding and comprehension skills "are separate and unrelated from preschool to early elementary school" and that "both sets of skills significantly and independently" influence early elementary school reading comprehension performance (p. 34). However, Nation (2005) suggests mini skill sets within decoding and comprehension combine to produce reading comprehension.

Regardless of interaction between decoding and comprehension, neuropsychologists also argue that cognitive load influences academic tasks such as reading comprehension (Hale, Skinner, Winn, Oliver, Allin & Molloy, 2005). Cognitive load refers to the cognitive resources that an individual has to complete a task (Hale et al., 2005). For example, a student with a poor working memory index and reading comprehension disability will demonstrate their difficulties differently than a student with an average working memory index and a reading comprehension disability. Psychologists argue that the need for understanding the fundamental differences in the application of cognitive resources also informs the intervention (Hale et al., 2005). Lesgold and Resnick (1982) and Breznits (1987), posited that a reading disability secondary to a compromised working memory could be accommodated by listening

while reading because the student has an increased fluency which compensates for the deficient working memory. In this instance, less time elapses during the accommodation so that the meaning of the text doesn't decay at the same rate as the reading disabled student reading to self (Lesgold & Resnick, 1982; Breznits, 1987; Hale et al., 2005). Hale et al. (2005) argue that the intervention of listening to text while reading text is useful for a student with a cognitive load deficiency. When this intervention is effective, it is because students can allocate resources to comprehension rather than simultaneously allocating resources to comprehension and decoding (Hale et al., 2005; McNamara & Kendeou, 2011).

In terms of accommodating a reading comprehension disability, theorists emphasize understanding the nuances involved in text comprehension, pinpointing the exact issue, and providing an accommodation and/or remediation that directly influences the weakness (Lesgold & Resnick, 1982; Breznits, 1987; Hale et al., 2005; McNamara & Kendeou, 2011). McNamara and Kendeou (2011) also discuss the additional factor of understanding how reading assessment is constructed and the interplay of multiple factors such as comprehension, decoding, fluency, and inferential ability in one test. Additionally, they emphasize that question format may influence comprehension results (MacNamara & Kendeou, 2011).

Reading Disability

The term "unexpected academic underachievement" is the hallmark trait of a specific learning disability (American Psychiatric Association, 2013, p. 69). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric

Association, 2013), categorizes reading disability under the overarching diagnosis of Specific Learning Disorder using the following criteria:

> "Difficulties learning and using academic skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties: (1) Inaccurate or slow and effortful word reading; (2) Difficulty understanding the meaning of what is read" (American Psychiatric Association, 2013, p. 66-67).

The diagnosis is made when achievement scores fall 1.5 standard deviations below the mean and when "the learning difficulties are not better accounted for by intellectual disabilities, lack of proficiency in the language of academic instruction, or inadequate educational instruction" (American Psychiatric Association, 2013, p. 67).

A reading disability always specifies whether the student is having difficulty with word reading accuracy, reading rate or fluency, reading comprehension, and the severity of the disability (American Psychiatric Association, 2013). With a mild disability the student is "able to compensate or function well when provided with appropriate accommodations or interventions;" with a moderate disability the child is "unlikely to become proficient without intensive intervention and accommodations may be needed to accurately and efficiently" accomplish specific academic tasks; with a severe learning disability the student requires "ongoing intensive individualized and specialized teacher for most of the school years and may not be able to complete home, school, or workplace tasks even with an array of appropriate accommodations" (American Psychiatric Association, 2013, pp. 67-68).

Specific learning disabilities are diagnosed in 5%-15% of kindergarten through twelfth-grade students (American Psychiatric Association, 2013). Through psychological evaluation, most adolescents diagnosed with a reading disability that has received appropriate remediation manifest decoding competency but still struggles with "slow and effortful" reading rate, along with "marked problems in reading comprehension" (American Psychiatric Association, 2013, p. 71). Common compensatory adolescent and young adult strategies include recurrent re-reading as a result of having difficulty understanding the main idea or making textual inferences (American Psychiatric Association, 2013).

K-12, Reading Disability, and Accommodations

The U.S. Department of Education reports 4.5% of students are labeled as having a learning disability (IES: NCES, 2016). The public school system defines a specific learning disability as the "unexplained difficulty a person of at least average intelligence has in acquiring basic academic skills" (Lai & Berkeley, 2012, p. 158). In 2004, IDEA added language to include the previously excluded population of students with disabilities to take part in accountability, or high stakes, testing and mandated that these students were accommodated. Thurlow, Lazarus, Thompson, and Morse (2005) point out that these high stakes examinations were not designed for these special populations.

Lai and Berkeley (2012) examined the public school accommodation system focusing on the empiricism and accommodations, state guidelines, and policy. Thurlow (2005) discusses five distinct categories of accommodation. They include: "timing," for example extended time, "response," differing ways for students to answer assessment questions, for example writing answers in a test booklet rather than a Scantron, "setting,"

or an alternative testing environment, "equipment and materials" for example calculators, study guides, or word banks; and "presentation," or differing ways in which to exhibit testing materials, for example a reader or scribe (Thurlow, 2005). Accommodations are not linked to diagnosis or disability but, instead, the presentation of the specific disorder or the combinations of disorders found in one student (Lai & Berkeley, 2012). Fuchs and Fuchs (2001) reported that most students are over-accommodated or given accommodations that are not effective for them. Regarding reading disabilities, Fuchs and Fuchs (2001) reported that 73% of students with a reading disability were given an unspecific accommodation but only 41% of those students benefited from it. For students with a math disability, sixty-five percent of students were accommodated in math computations but only 20% demonstrated benefit. Fuchs and Fuchs (2001) also reported that out of 93% of students who were given a math application accommodation only 32% of students found this efficacious. Regarding a math problem-solving accommodation, 93% of students were given a math problem-solving accommodation but only 42% demonstrated a benefit. Lai and Berkeley (2012) emphasize that IEP teams need to understand the empirical benefit of assigning appropriate accommodations and they must also balance the accommodation with the integrity of the assessment measure. That is, when reading comprehension is being assessed, it is not appropriate to use a reader or assistive technology to read the material to the student. However, if computational skills are being assessed through a word problem, it is appropriate to provide a reader or assistive technology. Lai and Berkeley (2012) discuss the construct of "differential boost" (Thompson, Blount, & Thurlow, 2002). A differential boost is defined as an empirically supported accommodation that demonstrates that students with the targeted

learning disability increase performance, whereas students without the learning disability do not benefit while maintaining the integrity of the construct being measured (Fuchs & Fuchs, 2001; Thompson, et al., 2002; Lai & Berkeley, 2012).

Thurlow's (2005) review of learning disability accommodations among states demonstrated significant heterogeneity (Lai & Berkeley, 2012). The noted variability was specific to which accommodations were given to specific populations of students and which were disallowed (Lai & Berkeley, 2012). In Lai and Berkeley's (2012) review, the authors noted the five different types of accommodations as defined by Thurlow (2005) and specific state policy. Lai and Berkeley (2015) excluded studies that did not employ an experimental or quasi-experimental methodology, only examined classroom accommodations, and were specific to the K-12 population with learning disabilities (Lai & Berkeley, 2012). The accommodation of timing was found in 7 studies published between the ranges of 1991-2005. Extended time given in an untimed format was granted in two studies. Extended time by increasing time 50-100% was reported in 3 studies and granting multiple sessions of opportunities to do the test was granted in two studies (Lai & Berkeley, 2012). Two studies focused on extended time in reading and math in grades 5 and 9 and neither found any positive benefit to the students with learning disabilities (Lai & Berkeley, 2012). Three studies investigated reading disabilities and one of these studies demonstrated a benefit whereas two did not. One study examined writing using the multiple session formats and students with learning disabilities gained a differential boost (Lai & Berkeley, 2012). Regarding state usage, timing accommodation was the most frequently used, with 35 states allowing frequent breaks and 32 states allowing extra time (Lai & Berkeley, 2012). Although timing

accommodations are the most widely used accommodation, the majority of studies indicated that students with learning disabilities did not get a differential boost and that non-LD students' performance decreased (Lai & Berkeley, 2012). Lai and Berkeley (2012) recommend caution when granting this accommodation.

Lai and Berkeley (2012) found one study using response accommodation that met their criterion. MacArthur and Cavalier (2004) investigated dictation to a person and dictation using assistive technology with students with LD and students without LD. Students with LD gained a modest differential boost in the assistive technology condition but demonstrated significant gains when dictating to a person. Lai and Berkeley (2012) report that states allow 13 differing response accommodations with most states allowing assistive technology, responses marked directly on test booklets (rather than a Scantron), and using dictation to a person (or a scribe); four states did not allow scribes for writing portions of high stakes testing (2012). Lai and Berkeley (2012) speculate the reason for the lack of empirical research in this area is because it is time, space, and personnel intensive. That is, research designs, or even schools conducting single-subject designs to indicate the efficacy of the accommodation for the specific student, require the time to investigate the accommodation, the space or setting of the accommodation, and a staff member to supervise or implement the accommodation (Lai & Berkeley, 2012).

According to Lai and Berkeley's literature review, an alternative testing environment, or setting has not been empirically evaluated (2012). Not one study investigated the efficacy of this accommodation yet most states allow this accommodation (Lai & Berkeley, 2012). Four studies implemented the use of equipment and materials accommodation, one study focused on keyboarding with writing and three

focused on calculators for math (Lai & Berkeley, 2012). None of the studies demonstrated a differential boost for students with LD. Most states allow keyboarding accommodating with no spell check and basic calculators without restrictions (Lai & Berkeley, 2012).

Thirteen studies examined presentation accommodations with most examining the read-aloud accommodation and two other studies examining different implementation (Lai & Berkeley, 2012). The read-aloud accommodation was presented by either having certain words read to the students, certain comprehension questions read, or utilizing assistive technology to read to the students (Lai & Berkeley, 2012). The other two studies were implemented by having the students read-aloud to self and segmenting reading passages for students. The subjects accommodated follow: Six for reading, six for math, and one was reading, math, science, and writing. Five of the 13 research designs indicated a differential boost for LD students for the read-aloud accommodation (Lai & Berkeley, 2012). The majority of states allow the read-aloud accommodation for non-reading assessments. Twenty-one states do not allow the read-aloud accommodation in all reading high-stakes evaluations but two states allow the test questions to be read aloud but not the reading passages (Lai & Berkeley, 2012). Lai and Berkeley (2012) discuss the need for additional evaluation of other presentation accommodations and further examination of the read-aloud accommodation for specific types of disabilities and specific types of academic tasks to further elucidate this multifaceted accommodation (Lai & Berkeley, 2012).

Assistive Technology and Skill Acquisition

Raskind and Higgins (1998) have focused on incorporating assistive technology as curriculum tool. Raskind and Higgins (1998) describe a three-year study completed at California State University using 140 participants with a diagnosed learning disability. The study was divided in years one, two, and three and targeted specific compensatory skill acquisition utilizing assistive technology with academic tasks such as writing or reading. Year one targeted text to speech as a reading strategy, text to speech as a proofreading strategy and speech to text as a writing strategy. Years two and three qualitative data in the form of academic behaviors and attitudes and quantitative data in the form of grade point average. All of the results demonstrated the effectiveness of assistive technology. Students reported more academic independence than the control group using traditional tutoring and 80% reported feeling "better about themselves academically" (Raskind & Higgins, 1998, p. 36).

Post-Secondary Accommodations

Students with learning disabilities wishing to avail themselves of accommodations provide appropriate documentation to their college or university of choice (Lindstrom, 2007). School representatives grant accommodations based on opinion related to the diagnosis rather than empirically sound accommodations (Lindstrom, 2007). One of the reasons for this is the lack of empirically validated accommodation strategies (Lindstrom, 2007; Lai & Berkeley, 2012). In examining students with reading disorders, the most common accommodation is extended time (Thurlow, 2005; Lindstrom, 2007; Lai & Berkeley, 2012). The implementation of extended time comes from the idea that the various factors needed for reading comprehension require extra time (Lindstrom, 2007). The research does not support

extended time for tasks other than reading (Lindstrom, 2007). It seems that the more severe an individual's reading disorder, the more they will benefit from extended time, having a reader, or relying on assistive technology (Lindstrom, 2007). In 1997, Higgins and Raskind investigated the differences among reading comprehension scores in three different conditions: Reading text to self, having text read by a person/reader, and the subject reading silently. Higgins and Raskind (1997) examined 37 college students' performance on reading comprehension measures. The authors found the following: There were inverse and correlational relationships for specific students but not within or between groups. Students who had the poorest reading comprehension scores when reading silently did significantly better when provided assistive technology; students that comprehended well on the silent reading task had lowered scores when using assistive technology. Higgins and Raskind (1997) call this ‘technology interference" (p. 75). Montali and Lewandowki (1996), Higgins and Raskind (1997), Hale et al. (2005), and Sorrell, Bell, and McCallum (2007) posit that the less-skilled the reader, the more benefit the student will receive in reading comprehension when presented in a multi-modality manner but caution that some students who are provided a reader or assistive technology do not benefit from it (Montali & Lewandowki, 1996; Higgins & Raskind, 1997; Hale et al., 2005; Sorrell, et al., 2007). A need exists to provide structure with appropriately accommodating students with reading disabilities in a post-secondary setting.

CHAPTER III: METHODOLOGY

Introduction

Reading comprehension accommodations are typically institution-specific rather than student-specific (Lai & Berkeley, 2012). For example, if an institution has iPads, students use the text to speech software that is available on the iPad. Most K-12 public schools have shifted to exclusively providing a reading comprehension accommodation through assistive technology because it outweighs the burden of a tutor/reader (Lai & Berkeley, 2012). However, very little research has been conducted to examine the effects of assistive technology accommodations on reading comprehension (Raskind & Higgins, 1998; Thurlow, 2005; Lindstrom, 2007; Lai & Berkeley, 2012) and, of research conducted, there appears to be significant discrepancy of what accommodations are provided for specific diagnoses (Lai & Berkeley, 2012) and how much these accommodations benefit the student (Lai & Berkeley, 2012). Hence, students are regularly provided accommodations that are not beneficial to them (Lindstrom, 2007; Lai & Berkeley, 2012).

To better understand the differential boost of reading disability accommodations and to elucidate what effect, if any, student characteristics have on receiving benefit from specific accommodations, the following study was conducted. This chapter will discuss research methodology used in this study, define the setting and subjects, as well as procedures used to collect data, and the statistical analysis of the data.

Research Questions

The overarching research questions seek to determine if a reader and text to speech technology are commensurate accommodations and further understand the influence of

student characteristics (i.e., IQ and achievement scores), student experience, and preference on text comprehension. The following lists the discrete questions the researcher answered:

1. How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks (reader, text to speech)?
2. What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?
3. How does student preference or experience impact accommodation efficacy?

Setting of the Study

The research was conducted at a small, private, liberal arts university in the southeastern United States. In the fall of 2017, the current undergraduate enrollment is 2,204 including 482 first semester, first-time freshman students. The university has 35 academic majors administered through the following six colleges: Arts and Sciences, Business and Management, Aeronautics, Communication and Design, Conservatory of Music, and Education. The institution offers certificates, associate's degree, bachelor, master, and doctoral degrees. Student to faculty ratio for undergraduate courses is 15:1 and 24% of the undergraduate population are comprised of international students. The average cost of tuition, room and board is $47,230 and 72% of students receive financial aid. For over 25 years, the university has an internationally-recognized academic support program specifically designed for college students with diagnosed learning disabilities. This program costs an additional $12,000 per academic year and 25% of the first year incoming students participate in this service. The six-year graduation rate for the institution is 50%.

The setting for the study was the university's academic support center and locations included the testing center and individual offices. The testing center is a large, windowed room with individual desks and computers for 50 students. Subjects may or may not have previous experience in this room. Students completed reading to themselves (Condition A) in this location. Conditions B and C took place in individual offices.

Description of Population and/or Sample

The population for this study is comprised of all university students with an independent psychological evaluation that denotes a reading disability, an accommodation for text to speech or a reader, and/or a discrepancy between Verbal Comprehension Index (VCI) and passage comprehension or a similar subtest. Subjects over the age of 18, who are native English speakers, were recruited via flyers (Appendix A) that were placed around the campus. As subjects demonstrated interest in participating in the research, the informed consent document (Appendix B) was discussed which includes permission for the researcher to view their previously submitted, independent psychological evaluations, explains the research, and emphasizes that participation is voluntary and that subjects have a right to end their participation at any time. Because the population being studied has a reading disability, the researcher read and reviewed the informed consent for each subject.

Seventy-six university students expressed interest in participating in this study. Upon learning about the research, seventeen subjects refused to participate and 21 did not meet criteria. Eleven subjects expressed interest but ultimately did not participate and 12 subjects reported interest but had prior obligations on the day of the data collection.

Fifteen subjects arrived the day of the data collection. Fourteen subjects completed the reading tasks and the survey. The one subject who did not complete the reading tasks is presumed to have believed he completed all conditions and did not realize the Scantron and test questions continued on a second page. A second subject completed all reading tasks but did not complete the survey. This is presumed to be a researcher administrative error.

Lai and Berkeley's (2012) analyses of conducted research with students with learning disabilities conclude that sample size is relatively small because of the labor involved, ethical issues, and cost. In their report of the 13 studies that met criteria for a sound experimental design, only half had a controlled study. The number of subjects with a learning disability in each study ranged from nine to 391. In these studies, students were given a different presentation accommodation consisting of a reader in group testing situation. The present study sought to focus more fully on a small number of subjects to understand their functioning in three different conditions. For these reasons, the first 15 interested subjects who consented to participation were selected for inclusion in this research.

Research Design

A quantitative quasi-experimental research design was utilized to provide a comprehensive snapshot of each of the subjects. Data was collected regarding student characteristics which were comprised of subject IQ and achievement measures, diagnoses, age, and gender; survey information was collected regarding subject experience with text to speech technology and preference for text to speech technology or

reader (see Appendix E for survey). Finally, reading comprehension is reported in the baseline condition and two treatment conditions.

The study utilized an ABC/BCA/CAB alternating treatment design to mitigate carryover effects (Barlow & Hayes, 1979). Condition A is the baseline of subject reading comprehension and is acquired by having the student read a passage and 10 comprehension questions to themselves. Subjects could avail themselves of their reading strategy, such as sub-vocalization or notetaking. Quantitatively, subjects were examined in two reading comprehension tasks with two different accommodations provided. The two different accommodations were the subject utilizing a reader (Condition B) and the subject using text to speech technology (Condition C) to access text. Each reading comprehension task was estimated to take about 10 minutes and included a passage to read and with 10 comprehension questions. Comprehension questions were presented in the same format as the passage comprehension task. The College Board's SAT sample reading comprehension task, which is written at an 8th and 9th-grade level, was the instrument for this research (College Board, 2017). Permission has been obtained from The College Board and is contained in Appendix C of this document. The exact reading comprehension task as subjects viewed it is in Appendix D of this document. Table 1 explains the different treatment conditions.

Table 1. Quasi-Experimental Within Subjects ABC/BCA/CAB Alternating Treatment Design

BASELINE Condition A: Read to Self	**Condition B: Using Reader**	**Condition C: Using Text to Speech**
Subjects will read text to self	Subjects will have text read to them by a reader	Subjects will use text to speech technology which will provide auditory and visual input
Subjects will answer 10 reading comprehension questions in the same format (i.e., read to self)	Subjects will answer 10 reading comprehension questions in the same format (i.e., reader will read questions)	Subjects will answer 10 reading comprehension questions in the same format (i.e., using text to speech technology)

The only research (Higgins & Raskind, 1997) that has previously undertaken this type of study indicates that specific student characteristics can impact the efficacy of specific accommodations. Higgins and Raskind (1997) found an inverse relationship between reading disability and assistive technology. The more severe the reading comprehension disability, the more benefit subjects received from assistive technology, but with a mild reading comprehension disability, assistive technology appeared to interfere with comprehension. For this reason, independently conducted psychological assessments of each subject were examined to report specific student characteristics including IQ indices and achievement measures and then compared with performance in the baseline and two treatment conditions. Table 2 indicates how this data was collected.

Table 2. Student Characteristics

SUBJECT	IQ				ACHIEVEMENT	GENDER	AGE
	VCI	PRI	WMI	PSI	PASSAGE COMP		

Further, as the literature review (Montali & Lewandowski, 1996; Higgins & Raskind, 1997; Fuchs & Fuchs, 2001; Hale et al., 2005; Thurlow, 2005; Sorrell et al., 2007; Lindstrom, 2007; Lai & Berkeley, 2012) indicates, students are accommodated

without empirical evidence supporting the accommodation. To examine the validity of accommodations that are recommended for students in psychological assessments, additional information was collected through the submitted psychological evaluations to include diagnosis/diagnoses.

Given that the only research of this kind was conducted in 1997, it is important to elucidate the relationship between student experience with text to speech technology and reading comprehension. That is, it is possible that students with less severe reading disabilities have had consistent exposure to this intervention through personal preference and that the consistent experience with assistive technology has mitigated Higgins and Raskind "technology interference" (Higgins & Raskind, 1997, p. 75). Additionally, student perception of what accommodation best supports their difficulty is important (Garner, 1990). To further understand student experience and preference with accommodating their reading disability a pre-task survey developed by the researcher was implemented. The survey is found in Appendix E and Table 3 below lists questions for subjects. The researcher read the questions and answers to the subjects.

Table 3. Pre-Task survey

In order to **best** understand written material, which is the best way for you to understand text?
Do you usually use assistive technology to read text to you?
Do you usually use a person to read text to you?
Do you think being able to use assistive technology for all reading tasks would help you understand material better
Do you think being able to use a person to read to you for all reading tasks would help you understand material better?

Data Collection

This data collection took place in a single day over a three-hour period. Overall, this study will take no longer than 4 weeks to complete. For the quasi-experimental within subjects ABC/BCA/CAB alternating treatment text comprehension tasks, reading comprehension was measured by the correct number of answers in each of the different conditions. A within subjects ANOVA was calculated to determine statistically significant differences at a probability value of <.05.

Next, for the student characteristics component of the research, a Pearson correlation coefficient was calculated for the relationship between participants IQ indices, passage comprehension subtests, and each of the three conditions (read to self, using a reader, using text to speech). The correlations were deemed to be of statistical significance at a probability value of <.05. Permission for access to the psychological testing is contained in the Informed Consent (Appendix B). The following represents the language used in the Informed Consent: You will be asked to permit the researcher to view the psychological assessment that you submitted to the university to receive accommodations. The researcher will use this information to further understand your reading disability. The informed consent was read to the potential subjects by the researcher.

Third, the pre-task survey was examined to identify accommodation preference and prior experience with assistive technology. This data is reported descriptively.

Instrumentation

None of the perused literature reports the reading comprehension instrument used in each study. In consultation with a school psychologist, the researcher decided upon using a reading comprehension test from the College Board's reading portion of the SAT

(2015). The reading test is publicly available on College Board's website and the 2015 version has been selected. This was chosen for its length (typically 10-20 minutes per passage), its medium reliability and validity (see Table 4), and because it is a typical task that high school or college students would be asked to perform. The author obtained permission from the College Board to use reading comprehension passages from the SAT (see Appendix C).

The College Board (2017) consistently statistically measures its instruments for internal validity and reliability as well as examining external validity and reliability. The most recent study examined 150,000 college-bound students attending over 110 university and colleges in the United States (The College Board, 2017). SAT correlates with first-year college grade point average and high school grade point average in the following ways for the following groups in terms of differential validity (Table 4) and differential prediction (Table 5).

Table 4. Differential Validity (The College Board, 2008)

Gender	Females r = 0.52 to 0.58
	Males r = 0.44 to 0.50
Race	Caucasian, correlation range 0.46 to 0.51
	Non Caucasian, correlation range 0.40 to 0.46
High School GPA	Caucasian, correlation r = 0.56
	Non Caucasian, correlation range 0.44 to 0.49

Table 5. Differential Prediction (The College Board, 2008)

First Year College GPA	Females: Mean standardized residuals range from -0.10 to -0.17; SAT under predicts female first year college GPA
	Males: Mean standardized residuals range from -0.11 to -0.20; SAT over predicts male first year college GPA
	African American: Standardized residuals range from -0.32 to 0.17; American Indian, African American, and Latino students are over predicted by all measures and combination of measures

SAT correlation coefficients have remained steady over the years and continue to prove reliable and valid (The College Board, 2017).

Reading passages from the SAT's practice, online, assistive technology format, Reading Comprehension Tests were examined. Of the eight available tests, only literature passages were selected, as opposed to reading comprehension passages that included tables, graphs, or scientific information. Each of the passages was examined through Microsoft Word's "Readability Statistics" (Table 6).

Table 6. College Board Reading Comprehension Tests Readability Score

Practice Test Number	**Title of Passage Excerpt & Original Publication Date**	**Author**	**Number of Words**	**Words per Sentence**	**Flesch Reading Ease**	**Flesch-Kincaid Grade Level**
1	*The Strangeness of Beauty*, 1999	Lydia Minatoya	832	8.1	73.7	4.9
2	*The Professor*, 1857	Charlotte Bronte	697	16.7	64.8	7
3	*The Schartz-Metterklume Method,* 1911	Saki	851	22.9	57.4	10.2
4	*The Balloonist*, 2011	MacDonald Harris	599	18.1	63.9	8.7
5	*The Folded Leaf*, 1945	William Maxwell	828	21.2	65.3	9.1
6	*Nawabdin Electrician,* 2009	Daniyal Mueenuddin	831	21.3	65	9.3
7	*Silas Marner*, 1861	George Eliot	652	40.6	52.2	13.3
8	*The Angel's Game*, 2009	Carlos Ruiz Zafron	674	19.7	76.1	7.5

Passages 4, 5, and 6 were selected as the reading comprehension tasks for this study because of their proximity to one another in Flesch-Kincaid Grade Level scores; passages 4, 5, and 6 were assigned to Condition A, B, or C based on a coin toss. Passage 4, The Balloonist (Flesch-Kincaid Grade Level = 8.7) was chosen for Condition A (Read to Self), Passage 5, The Folded Leaf (Flesh-Kincaid Grade Level = 9.1), was chosen for Condition B (Using Reader), and passage 6, Nawabdin Electrician (Flesh-Kincaid Grade Level = 9.3) was selected for Condition C (Text to Speech).

The instruments have had formatting edits so that each reading task looks similar to the subject. No changes have been made to The College Board's text. The complete document as it appeared to subjects is included in Appendix D.

The readers for this research had worked in the academic support program for over five years and have experience as examination readers. The readers have been trained and instructed, both for their position as a reader and for this research not to engage students in conversation and to only read text once unless the student asks for text to be repeated. The reader may re-read words, phrases, sentences, paragraphs as many times as the subject requests. The readers have been instructed as examination readers and for this research to not to provide any clarification or define unfamiliar terms for students. The readers have been trained and agree to keep confidential all student behavior taking place during testing sessions.

On the day of the quasi-experimental portion of the research design, i.e., the reading comprehension task, six academic support center staff were directed subjects to the correct area, collected Scantron sheets, and facilitated subject access to the reading comprehension conditions as well as activating the text to speech feature for Condition C.

Quality of Data

The quality of data is deemed appropriate as the dependent variable, College Board's 2015 SAT reading comprehension measure, is an instrument with years of validity and reliability. The survey is requesting nominal self-report data and is read to students as well as including targeted formatting and language for students with reading disabilities (Appendix F). The independent psychological evaluation data is expected to be conducted according to American Psychological Association standards.

Data Analysis

Data was input into SPSS and results were calculated in a within subjects ANOVA to compare the number of correct answers in each of the reading task conditions. The reading comprehension task was measured by the SAT reading comprehension test. The independent variable is number of answers correct and the dependent variable is using a reader or text to speech to comprehend text. A probability value of $<.05$ determined the statistical significance of the result.

Next, subject IQ indices, passage comprehension subtests, and performance in each of the three conditions (Read to Self, Using Reader, Text to Speech) were compared using a Pearson correlation to discern relationships. The reading comprehension task was measured by the SAT reading comprehension test. The independent variable was the number of answers correct and the dependent variable was using a reader or text to speech to comprehend text. A probability value of $<.05$ determined the statistical significance of the result.

Student self-report data was examined to discern if students are good predictors of beneficial accommodations and their experience in accommodating themselves. These results are reported as descriptive statistics.

Procedure

The following procedures for this study were set forth. Once potential subjects consented to participate in the research, the researcher began collecting student characteristics data, which is the independent psychological evaluation, to ensure they met the outlined criteria. The criteria for inclusion in the study is the following: An independent psychological evaluation that denotes a reading disability, an accommodation for text to speech or a reader, and/or a discrepancy between Verbal Comprehension Index (VCI) and passage comprehension or a similar subtest, subjects must be native English speakers, and over the age of 18.

Once subjects met that criteria, the quasi-experimental portion of the research began. The primary investigator checked-in each subject, ensure they understood the tasks, and were voluntarily consenting to participation. Then each subject was assigned a condition sequence, i.e., ABC/BCA/CAB and directed to their first location. The entire quasi-experimental portion of the research was completed in less than three hours.

The reading tasks took place in the academic support program when the center was closed for the day. Only students who are subjects in the study were in the environment at this time. The project entailed the use of three stations and six staff members from the academic support program. The staff understood the ethics and confidentially expected as it is the same for their day to day work experience. A description of the three stations follows: The use of the testing center for Condition A,

the baseline condition in which the subject reads to self. Condition B was conducted in private offices for the reader and student. Private offices were used for Condition C, the text to speech accommodation. Support center staff were stationed throughout the environment to direct subjects to the correct area and in the correct sequence (i.e., ABC/BCA/CAB). Support center staff assisted subjects in accessing the computerized reading conditions (Appendix D) and facilitating the subject turning on the text to speech feature. Support center staff collected the Scantrons at the end of each condition and gave the completed Scantrons to the primary investigator at the end of the data collection.

Limitations and Delimitations

It is recognized that given the small sample size, generalizing results to a broader population may not be appropriate. Additionally, the variables of IQ and achievement reported scores are a snapshot representation of that specific subject on that particular day; further, the reading comprehension task used in this study yields similar data that should be interpreted cautiously. Current research suggests that students with a reading disorder may manifest this secondary to an attention deficit (Wasserman, 2012). Because the current study is relying on third-party evaluations, the etiology or in some cases the origin of the reading disability (i.e., a language based disability or phonetic awareness deficits) as well as attentional influencers may not be adequately assessed, explained, or this researcher may be ignorant of extraneous neurological/biological variables.

While the same reader was initially deemed desirable for the research, on the day of data collection, Condition B with the reader began taking much longer than anticipated, subjects were waiting and it was decided to add two more readers to the condition to have subjects complete the tasks within the expected time frame of 90

minutes. Both these added readers had experience with being a reader for collegiate examinations and have been trained to keep student information confident as well complying with research protocol regarding clarification, rephrasing, etc.

Finally, the primary investigator, academic support center staff, and the readers for this project may be known to the subjects. This may have impacted subject performance in undetermined ways.

Ethical Considerations

The researcher has completed the National Institute for Health (NIH) certification for research involving human subjects. The researcher submitted a proposal to gain approval from the Institutional Review Board (IRB) before any research was conducted. By NIH and IRB guidelines, subjects had an Informed Consent document provided, explained, and read to them before obtaining their consent (see Appendix B). The Informed Consent detailed the possible risks or discomfort with the following language: The risks involved as a participant in this project are small. Also, participation in this study requires a minimal amount of your time and effort. The Informed Consent discussed possible benefits in the following way: It may be helpful for you to learn how to best accommodate your reading weakness. The researcher will share the outcomes and discuss them with you after the study has completed. Confidentially is explained to the subjects in the following manner: Subjects will be identified by an assigned number. Only the principal researcher will have access to this information. All information collected in this study is confidential. Researchers are required to keep your participation confidential and your participation in this project will not be disclosed to anyone other than the researcher. Additionally, the reader(s) for this research will keep all information

confidential. When this research is completed, the results will be presented in group format, and no names will be disclosed.

Additionally, subject-specific data was coded by the researcher, kept in a locked file with an electronic password protected file. No published information will reflect any identifiable individual subject characteristics.

Summary

Montali and Lewandowki (1996), Higgins and Raskind (1997), Hale et al. (2005), and Sorrell, Bell, and McCallum (2007) posit that the less-skilled the reader, the more benefit the student will receive in reading comprehension when presented in a multi-modality manner but caution that some students who are provided a reader or assistive technology do not benefit from it (Montali & Lewandowki, 1996; Higgins & Raskind, 1997; Hale et al., 2005; Sorrell, et al., 2007). A need exists to provide structure in appropriately accommodating students with reading disabilities in a post-secondary setting. This mixed methods quasi-experiential study intended to capture as much data as possible for a small sample to inform a complete understanding of each student and their subsequent reading comprehension performance.

CHAPTER IV: RESULTS

Introduction

The present study examined reading comprehension in three conditions using a quasi-experimental (ABC/BCA/CAB) alternating treatment design over a three-hour period in one day. The three conditions investigated subject reading to self (Condition A, baseline), using a person-reader (Condition B), and using text to speech technology (Condition C). Fourteen college students with independently diagnosed reading disabilities, participated in the study.

The purpose of this study was to inform best practices in determining appropriate and beneficial accommodations for students with reading disabilities in post-secondary educational settings; to determine the relationship among different accommodations and to read disability severity, and to elucidate if student preference for a specific accommodation positively impacts performance. The research examined both quantitative and qualitative aspects of accommodations and text comprehension utilizing subjects with independently diagnosed reading disabilities. The following research questions were answered:

1. How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks (reader, text to speech)?
2. What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?
3. How does student preference or experience impact accommodation efficacy?

Participants

The target population for this study was native English speakers, over the age of 18, with an independent psychological evaluation that denotes a reading disability, an

accommodation for text to speech or a reader, and/or a discrepancy between Verbal Comprehension Index (VCI) and passage comprehension or a similar subtest. Of the 14 subjects who completed the tasks, nine were male and five were female. The age range was 19-22 years old with a mean = 19.42. Table 7 depicts the breakdown of gender, age, and race.

Table 7. Student Demographics, N = 14

GENDER	**Number of Subjects**
Male	9 subjects
Female	5 subjects
AGE	**Range/Mean**
Range	18-22
Mean	19.42
RACE/ETHNICITY	**Number of Subjects**
African American	1 subject
Caucasian	9 subjects
Latino	1 subject
2 or more Races	1 subject
Not Disclosed	2 subjects

Summary of Analyses

Research question 1 states: **How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks?** A within subjects ANOVA indicated no statistically significant difference between comprehension tasks ($F(2,26) = 1.808$, $MSE = 3.016$, $p = .184$). While there are no statistically significant results, it is apparent that some students performed better in some conditions as compared with other conditions and subject specific task performance is discussed below in more detail. A Pearson correlation coefficient indicated a statistically significant result ($r(12) = .76$, $p = < .01$) for reader and text to speech conditions, demonstrating a trend in performance in those conditions. For example,

students who perform poorly in the reader condition also perform poorly in the text to speech condition and vice versa.

Research Question 2 states: **What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?** A Pearson correlation coefficient was calculated for the relationship between participants IQ indices, passage comprehension subtests, and each of the three conditions (read to self, using a reader, using text to speech). A statistically significant correlation was found ($r(13) = .665$, $p = .0130$) indicting a linear relationship between PRI and reading to self. Thus, the trend indicated that students with high PRI scores performed higher in the reading to self condition and vice versa. Further, a positive correlation was found ($r(13) = .726$, $p = .005$) indicting a significant linear relationship between the VCI and performance in the text to speech condition. That is, students with high VCI scores performed higher in the text to speech condition and vice versa.

Research Question 3 states: **How does student preference/experience impact accommodation efficacy?** Of 13 subjects who completed the three comprehension tasks and the survey, four accurately identified how they best comprehend text (preference); Two identified Reader (Condition B), one identified Self (Condition A) and one identified Text to Speech (Condition C). In terms of experience, subjects were almost evenly split with how they typically access text, with six subjects reporting they typically read to themselves and seven subjects reporting they typically use text to speech. This experience only appeared to augment performance for two subjects. Two of the subjects who reported they typically read to self preformed best in this condition. Individual

subject performance in combination with preference and experience is discussed in more detail below.

Research Questions and In-Depth Analyses

The following examines each research question in detail and discusses statistical tests, data, and outliers within the data.

Research Question 1.

Research question 1 states: How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks (reader, text to speech)? A comparison between groups is examined and relevant specific subject task performance is discussed.

In terms of overall performance, subjects experienced descending performance throughout the three conditions. They performed best in Read to Self (Condition A) mean = 5.0, next Using Reader (Condition B) mean = 4.14, and worst in Text to Speech (Condition C) mean = 3.78 (see Table 8).

Table 8. Group Reading Comprehension, N = 14

	Condition A Read to Self	**Condition B Person as Reader**	**Condition C Text to Speech**
Mean	5	4.14	3.78
Standard Deviation	2.11	2.85	2.29

Table 9 presents individual subjects' best performance in each of the conditions but does not include conditions in which three subjects obtained equal performance in two or more conditions.

Table 9. Number of Subjects Who Performed Best in Each Condition, N = 11

Condition A: Read to Self	6
Condition B: Person as Reader	4

Condition C: Text to Speech	1

Specific information regarding the three subjects who are not included in Table 9 are indicated. Subject 5 performed equally well in Using Reader (Condition B) and Text to Speech (Condition C) with 8/10 comprehension questions correct. Subjects 6 and 11 are not included in the above table because they also produced equal performances in two conditions. Table 10 depicts this information.

Table 10. One or More Equal Performances, N =3

	Condition A Read to Self	**Condition B Person as Reader**	**Condition C Text to Speech**
Subject 5	**8**	**8**	**8**
Subject 6	**4**	**4**	**2**
Subject 11	**4**	**2**	**4**

Below Figures 1-3 depict overall subject performance in each of the conditions and Figure 4 depicts subject performance in all three conditions.

Figure 1 with a mean of 5.0 and a standard deviation of 2.11 is reflective of the variable subject performance in the baseline measure, Read to Self (Condition A).

Figure 1. Read to Self, Condition A, N = 14

Figure 2 with a mean of 4.14 and the standard deviation of 2.85 is reflective of the variable subject performance in Using Reader (Condition B).

Figure 2. Person Reads to Subject, Condition B, N = 14

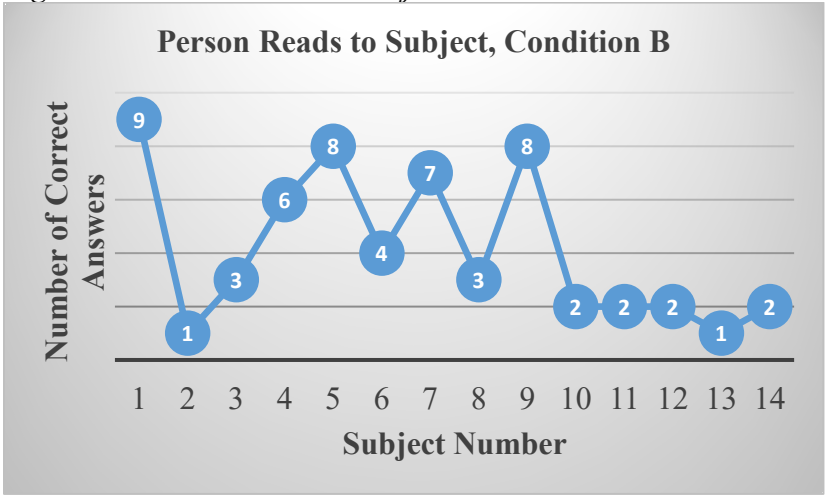


Figure 3 with a mean of 3.78 and the standard deviation of 2.29 is reflective of the variable subject performance in Text to Speech, Condition C.

Figure 3. Text to Speech, Condition C, N =14

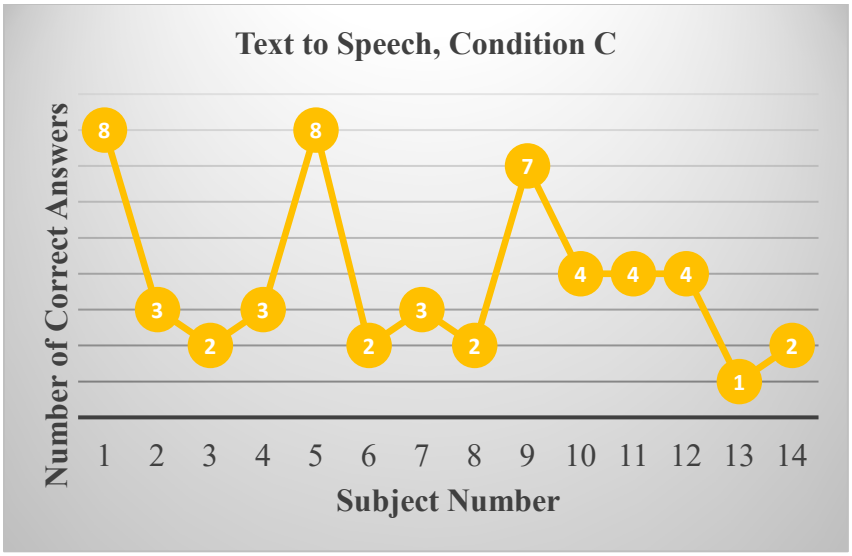


Figure 4 depicts individual subject performance in each of the conditions with corresponding colors.

Figure 4. All Conditions, N = 14

A Person correlation coefficient was calculated for the relationship between subjects' number of comprehension questions correct in each of the conditions: Condition A: Read to Self, Condition B: Using Reader, and Condition C: Using Text to Speech. A positive correlation was found ($r(12) = .746$, $p < .01$) indicating a significant relationship

between Reader (Condition B) and Text to Speech (Condition C). Subjects performed similarly while using a reader and using text to speech see Table 11.

Table 11. Pearson Correlation Coefficient for Number of Correct Answers in Three Conditions

Condition	Pearson Correlation Coefficient	Condition A: Read to Self	Condition B: Reader	Condition C: Text to Speech
Condition A: Read to Self	Pearson Correlation	1	.409	.302
	Sig (2-tailed)		.147	.294
	N	14	14	14
Condition B: Reader	Pearson Correlation	.409	1	.746**
	Sig (2-tailed)	.147		.002
	N	14	14	14
Condition C: Text to Speech	Pearson Correlation	.302	.746**	1
	Sig (2-tailed)	.294	.002	
	N	14	14	14

** Correlation is significant at the 0.01 level (2-tailed).

While the correlation is highly significant, specific individual performances for two subjects indicated very disparate performances. Subjects 4 and 7 did not demonstrate a commensurate relationship between accommodations and appeared to perform substantially better in one of the two conditions (Figures 5 and 6).

Figure 5. Subject 4 Disparate Performance

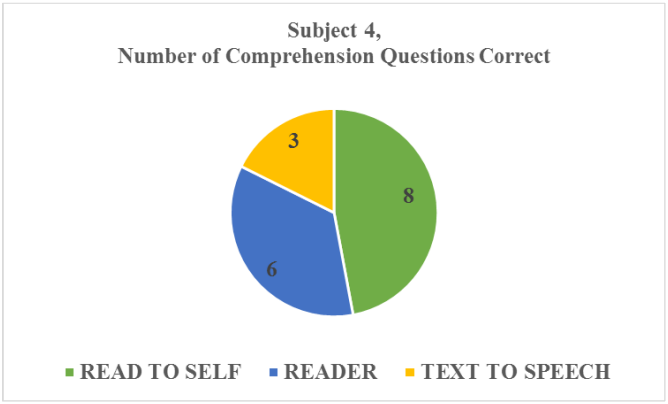
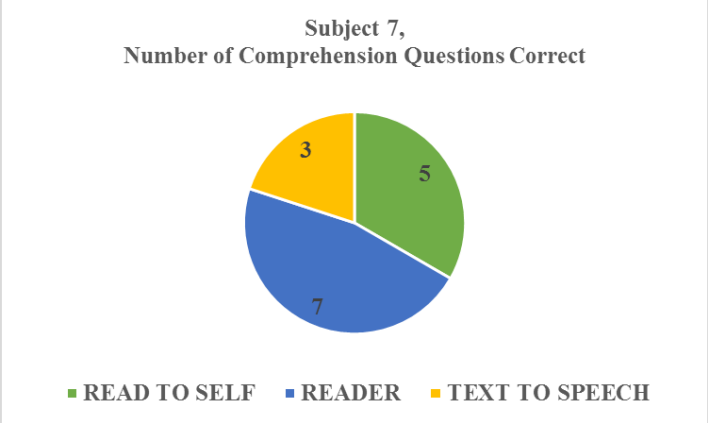


Figure 6. Subject 7 Disparate Performance



Research question one states: How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks? In terms of overall results of these subjects with a reading disability and performance in each of the conditions, there were no statistically significant results with reading comprehension and performance in any of the three conditions. Moreover, student success or failure in using a reader and text to speech were statistically significantly correlated. Further, in examining each subject's individual performance in the three conditions, it is apparent that some students performed better in some conditions as compared with other conditions. Subjects 8, 9, and 14 demonstrated the most variable performances in each condition. Table 12 contains those subject specific results.

Table 12. Variable Performances, N =3

SUBJECT	READ TO SELF Condition A	READER Condition B	TEXT TO SPEECH Condition C
8	6 correct	3 correct	2 correct
9	4 correct	8 correct	7 correct
14	7 correct	1 correct	1 correct

Research Question Two.

Research Question 2 states: What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension? Of the

14 subjects that completed the study, 13 reported all four WAIS Indices and 10 reported the subtest of Passage Comprehension (see Table 13).

Table 13. Subject IQ, Passage Comprehension, and Number of Comprehension Questions Correct in the Baseline (Read to Self) and Accommodated (Reader, Text to Speech) Conditions, N = 14

SUBJECT	VCI	PRI	WMI	PSI	PASS COMP	READ TO SELF	READER	TEXT TO SPEECH
1					103	7	9	8
2	91	96	77	74	63	4	1	3
3	93	73	92	79	81	1	3	2
4	95	105	83	71	98	8	6	3
5	120	107	83	62	89	8	8	8
6	81	90	83	65		4	4	2
7	87	73	77	89	79	5	7	3
8	76	75	95	81		6	3	2
9	110	86	86	69	93	4	8	7
10	96	73	97	70	85	2	2	4
11	78	82	86	84		4	2	4
12	Subject 12 disqualified himself by not completing all of the reading conditions.							
13	108	92	89	89	101	6	2	4
14	98	86	92	89	96	7	1	1
15	80	69	71	94	74	4	2	2

A Person correlation coefficient was calculated for the relationship between the four WAIS Indices of Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), and Processing Speed Index (PSI), the passage comprehension score, and the number of correctly answered questions in each condition (read to self, using a reader, using text to speech). A positive correlation was found ($r(13) = .665$, $p < 0.05$) indicting a significant linear relationship between the PRI and reading to self. Students with high PRI scores performed better in the reading to self condition and vice versa. Further a positive correlation was found ($r(13) = .726$, $p < 0.01$) indicting a significant linear relationship between the VCI and performance in the

text to speech condition. That is, students with high VCI scores performed better in the text to speech condition and vice versa. Table 14 depicts the Pearson correlation coefficient.

Table 14. Correlations of 4 IQ Indices (VCI, PRI, WMI, PSI), Passage Comprehension Subtest, and Number of Correctly Answered Questions in Each Condition, N =14

Correlations											
		Condition A: Read to Self	Condition B: Reader	Condition C: Text to Speech	PASS COMP	WORD ATTACK	LETTER WORD	VCI	PRI	WMI	PSI
Condition A: Read to Self	Pearson Correlation	1	.409	.302	.562	.353	.001	.329	.665*	-.130	-.033
	Sig (2-tailed)		.147	.294	.072	.437	.998	.273	.013	.672	.915
	N	14	14	14	11	7	11	13	13	13	13
Condition B: Reader	Pearson Correlation	.409	1	.746**	.412	.154	-.101	.460	.336	-.215	-.481
	Sig (2-Tailed)	.147		.002	.208	.741	.769	.114	.262	.482	.096
	N	14	14	14	11	7	11	13	13	13	13
Condition C: Text to Speech	Pearson Correlation	.302	.746**	1	.397	.533	-.204	.726**	.488	-.037	-.541
	Sig (2-tailed)	.294	.002		.227	.218	.547	.005	.125	.905	.056
	N	14	14	14	11	7	11	13	13	13	13
PASS COMP	Pearson Correlation	.562	.412	.397	1	.754	.493	.588	.352	.539	-.080
	Sig (2-Tailed)	.072	.208	.227		.050	.123	.074	.318	.108	.827
	N	11	11	11	11	7	11	10	10	10	10
WORD ATTACK	Pearson Correlation	.353	.154	.533	.754	1	.745	.565	.250	.786	-.117
	Sig (2-Tailed)	.437	.74	.218	.050		.054	.242	.633	.064	.825
	N	7	7	7	7	7	7	6	6	6	6
LETTER WORD	Pearson Correlation	.001	-.101	-.204	.493	.745	1	-.135	-.158	.591	.036
	Sig (2-Tailed)	.998	.769	.547	.123	.054		.710	.663	.072	.921
	N	11	11	11	11	7	11	10	10	10	10
VCI	Pearson Correlation	.329	.460	.726**	.588	.565	-.135	1	.567*	.142	-.392
	Sig (2-Tailed)	.273	.114	.005	.074	.242	.710		.044	.644	.185
	N	13	13	13	10	6	10	13	13	13	13
PRI	Pearson Correlation	.665*	.336	.448	.352	.250	-.158	.567*	1	-.138	-.560*
	Sig (2-Tailed)	.013	.262	.125	.318	.633	.663	.044		.652	.047
	N	13	13	13	10	6	10	13	13	13	13
WMI	Pearson Correlation	-.130	-.215	-.037	.539	.786	.591	.142	-.138	1	-.158
	Sig (2-Tailed)	.672	.482	.905	.108	.064	.072	.644	.652		.606
	N	13	13	13	10	6	10	13	13	13	13
PSI	Pearson Correlation	-.033	-.481	-.541	-.080	-.117	.036	-.392	-.560*	-.158	1
	Sig (2-Tailed)	.915	.096	.056	.827	.825	.921	.185	.047	.606	
	N	13	13	13	10	6	10	13	13	13	13

*Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Research Question Three.

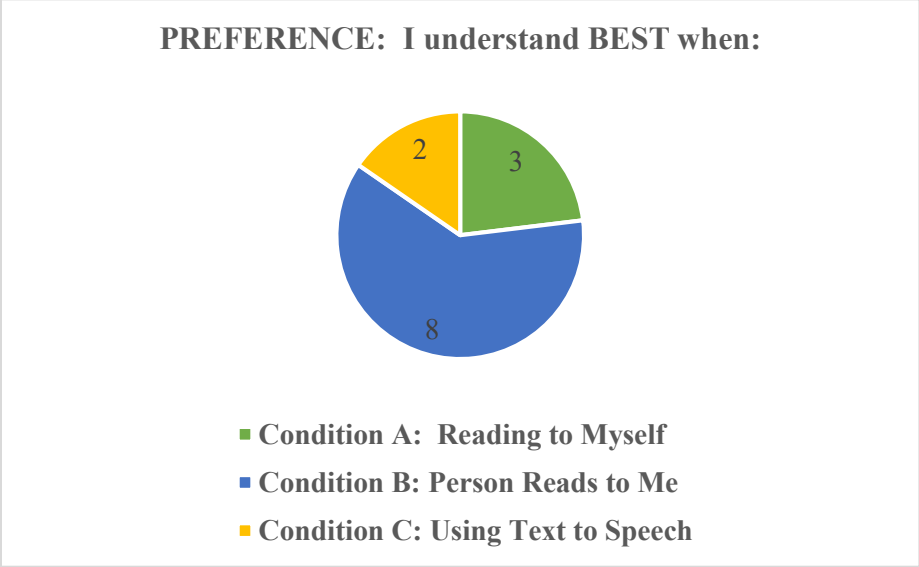
Research Question 3 states: How does student preference/experience impact accommodation efficacy? Higgins and Raskind's 1997 study appeared to indicate that students with mild reading disorders using text to speech experienced "technology interference" (p. 75). Because students have had more exposure to this technology than the 1997 subjects, a survey component was added to ask students how they typically access text (experience) and in which conditions they believe they comprehend text best (preference). On the day of the reading comprehension tasks, subjects were asked to complete a survey regarding their experience typically accessing text and their preference for accessing text prior to engaging in the SAT reading comprehension tasks. Experience refers to the response given by subjects in the survey which queries how they typically access text (reading to self, using a reader, or using text to speech). Preference refers to the response given by subjects in the survey which queries how they best comprehend text (reading to self, using a reader, or using text to speech). The researcher read each question to the subject and then assisted, if needed, the subject circling their reply. Although 14 subjects completed the reading comprehension task, one subject did not complete the survey. Table 15 below demonstrates the structure of the potential survey answers.

Table 15. Potential Answers to Pre-Task Survey, N = 13

PREFERENCE
I understand best READING MATERIAL TO MYSELF.
I understand best HAVING A PERSON READ TEXT TO ME.
I understand best using TEXT TO SPEECH SOFTWARE.
EXPERIENCE
I usually READ TO MYSELF.
I usually use a PERSON TO READ TO ME.
I usually use TEXT TO SPEECH TO READ TO ME.

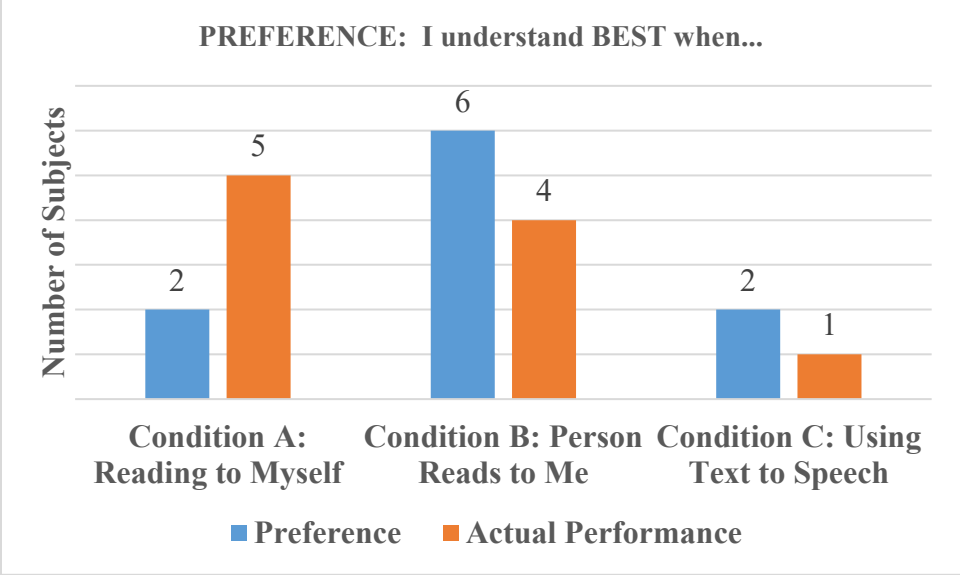
Subject Preference. Figure 5 demonstrates subject preference with Reading to Self (Condition A), Using a Reader (Condition B), and Text to Speech (Condition C).

Figure 7. Subject Preference for Comprehending Text, N = 13



In all, 4 of 13 subjects accurately identified how they best comprehend textual information, as seen in Figure 6 below which indicates the subject preference for textual information as well as in which condition the subject actually performed best.

Figure 8. Subject Preference Compared with Actual Performance, N = 10



Four subjects are not represented on Figure 6 for one of the following reasons: Did not complete survey or scored the same in 2 or more conditions (See Table 18).

Table 18. Rationale for Subjects Excluded from Figure 6, N = 4

SUBJECT	PREFERENCE	ACTUAL PERFORMANCE
4	Did not complete survey	
5	Read to Self (Condition A)	Score the same in all conditions. 8 questions correct.
6	Reader (Condition B)	Scored the same Read to Self (Condition A) and using a Reader (Condition B). 4 questions correct.
11	Reader (Condition B)	Scored the same Read to Self (Condition A) and Text to Speech (Condition C). 4 questions correct

Subjects 8 and 14 significantly misidentified how they best access text. Both subjects reported understanding text best with a reader but actually preformed best when reading to self (Figures 7 and 8).

Figure 9. Subject 8 Reports Comprehending Best with a Reader

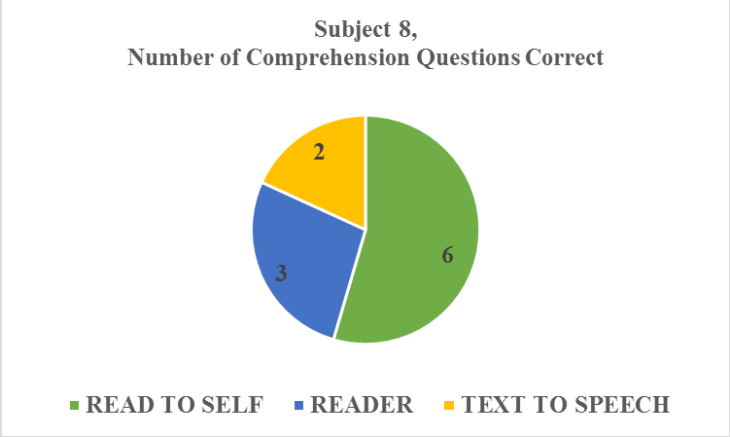
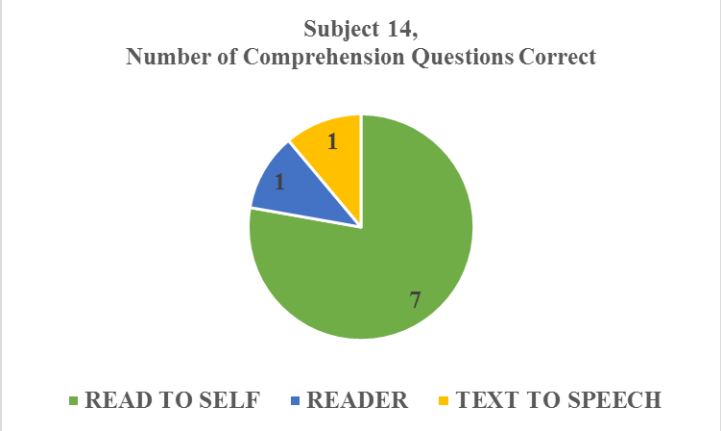


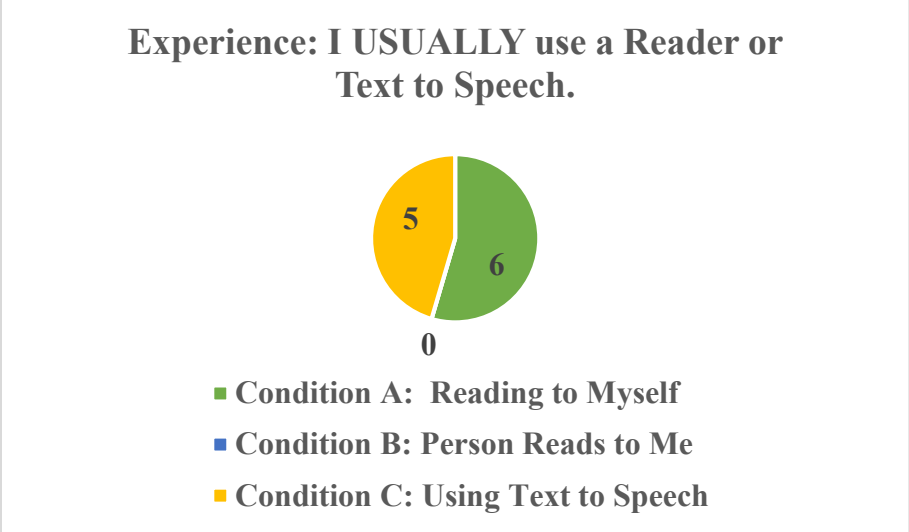
Figure 10. Subject 14 Reports Comprehending Best with a Reader



Generally, subjects in this study were not able to accurately predict in which condition they best comprehend text.

Subject Experience. The experience portion of the survey was intended to make a determination as to how novel using a reader or text to speech was for the subjects, which could impact task results. Additionally, the study was designed to assess Higgins and Raskind's (1997) "technology interference" (p. 75) in terms of the novelty of text to speech usage. The subjects were almost evenly split in their responses in terms how they typically access text material, as depicted in Figure 7.

Figure 11. Subject Survey Response of How Text is Typically Accessed, N = 11



Subjects 4, 5, 6, and 11 are not included in this data because they either did not complete the survey or performed equally well in 2 or more conditions as discussed in the Subject Preference section above and depicted in Table 18. It is important to note that, although five students typically access textual information by reading to themselves, only one reported that this was the "best way" for him to comprehend information. Further, when completing the survey with the subjects, many spontaneously reported they would prefer to use others to read to them but that it was unavailable resource.

Two of the 11 subjects reported that they typically access text by reading to themselves and recorded their best performance in that condition. Subject 15 (Figure 8) reported that she typically accesses text by reading to herself and recorded four correct comprehension responses in that condition; she scored two correct in using a reader and using text to speech. Subject 13 (Figure 9) reported that he typically accesses text by reading to himself and recorded six correct comprehension responses in that condition; he scored two correct in using a reader and four correct using text to speech.

Figure 12. Subject 13 Performance

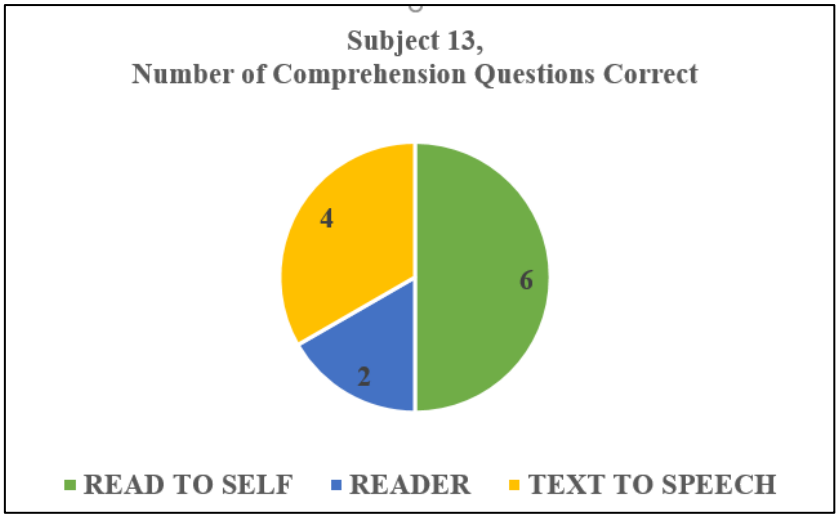
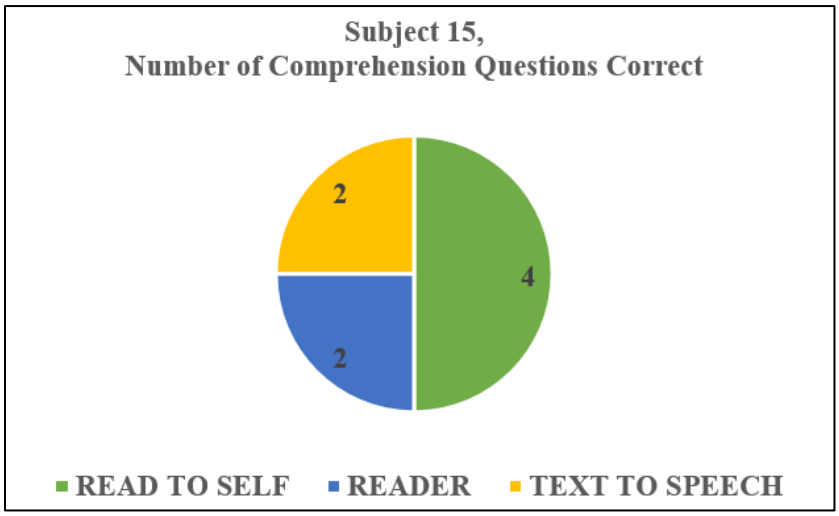


Figure 13. Subject 15 Performance



Hence, for most of the subjects, it appears that the frequency or typicality with which they report accessing text did not associate with their best performance.

Research Question 3 states: How does student preference/experience impact accommodation efficacy? The majority of subjects appeared to hold a preference or belief about how they best comprehended material that was incorrect. Although the subjects were almost split on typically accessing text by reading to self or using assistive

technology, there appeared to be no trend with regard to actual performance on this reading comprehension task.

Summary of Results

Statistically insignificant results were found for Research Question 1. Different accommodations (reader, text to speech) did not influence college students with reading disabilities performance on reading comprehension tasks and there was no difference in performance among the tasks.

Statistically significant results were found for Research Questions 1 and 2. Performance in reader and text to speech conditions were found to be highly correlated. Hence, students who did well in one accommodated setting did well in the other; however, students who did not benefit from the reader tended to not benefit with text to speech. Two subjects presented as significant outliers to this correlation. Research Question 2 investigated the relationship between task performance, IQ, and Achievement scores and found statistically significant correlations for Verbal Comprehension Index and the text to speech condition (Condition C) and for Perceptual Reasoning Index and subjects reading to themselves (Condition A). Hence, students who had lower Verbal Comprehension Indices tended to preform lower in the Using Reader condition. Students who had lower Perceptional Reasoning Indices tended to perform lower reading to themselves.

Descriptive statistics were reported for Research Question 3 and indicated that students were not particularly adept at determining how best to accommodate their reading disability and that their experience or usual way of accommodating their disability did not appear influence comprehension performance. Further, significant variability was evident among individual subjects.

Summary

Montali and Lewandowki (1996), Higgins and Raskind (1997), Hale et al. (2005), and Sorrell, Bell, and McCallum (2007) posit that the less-skilled the reader, the more benefit the student will receive in reading comprehension when presented in a multi-modality manner but caution that some students who are provided a reader or assistive technology do not benefit from it (Montali & Lewandowki, 1996; Higgins & Raskind, 1997; Hale et al., 2005; Sorrell, et al., 2007). A need exists to provide structure in appropriately accommodating students with reading disabilities in a post-secondary setting.

CHAPTER V: CONCLUSION

This section includes an overview of current research, the current investigation, and a summary of results. The summary of results examines statistical significance and a discussion of these. Lastly, implications for practice and recommendations for future research is discussed.

Introduction

College students with learning disabilities are attending post-secondary institutions at record rates with most schools reporting 10% of their student population receiving accommodation services (Lindstrom, 2007; Samson, 2011; Holmes & Silvestri, 2012). Elementary, secondary, and post-secondary institutions typically provide institution-specific rather than student-specific accommodations (Lai & Berkeley, 2012). For example, if an institution has iPads, students use the text to speech software that is available on the iPad. Most K-12 public schools have shifted to exclusively providing a reading comprehension accommodation through assistive technology because it outweighs the burden of a tutor/reader (Lai & Berkeley, 2012). However, very little research has been conducted to examine the effects of assistive technology accommodations on reading comprehension (Raskind & Higgins, 1998; Thurlow, 2005; Lindstrom, 2007; Lai & Berkeley, 2012) and, of research conducted, there appears to be significant discrepancy of what accommodations are provided for specific diagnoses (Lai & Berkeley, 2012) and how much these accommodations benefit the student (Lai & Berkeley, 2012). Hence, students are regularly provided accommodations that are not beneficial to them (Lindstrom, 2007; Lai & Berkeley, 2012). Thus, a need exists to

provide some structure in appropriately accommodating students with reading disabilities in a post-secondary setting.

This study examined reading comprehension in three conditions using a quasi-experimental (ABC/BCA/CAB) alternating treatment design over a three-hour period in one day. The three conditions investigated subject reading to self (Condition A, baseline), using a person-reader (Condition B), and using text to speech technology (Condition C). Fourteen college students with independently diagnosed reading disabilities, participated in the study investigating the following research questions:

1. How do different accommodations (reader, text to speech) influence college students with reading disabilities performance on reading comprehension tasks?
2. What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?
3. How does student preference or experience impact accommodation efficacy?

Summary of Results

Results for Research Question 1, regarding different accommodations (reader, text to speech) influencing reading comprehension performance indicated no statically significant difference among comprehension tasks ($F(2,26) = 1.808$, $MSE = 3.016$, $p = .184$) using a within subjects ANOVA. However, a Pearson correlation coefficient indicated a statistically significant result ($r(12) = .76$, $p = < .01$) for reader and text to speech conditions. Hence, there was a trend in performance in the two accommodated conditions.

Results for Research Question 2, regarding the relationship between the IQ and achievement measures and reading comprehension indicated a statistically significant

Pearson correlation coefficient ($r(13) = .726$, $p < 0.01$) for the IQ measure of Verbal Comprehension Index (VCI) and subject performance in the text to speech condition. A Pearson correlation coefficient was also statistically significant ($r(13) = .665$, $p < 0.05$) for Perceptual Reasoning Index (PRI) and reading to self.

Results for Research Question 3 regarding the impact of preference and experience indicated that students were not particularly adept at determining how best to accommodate their reading disability and that their experience or usual way of accommodating their disability did not appear to positively or negatively influence reading comprehension. Further, significant performance variability was evident among individual subjects.

Discussion

Research question one states: **How do different accommodations influence college students with reading disabilities performance on reading comprehension tasks?** Research question one focused on the different accommodations of using a reader versus using text to speech accommodations on text comprehension. While no statistically significant ANOVA result was found for comprehension performance differences, the small sample size (N = 14) with the standard deviation (reader, $sd = 2.85$ and text to speech, $sd = 2.29$) may have muted effects for some subjects. In examining each subject's performance in the three conditions, while there are no statistically significant results, it is apparent through individual subject performance, that some subjects performed better in a specific condition. In looking at subjects individually, subjects four and seven had very disparate performances in using a reader versus using text to speech. Subject Four correctly answered six comprehension questions with a

reader but only three correctly using text to speech. Subject Seven correctly answered seven comprehension questions with a reader but only three correctly using text to speech. Thus, at least, for these two subjects using a reader and using text to speech were not commensurate accommodations. Hence, the need for additional quasi-experimental or experimental research is needed with a much larger sample size to draw generalizable conclusions.

Moreover, a statistically significant correlational result for reader and text to speech conditions indicated a performance trend in both of these conditions. That is, students who perform poorly in the reader condition also perform poorly in the text to speech condition and vice versa. Hence, this evidence suggests that using a reader or text speech technology share common accommodating traits. However, the fact that the trend highly correlated indicates that accommodating some students with reading disabilities with a reader or text to speech technology may not be beneficial.

It appears that making recommendations as to whether a student should read independently, have a reader, or use text to speech technology is an accommodation/strategy that has very different results for different types of students. In taking a prudent approach, it is suggested that before accommodating or making accommodation recommendations to students, that a single subject design is conducted to discern what works best for the particular student.

Research Question 2 states: **What is the relationship between the IQ and achievement measures and specific accommodations on reading comprehension?** Of the 14 subjects that completed the study, 13 reported all four WAIS Indices and 10 reported the subtest of Passage Comprehension. The four WAIS Indices of Verbal

Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), and Processing Speed Index (PSI), the passage comprehension score, and the number of correctly answered questions in each condition (read to self, using a reader, using text to speech) was calculated using a Pearson correlation coefficient. Further a positive correlation was (p = .005) indicting a significant linear relationship between the VCI and performance in the text to speech condition. That is students with high VCI scores performed higher in the text to speech condition and vice versa. This is an expected result as VCI is considered to measure the foundations of language and literacy (Nugent, 2013). Although it is unusual that text to speech was the only condition that correlated with this performance particularly, given that Using Reader and Text to Speech conditions correlated (p = .044) with one another. Hence, a demonstrated trend in performance in those conditions where students who perform poorly in the reader condition also perform poorly in the text to speech condition and vice versa calling into question the efficacy of either accommodation with this particular group of subjects.

A positive correlation was found (p = .013) indicating a significant linear relationship between PRI and Read to Self. Students with high PRI scores performed higher in the reading to self condition and vice versa. This is an unexpected finding that suggests that rather than a reading comprehension task, the task required additional cognitive functions that are not typically associated with reading comprehension. The Perceptual Reasoning Index is typically conceptualized as "nonverbal fluid reasoning, spatial processing, and visual perception" (IAC Publishing, 2018). It could be argued that the subject's ability to go and back and forth between the comprehension questions and relevant text became the construct of focus rather than reading comprehension.

This finding is particularly concerning and needs further research quasi-experimental or experimental research with a much larger sample size to draw generalizable conclusions. In taking a prudent approach, it would make sense for test constructors to include this as an area of concern when designing comprehension tasks and for teachers and students to be aware strength or weakness in this area so that it can be directly addressed.

Research Question 3 states: **How does student preference/experience impact accommodation efficacy?** Research question three examined how well students could predict (Preference) how they best comprehended text and how they typically access text (Experience). Of the 13 subjects that completed the reading task and the survey, only four were able to accurately predict how they comprehend best: Reading to self, using a reader or using text to speech. Subjects eight and 14 both reported they comprehend best when having a reader but, in fact, did not. Subject eight correctly answered six questions while reading to herself and only three when using a reader; Subject 14 correctly answered seven questions while reading to himself and only one when using a reader. This demonstrates a disconcerting theme of poor readers not explicitly knowing what works best for them; students must be taught and correctly identify what strategies or accommodations work best for them in various academic tasks (Garner, 1987; 1990). Although the subjects were about evenly split (Read to Self = 7; Text to Speech = 6) on their typically accessing of text, experience with the modality did not appear to augment individual performance on the reading comprehension task. Hence, it appears, for these subjects, that practice (Experience) did not enhance performance. This aligns with empirical evidence that students with reading disabilities display “growth to plateau” in

which intervention and practice no longer mitigate the disability (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996).

Hence, the need for additional quasi-experimental or experimental research is suggested with a much larger sample size to draw generalizable conclusions. In taking a prudent approach, it is suggested that before accommodating or making accommodation recommendations to students, that a single subject design is conducted to discern what works best for the particular student.

Implications for Practice

The author recommends single subject designs as a part of all psychoeducational evaluations to determine what works best for the particular student being evaluated. Additionally, teachers can implement this as action research in the classroom to discern what works best for specific students. When this information between psychologists, teachers, and researchers is shared, a more predictable pattern of what works and what doesn't work for students will emerge. Providing the same accommodation for all reading disabilities negates the research of the varied reasons students' experience difficulty with reading (Lindstrom, 2007; (Lai & Berkeley, 2012; Wasserman, 2012).

Recommendations for Future Research

The preceding research sought to substantiate findings of other studies (Higgins & Raskind, 1997) and to illuminate appropriate accommodations for college students with reading disabilities. Through this endeavor, findings have indicated the need for much larger experimental or quasi-experimental research in this field and to very specifically tailor accommodations to specific students rather than to labels or diagnoses.

Summary

The results of this research demonstrated that some students who are provided a reader or assistive technology do not benefit from it (Montali & Lewandowki, 1996; Higgins & Raskind, 1997; Hale et al., 2005; Sorrell et al., 2007). A need exists to provide structure in appropriately accommodating students with reading disabilities in a post-secondary setting. Given that at least 10% of the population has a reading disability (Samson, 2011; IES: NCES, 2016), it seems particularly grievous that answers to these questions have not already been given. While having a reading disability negatively impacts wealth and self-esteem (Cortiella & Horowitz, 2014). Educators, psychologists, and researchers must do better. We have a responsibility to provide cogent evidence and arguments to validate our work. This under-researched population of students with reading disabilities deserves empirical research, to definitively know what accommodations are efficacious, and what will work for them as individuals.

References

Adlof, S.M., Catts, H.W., & Little, T. (2006). Should the simple view of reading include a fluency component? *Reading and Writing: An Interdisciplinary Journal*, 19, 933-958.

Alper, S. R. (2006). Assistive Technology for Individuals with Disabilities: A Review and Synthesis of the Literature. *Journal of Special Education Technology*, 47-64.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for Educational Psychological Testing.* Washington, D.C.: American Educational Research Association.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.* Arlington, VA: Amiercan Psychiatric Association.

Barlow, D., & Hayes, S. (1979). Alternating treatments design: one strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis*, 199-210.

Breznitz, Z. (1987). Increasing first graders' reading accuracy and comprehension by accelerating their reading rates. *Journal of Educational Psychology*, 79, 236-242.

Brown, J. I., Fishco, V. V., & Hanna, G. S. (2017). *Hartcourt Mifflin Hartcourt*. Retrieved from Nelson-Denny Reading Test: http://www.hmhco.com

Cain, K. & Oakhill, J.V. (1999). Inference making and its relation to comprehension failure. *Reading and Writing*, 11 , 489-503.

Cain, K., Oakhill, J., & Bryant, P.E. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills.

Journal of Educational Psychology , 96, 31-42.

Cain, K., Oakhill, J., & Lemmon, K., (2005). The relation between children's reading comprehension level and their comprehension of idioms. *Journal of Experimental Child* P*sychology*, 90, 65-87.

Cavalier, A. R., Ferretti, R. P., & Okolo, C. M. (1994). Technology and individual differences. Journal of Special Education Technology, 12, 175-181.

European Agency for Special Needs and Inclusive Education. (n.d.). *Sweden - Special Needs Education with the Educational System*. Retrieved from European Agency for Special Needs and Inclusive Education: http://www.european-agency.org

Fuchs, L. S. and Fuchs, D. (2001), Principles for the Prevention and Intervention of Mathematics Difficulties. *Learning Disabilities Research & Practice*, 16: 85–95. doi:10.1111/0938-8982.00010

Garner, R. (1987). *Metacognition and Reading Comprehension.* Norwood, NJ: Academic.

Garner, R. (1990). When Children and Adults Do Not Use Learning Strategies: Toward a Theory of Settings. *Review of Educational Research*, 517-529.

Gasparini, A. A., & Culen, A. L. (2012). Tablet PC's-an Assistive Technology for Students with Reading Difficulties? *Advances in Computer Human Interaction.* Oslo.

Government Publishing Office. (n.d.). *Title 2---Education*. Retrieved from Government Publishing Office: http://gpo.gov

Gough, P.B., Hoover, W.A., & Peterson, C.L. (1996). Some observations on a simple view of reading. In C.Cornoldi & J. Oakhill (Eds.), Reading comprehension difficulties (pp. 1-13).

Gough, P.B., Tunmer, W.E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education,* 6-10.

Hale, A., Skinner, C. H., Winn, B. D., Oliver, R., Allin, J. D., & Molloy, C. C. (2005). An Investigation of Listening and Listening-While-Reading Accommodations on Reading Comprehension Levels and Rates in Students with Emotional Disorders. *Psychology in the Schools*, 39-51.

Higgins, E., & Raskind, M. H. (1997). The Compensatory Effectiveness of Optical Character Recognition/Speech Synthesis on Reading Comprehension of Postsecondary Students with Learning Disabilities. *Journal of Learning Disabilities*, 75-87.

Holmes, A., & Silvestri, R. (2012). Assistive Technology Use by Students with LD in Postsecondary Education: A Case of Application Before Investigation? *Canadian Journal of School Psychology*, 81-97.

IES: NCES. (2015). *Program for International Student Assessment (PISA)*. Retrieved from IES: NCES (National Center for Education Statistics): http://www.nces.ed.gov

IES: NCES. (2016). *National Center for Education Statistics*. Retrieved from IES: NCES: https://nced.ed.gov

LaBerge, D., Samuels, S.J. (1974). Toward a Theory of Automatic Information Processing in Reading. *Cognitive Psychology*, 293-323.

Lai, S. Berkeley, S. (2012). High-Stakes Test Accommodations: Research and Practice. *Learning Disability Quarterly*, 158-169.

Lesgold, A.M., & Resnick, L. (1982). How reading difficulties develop: perspectives

from a longitudinal study. In J. Das, R. Mulcahy, & A. Wall (Eds.) Theory and research in learning disabilities (pp.155-187). New York: Plenum Press.

Lindstrom, J. (2007). Determining Appropriate Accommodations for Postsecondary Students with Reading and Written Expression Disorders. *Learning Disabilities Research and Practice*, 229-236.

Lovett, B. J. (2010). Extended Time Testing Accommodations for Students with Disabilities: Answers to Five Fundamental Questions. *Review of Educational Research*, 611-638.

Lynn University. (2017). *Institute for Achievement and Learning*. Retrieved from Lynn University: http://www.lynn.edu

Lynn University. (2017). *Lynn Facts*. Retrieved from Lynn University: http://www.lynn.edu

MacArthur, C. A., & Cavalier, A. R. (2004). Dictation and Speech Recognition Technology as Test Accommodations. *Exceptional Children*, 43-58.

McNamara, D., & Kendeou, P. (2011). Translating Advances in Reading Comprehension Research to Education Practice. *International Electronic Journal of Elementary Education*, 33-46.

Montali, J., & Lewandowski, L. (Journal of Learning Disabilities). 1996. *Bimodal reading: Benefits of a Talking Computer for Average and Less Skills Readers*, 271-291.

Mittler, J. (2007). Assistive technology and IDEA. In C. Warger (Ed.), Technology integration: Providing access to the curriculum for students with disabilities. Arlington, VA: Technology and Media Division (TAM).

Nation, K. (2005). Children's reading comprehension difficulties. In M.J. Snowling & C. Hulme (Eds.), The science of reading: A handbook (pp 248-265). Oxford, UK: Blackwell Publishing.

National Center for Educational Outcomes. (2016). *Accommodations for Students with Disabilities*. Retrieved from NCEO: https://nceo.info/

Nugent, P. (2013, April 29). *Verbal Comprehension Index*. Retrieved from Psychology Dictionary: http://www.psychologydictionary.org

Ouimet, T., & Balaban, E. (2009). Auditory Stream Biasing in Children with Reading Impairments. *Dyslexia*, 45-65.

Parette, H., Peterson-Karlan, G. R., Smith, S., Gray, T., & Silver-Pacuilla. (2006). The State of Assistive Technology: Themes From an Outcomes Summit. *Assistive Technology Outcomes and Benefits*, 15-33.

Raskind, M. H., & Higgins, E. L. (1998). Assistive Technology for Postsecondary Students with Learning Disabilities: An Overview. *Journal of Learning Disabilities*, 27-40.

Resnick, L.B. (1982). Syntax and Semantics in Learning to Subtract. Learning Research and Development Center. University of Pittsburg, Hillsdale, New Jersey.

Samson, S. (2011). Best practices for serving students with disabilities. *Reference Services Review*, 260-277.

Schmitt, A., Hale, A. D., McCallum, E., & Mauck, B. (2011). Accommodating Remedial Readers in the General Education Setting: Is Listening-While-Reading sufficient to Improve Factual and Inferential Comprehension? *Psychology in the Schools*, 37-45.

Sorrell, C. A., Bell, S. M., & McCallum, R. S. (2007). Reading Rate and Comprehension as a Function of Compututerized Versus Traditional Presentation Mode: A Preliminary Study. *Journal of Special Education Technology*, 1-12.

Spooner, A., Baddeley, A.D., & Gathercole, S.E. (2004). Can reading accuracy and comprehension be separated in the Neale Analysis of reading ability? *British Journal of Educational Psychology*, 74,187-204.

Stothard, S.E. & Hulme, C. (1992). Reading comprehension difficulties in children: The role of language comprehension and working memory skills. *Reading and Writing,* 4, 245-256.

Stodden, R. A., Conway, M. A., & Chang, K. B. (2003). Findings from the Study of Transition, Technology and Postsecondary Supports for youth with Disabilities: Implications for Secondary School Educators. *Journal of Special Education Technology*, 29-44.

The College Board. (2017). *Validity Studies*. Retrieved from College Board: https://research.collegeboard

The College Board. (2008, October 17). Validity of the SAT for Predicting First-Year College Grade Point Average. Retrieved from http://www.research.collegeboard.org

Thompson, S. Blount, A., Thurlow, M. (2002). *A summary of research and the effects of test accommodations: 1991 through 2001* (Technical Report 34). Minneapolis, MA: University of Minnesota, National Center on Educational Outcomes. Retrieved October 18, 2016 from http://education.umn.edu.

Thurlow, M. L. (2005). State Policies on Assessment Participation and Accommodations for Students with Disabilities. *The Journal of Special Education*, 232-240.

Thurlow, M.L. Lazarus, S.S., Thompson, S.J., Morse, A.B. (2005). State Policies on Assessment Participation and Accommodations for Students with Disabilities. *The Journal of Special Education*, 232-240.

U.S. Department of Education. (2004). *Building the Legacy: IDEA 2004*. Retrieved from U.S. Department of Education: http://www.idea.ed.gov

U.S. Department of Education. (2007, March 3). *A Guide to the Individualized Education Program*. Retrieved from U.S. Department of Education: http://www2.ed.gov

U.S. Department of Education. (n.d.). *Building the Legacy: IDEA 2004*. Retrieved from U.S. Department of Education: http:www.ed.gov

U.S. Department of Justice. (2009, July). *A Guide to Disability Rights Law.* Retrieved from U.S. Department of Justice, Civil Rights Division: http://www.ada.gov

U.S. Equal Employment Opportunity Commission. (2017). *The Americans with Disabilities Act of 1990*. Retrieved from EEOC: http://www.eeoc.gov

U.S. Government Publishing Office. (n.d.). *Public Law 94-142-Nov. 29, 1975.* Retrieved from GPO: http://www.gpo.gov

Wasserman, T. (2012). Attention, Motivation, and Reading Coherence Failure: A Neuropsychological Perspective. *Applied Neuropsychology*, 42-52.

APPENDIX A: Subject Recruitment Flyer

PARTICIPANTS NEEDED

Lynn University's
Institute for Achievement
& Learning

A research project on reading

We would like to measure how students read in different environments

Who can participate?

- Students who have a reading disability
- English is your native language
- Students over the age of 18

For more information, please contact:

Catherine Wharton at

cwharton@lynn.edu

561-237-7105

The information we find out in this study could provide useful information about you and could help other students who have a reading disability.

Where? The Institute for Achievement & Learning

What? Read 3 passages and answer 10 questions about each passage.

How Long? The study will take about 2 hours.

When? TBD

All student information will be kept confidential. If research gleaned from this study is published, no personal information will be used.

This study is strictly voluntary and will not impact your classes or any IAL services.

Risks: It may be uncomfortable, stressful, or frustrating to read the passages.

Benefits: You may be provided information regarding how you read best.

APPENDIX B: Informed Consent

THIS DOCUMENT SHALL ONLY BE USED TO PROVIDE AUTHORIZATION FOR VOLUNTARY CONSENT

Project Title: Reading Comprehension in Two Accommodated Reading Tasks with College Students with Reading Disabilities

Researcher: Catherine Wharton

Faculty Sponsor: Kelly Burlison, Ed.D.

DIRECTIONS FOR THE PARTICIPANT:

You are being asked to participate in a research study being conducted by Catherine Wharton for a dissertation under the supervision of Kelly Burlison, Ed.D. in the program of Educational Leadership. Please read this form carefully. This form provides you with information about the study. The Principal Investigator, Catherine Wharton, M.A., will answer all of your questions. You may contact Ms. Wharton at (561) 237-7105 or cwharton@lynn.edu. You are free to ask questions at any time before, during, or after your participation in this study. Your participation is entirely voluntary and you can refuse to participate, there will be no negative effect on your status in a course or at the university if you decide not to participate.

PURPOSE OF THIS RESEARCH STUDY: The purpose of this research is to learn about accommodations for reading disabilities.

PROCEDURES: You will be asked to give permission to the researcher to view the psychological assessment that you submitted to the university to receive accommodations. The researcher will use this information to further understand your reading disability and your inclusion in the study.

TASK: You will be asked to complete three reading activities and answer reading comprehension questions. The reading activities will take less than two hours and you will complete all the sessions in one day. One session, you will be required to read passages to yourself and then answer 10 comprehension questions; then you will have a passage it read to you by a person and then answer 10 comprehension questions; then you will activate text to speech technology and have a passage read to you and answer 10

comprehension questions. Each session should take about 20-30 minutes and there will be three (3) sessions.

VIDEO RECORDING: You will be asked to give permission for the researcher to video record you while you are completing the reading tasks. The purpose for this is to understand student behavior in the two different conditions.

POSSIBLE RISKS OR DISCOMFORT: The risks involved as a participant in this project are small. You may feel frustrated by the reading comprehension tasks. Participation in this study requires a minimal amount of your time and effort. You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate. You may stop participating in this research project at any time with no negative consequences. Your participation is completely voluntary and there will be no negative effect on you if you decide not to withdraw or not participate in the study.

POSSIBLE BENEFITS: It may be helpful for you to learn how to best accommodate your reading weakness. The researcher will share the outcomes and discuss them with you after the study has completed.

FINANCIAL CONSIDERATIONS: You will not be paid for participating in this study, nor will it cost you any money.

CONFIDENTIALITY: Subjects will be identified by an assigned number. Only the principal researcher will have access to this information. All information collected in this study is confidential. Researchers are required to keep your participation confidential and your participation in this project will not be disclosed to anyone other than the researcher. Additionally, the reader for this research will keep all information confidential. When this research is completed, the results will be presented in group format, and no names will be disclosed.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate. You may stop participating in this research project at any time with no negative consequences. Your participation is completely voluntary and there will be no negative effect on you if you decide not to withdraw or not participate in the study.

CONTACTS FOR QUESTIONS/ACCESS TO CONSENT FORM: Any further questions you have about this study or your participation in it, either now or any time in the future, will be answered by Catherine Wharton, M.A., who may be reached at: (561) 237-7105. You may also contact Ms. Wharton's faculty sponsor, Dr. Kelly Burlison at 561-237-7046. A copy of this consent form will be given to you.

AUTHORIZATION FOR VOLUNTARY CONSENT:

I have read and understand this consent form. I have been given the opportunity to ask questions, and all my questions have been answered to my satisfaction. I have been assured that any future questions that may arise will be answered. I understand the aspects of confidentiality of this project. I have been informed of the risks and benefits. I have been informed in advance as to what my task(s) will be and what procedures will be followed.

I voluntarily give permission for the researcher to view and collect data from my independently provided psychological evaluation.

I voluntarily choose to participate in three reading tasks.

I voluntarily give consent to video recording of my reading tasks. All records will be viewed for analysis, secured on a jump drive during the duration of this research and then destroyed.

I know that I can withdraw this consent to participate at any time without penalty or prejudice. I further understand that nothing in this consent form is intended to replace any applicable Federal, state, or local laws. I understand that I will receive a copy of this form.

Participant Signature Date

Researcher's Signature Date

APPENDIX C: Permission to use Instrument

permission <permission@collegeboard.org> Catherine Wharton

RE: Permission Request Form - Lynn University

You replied to this message on 6/6/2017 6:25 PM.

Action Items

Dear Catherine,

Thank you sending the below permission request to the College Board. As the content posted on our website is intended for educational, non-commercial purposes, including research such as what you describe, your request is **APPROVED**.

Permission is granted on the one-time, non-exclusive and non-transferable basis, provided you agree to the following terms and conditions:

1. When administering the questions, you shall state that the test administration is for research purposes only and not as an agent of the College Board or SAT® exam program.
2. You shall distribute the test questions directly to only test takers participating in your research project.
3. When using the questions from the practice test:
   a. You shall limit the distribution to one handout per test taker and the handout must be distributed as a stand-alone document and not incorporated into your own publication.
   b. The College Board logo, SAT® trademark and copyright information remains intact within the printouts.
   c. You shall print or copy the pages exactly as they appear and not alter the content of the exam.
4. If at some point you publish your work and need a copyright source citation for the test questions, you must include the proper citation, as example of which is below:

   Source: Official SAT® Practice Test, © 2017. The College Board. www.collegeboard.org. Used with permission.

Please let me know if you have any questions or need further information. I wish you the best of luck with your dissertation!

Thank you,
Dane

Dane Lay *Executive Assistant and Permissions Request Administrator*

The College Board
250 Vesey Street, New York, NY 10281
permission@collegeboard.org

Clearing a path for all students to own their future

APPENDIX D: Three Reading Conditions as Presented to Subjects

Condition A: SELF MODALITY

You read to yourself.

One passage

10 questions

Directions

This passage is followed by 10 questions. After reading the passage, choose the best answer to each question based on what is stated or implied in the passage.

Questions 1 through 10 are based on the following passage.

This passage is adapted from MacDonald Harris, The Balloonist. ©2011 by The Estate of Donald Heiney. During the summer of 1897, the narrator of this story, a fictional Swedish scientist, has set out for the North Pole in a hydrogen-powered balloon.

My emotions are complicated and not readily verifiable. I feel a vast yearning that is simultaneously a pleasure and a pain. I am certain of the consummation of this yearning, but I don't know yet what form it will take, since I do not understand quite what it is that the yearning desires. For the first time there is borne in upon me the full truth of what I myself said to the doctor only an hour ago: that my motives in this undertaking are not entirely clear. For years, for a lifetime, the machinery of my destiny has worked in secret to prepare for this moment; its clockwork has moved exactly toward this time and place and no other. Rising slowly from the earth that bore me and gave me sustenance, I am carried helplessly toward an uninhabited and hostile, or at best indifferent, part of the earth, littered with the bones of explorers and the wrecks of ships, frozen supply caches, messages scrawled with chilled fingers and hidden in cairns that no eye will ever see. Nobody has succeeded in this thing, and many have died. Yet in freely willing this enterprise, in choosing this moment and no other when the south wind will carry me exactly northward at a velocity of eight knots, I have converted

the machinery of my fate into the servant of my will. All this I understand, as I understand each detail of the technique by which this is carried out. What I don't understand is why I am so intent on going to this particular place. Who wants the North Pole! What good is it! Can you eat it? Will it carry you from Gothenburg to Malmö like a railway? The Danish ministers have declared from their pulpits that participation in polar expeditions is beneficial to the soul's eternal well-being, or so I read in a newspaper. It isn't clear how this doctrine is to be interpreted, except that the Pole is something difficult or impossible to attain which must nevertheless be sought for, because man is condemned to seek out and know everything whether or not the knowledge gives him pleasure. In short, it is the same unthinking lust for knowledge that drove our First Parents out of the garden.

And suppose you were to find it in spite of all, this wonderful place that everybody is so anxious to stand on! What would you find? Exactly nothing. A point precisely identical to all the others in a completely featureless wasteland stretching around it for hundreds of miles. It is an abstraction, a mathematical fiction. No one but a Swedish madman could take the slightest interest in it. Here I am. The wind is still from the south, bearing us steadily northward at the speed of a trotting dog. Behind us, perhaps forever, lie the Cities of Men with their teacups and their brass bedsteads. I am going forth of my own volition to join the ghosts of Bering and poor Franklin, of frozen De Long and his men. What I am on the brink of knowing, I now see, is not an ephemeral mathematical spot but myself. The doctor was right, even though I dislike him. Fundamentally I am a dangerous madman, and what I do is both a challenge to my egotism and a surrender to it.

Question 1.

Over the course of the passage, the narrator's attitude shifts from

A. fear about the expedition to excitement about it.
B. doubt about his abilities to confidence in them.
C. uncertainty of his motives to recognition of them.
D. disdain for the North Pole to appreciation of it.

Question 2.

Which choice provides the best evidence for the answer to question 1?

A. "For years, for a lifetime, the machinery of my destiny has worked in secret to prepare for this moment"
B. "Yet in freely willing this enterprise, in choosing this moment and no other when the south wind will carry me exactly northward at a velocity of eight knots, I have converted the machinery of my fate into the servant of my will."
C. "And suppose you were to find it in spite of all, this wonderful place that everybody is so anxious to stand on!"
D. "What I am on the brink of knowing, I now see, is not an ephemeral mathematical spot but myself."

Question 3.

As used in sentence 1 of paragraph 1, "not readily verifiable" most nearly means

A. unable to be authenticated.
B. likely to be contradicted.
C. without empirical support.
D. not completely understood.

Question 4.

Sentence 5 in paragraph 1 (“For years . . . other”) mainly serves to

A. expose a side of the narrator that he prefers to keep hidden.
B. demonstrate that the narrator thinks in a methodical and scientific manner.
C. show that the narrator feels himself to be influenced by powerful and independent forces.
D. emphasize the length of time during which the narrator has prepared for his expedition.

Question 5.

The narrator indicates that many previous explorers seeking the North Pole have

A. perished in the attempt.
B. made surprising discoveries.
C. failed to determine its exact location.
D. had different motivations than his own.

Question 6.

Which choice provides the best evidence for the answer to question 5?

A. “Nobody has succeeded in this thing, and many have died.”
B. “All this I understand, as I understand each detail of the technique by which this is carried out.”
C. “The Danish ministers have declared from their pulpits that participation in polar expeditions is beneficial to the soul’s eternal well-being, or so I read in a newspaper.”
D. “Behind us, perhaps forever, lie the Cities of Men with their teacups and their brass bedsteads.”

Question 7.

Which choice best describes the narrator's view of his expedition to the North Pole?

A. Immoral but inevitable
B. Absurd but necessary
C. Socially beneficial but misunderstood
D. Scientifically important but hazardous

Question 8.

The question the narrator asks in sentence 14 of paragraph 1 ("Will it carry you from Gothenburg to Malmö like a railway?") most nearly implies that

A. balloons will never replace other modes of transportation.
B. the North Pole is farther away than the cities usually reached by train.
C. people often travel from one city to another without considering the implications.
D. reaching the North Pole has no foreseeable benefit to humanity.

Question 9.

As used in sentence 6 of paragraph 2, "take the slightest interest in" most nearly means

A. accept responsibility for.
B. possess little regard for.
C. pay no attention to.
D. have curiosity about.

Question 10.

As used in sentence 8 of paragraph 2, "bearing" most nearly means

A. carrying.
B. affecting.
C. yielding.
D. enduring.

THANK YOU!!!!

You have completed Condition A.

Condition B: AUDITORY-MODALITY

A person reads to you

One passage

10 questions

Directions

This passage is followed by 10 questions. After reading the passage, choose the best answer to each question based on what is stated or implied in the passage.

"I cannot let you read along with me, I am reading to you. Please let me know if you would like me to repeat phrases, words, etc. I can repeat anything as many times as you request. I cannot provide you with definitions or clarify parts of the passage. When we begin reading the questions, certain questions direct you to a specific sentence or part of the passage, you have to ASK me to return to that part of the passage."

Questions 11 through 20 are based on the following passage.
This passage is adapted from William Maxwell, *The Folded Leaf*. ©1959 by William Maxwell. Originally published in 1945.

The Alcazar Restaurant was on Sheridan Road near Devon Avenue. It was long and narrow, with tables for two along the walls and tables for four down the middle. The decoration was *art moderne*, except for the series of murals depicting the four seasons, and the sick ferns in the front window. Lymie sat down at the second table from the cash register, and ordered his dinner. The history book, which he propped against the catsup and the glass sugar bowl, had been used by others before him. Blank pages front and back were filled in with maps, drawings, dates, comic cartoons, and organs of the body; also with names and messages no longer clear and never absolutely legible. On nearly every other page there was some marginal notation, either in ink or in very hard pencil. And unless someone had upset a glass of water, the marks on page 177 were from tears.

While Lymie read about the Peace of Paris, signed on the thirtieth of May, 1814, between France and the Allied powers, his right hand managed again and again to bring food up to his mouth. Sometimes he chewed, sometimes he swallowed whole the food that he had no idea he was eating. The Congress of Vienna met,

with some allowance for delays, early in November of the same year, and all the powers engaged in the war on either side sent plenipotentiaries. It was by far the most splendid and important assembly ever convoked to discuss and determine the affairs of Europe. The Emperor of Russia, the King of Prussia, the Kings of Bavaria, Denmark, and Wurttemberg, all were present in person at the court of the Emperor Francis the First in the Austrian capital. When Lymie put down his fork and began to count them off, one by one, on the fingers of his left hand, the waitress, whose name was Irma, thought he was through eating and tried to take his plate away. He stopped her. Prince Metternich (his right thumb) presided over the Congress, and Prince Talleyrand (the index finger) represented France.

A party of four, two men and two women, came into the restaurant, all talking at once, and took possession of the center table nearest Lymie. The women had shingled hair and short tight skirts which exposed the underside of their knees when they sat down. One of the women had the face of a young boy but disguised by one trick or another (rouge, lipstick, powder, wet bangs plastered against the high forehead, and a pair of long pendent earrings) to look like a woman of thirty-five, which as a matter of fact she was. The men were older. They laughed more than there seemed any occasion for, while they were deciding between soup and shrimp cocktail, and their laughter was too loud. But it was the women’s voices, the terrible not quite sober pitch of the women’s voices which caused Lymie to skim over two whole pages without knowing what was on them. Fortunately, he realized this and went back. Otherwise he might never have known about the secret treaty concluded between England, France, and Austria, when the pretensions of Prussia and Russia, acting in concert, seemed to threaten a renewal of the attack. The results of the Congress were stated clearly at the bottom of page 67 and at the top of page 68, but before Lymie got halfway through them, a coat that he recognized as his father’s was hung on the hook next to his chair. Lymie closed the book and said, “I didn’t think you were coming.”

Time is probably no more unkind to sporting characters than it is to other people, but physical decay unsustained by respectability is somehow more noticeable. Mr. Peters' hair was turning gray and his scalp showed through on top. He had lost weight also; he no longer filled out his clothes the way he used to. His color was poor, and the flower had disappeared from his buttonhole. In its place was an American Legion button.

Apparently he himself was not aware that there had been any change. He straightened his tie self-consciously and when Irma handed him a menu, he gestured with it so that the two women at the next table would notice the diamond ring on the fourth finger of his right hand. Both of these things, and also the fact that his hands showed signs of the manicurist, one can blame on the young man who had his picture taken with a derby hat on the back of his head, and also sitting with a girl in the curve of the moon. The young man had never for one second deserted Mr. Peters. He was always there, tugging at Mr. Peters' elbow, making him do things that were not becoming in a man of forty-five.

Question 11.
Over the course of the passage, the primary focus shifts from

A. Lymie's inner thoughts to observations made by the other characters.

B. an exchange between strangers to a satisfying personal relationship.

C. the physical setting of the scene to the different characters' personality traits.

D. Lymie's experience reading a book to descriptions of people in the restaurant.

Question 12.
The main purpose of the first paragraph is to

A. introduce the passage's main character by showing his nightly habits.

B. indicate the date the passage takes place by presenting period details.

C. convey the passage's setting by describing a place and an object.

D. foreshadow an event that is described in detail later in the passage.

Question 13.
It can reasonably be inferred that Irma, the waitress, thinks Lymie is "through eating" (sentence 6 of paragraph 2) because

A. he has begun reading his book.

B. his plate is empty.

C. he is no longer holding his fork.

D. he has asked her to clear the table.

Question 14.
Lymie's primary impression of the "party of four" (sentence 1 of paragraph 3) is that they

A. are noisy and distracting.

B. are a refreshing change from the other customers.

C. resemble characters from his history book.

D. represent glamour and youth.

Question 15.
Which choice provides the best evidence for the answer to question 4?

A. Sentence 2 of paragraph 3 ("The women . . . down")

B. Sentence 3 of paragraph 3 ("One . . . was")

C. Sentence 6 of paragraph 3 ("But . . . them")

D. The first part of sentence 10 of paragraph 3 ("Lymie . . . book")

Question 16.
The narrator indicates that Lymie finally closes the history book because

A. his father has joined him at the table.

B. the people at the other table are too disruptive.

C. he has finished the chapter about the Congress.

D. he is preparing to leave the restaurant.

Question 17.
The primary impression created by the narrator's description of Mr. Peters in sentences 2 through 5 of paragraph 4 is that he is

A healthy and fit.

B. angry and menacing.

C. nervous and hesitant.

D. aging and shriveled.

Question 18.
The main idea of the last paragraph is that Mr. Peters

A. neglects to spend any time with his family members.

B. behaves as if he is a younger version of himself.

C. is very conscious of symbols of wealth and power.

D. is preoccupied with the knowledge that he is growing old.

Question 19.
Which choice best supports the conclusion that Mr. Peters wants to attract attention?

A. Sentence 1 of paragraph 5 ("Apparently . . . change")

B. Sentence 2 of paragraph 5 ("He straightened . . . hand")

C. Sentence 4 of paragraph 5 ("The young . . . Mr. Peters")

D. Sentence 5 of paragraph 5 ("He was . . . forty-five")

Question 20.
As used in sentence 5 of paragraph 5, the word "becoming" most nearly means

A. emerging.

B. fitting.

C. developing.

D. happening.

THANK YOU!!!

You have completed Condition B.

Condition C: BI-MODALITY

Text to speech reads to you.

One passage

10 questions

Directions
This passage is followed by 10 questions. After reading the passage, choose the best answer to each question based on what is stated or implied in the passage.

Questions 21 through 30 are based on the following passage.
This passage is adapted from Daniyal Mueenuddin, "Nawabdin Electrician." ©2009 by Daniyal Mueenuddin.

Another man might have thrown up his hands—but not Nawabdin. His twelve daughters acted as a spur to his genius, and he looked with satisfaction in the mirror each morning at the face of a warrior going out to do battle. Nawab of course knew that he must proliferate his sources of revenue—the salary he received from K. K. Harouni for tending the tube wells would not even begin to suffice. He set up a little one-room flour mill, run off a condemned electric motor—condemned by him. He tried his hand at fish-farming in a little pond at the edge of his master's fields. He bought broken radios, fixed them, and resold them. He did not demur even when asked to fix watches, though that enterprise did spectacularly badly, and in fact earned him more kicks than kudos, for no watch he took apart ever kept time again.

K. K. Harouni rarely went to his farms, but lived mostly in Lahore. Whenever the old man visited, Nawab would place himself night and day at the door leading from the servants' sitting area into the walled grove of ancient banyan trees where the old farmhouse stood. Grizzled, his peculiar aviator glasses bent and smudged, Nawab tended the household machinery, the air conditioners, water heaters, refrigerators, and water pumps, like an engineer tending the boilers on a foundering steamer in an Atlantic gale. By his superhuman efforts he almost managed to maintain K. K. Harouni in the same mechanical cocoon, cooled and bathed and lighted and fed, that the landowner enjoyed in Lahore.

Harouni of course became familiar with this ubiquitous man, who not only accompanied him on his tours of inspection, but morning and night could be found standing on the master bed rewiring the light fixture or in the bathroom poking at the water heater. Finally, one evening at teatime, gauging the psychological moment, Nawab asked if he might say a word. The landowner, who was cheerfully filing his nails in front of a crackling rosewood fire, told him to go ahead.

"Sir, as you know, your lands stretch from here to the Indus, and on these lands are fully seventeen tube wells, and to tend these seventeen tube wells there is but one man, me, your servant. In your service I have earned these gray hairs"—here he bowed his head to show the gray—"and now I cannot fulfill my duties as I should. Enough, sir, enough. I beg you, forgive me my weakness. Better a darkened house and proud hunger within than disgrace in the light of day. Release me, I ask you, I beg you."

The old man, well accustomed to these sorts of speeches, though not usually this florid, filed away at his nails and waited for the breeze to stop.

"What's the matter, Nawabdin?"

"Matter, sir? O what could be the matter in your service. I've eaten your salt for all my years. But sir, on the bicycle now, with my old legs, and with the many injuries I've received when heavy machinery fell on me—I cannot any longer bicycle about like a bridegroom from farm to farm, as I could when I first had the good fortune to enter your employment. I beg you, sir, let me go."

"And what's the solution?" asked Harouni, seeing that they had come to the crux. He didn't particularly care one way or the other, except that it touched on his comfort—a matter of great interest to him.

"Well, sir, if I had a motorcycle, then I could somehow limp along, at least until I train up some younger man."

The crops that year had been good, Harouni felt expansive in front of the fire, and so, much to the disgust of the farm managers, Nawab received a brand-new motorcycle, a Honda 70. He even managed to extract an allowance for gasoline.

The motorcycle increased his status, gave him weight, so that people began calling him “Uncle,” and asking his opinion on world affairs, about which he knew absolutely nothing. He could now range further, doing a much wider business. Best of all, now he could spend every night with his wife, who had begged to live not on the farm but near her family in Firoza, where also they could educate at least the two eldest daughters. A long straight road ran from the canal headworks near Firoza all the way to the Indus, through the heart of the K. K. Harouni lands. Nawab would fly down this road on his new machine, with bags and cloths hanging from every knob and brace, so that the bike, when he hit a bump, seemed to be flapping numerous small vestigial wings; and with his grinning face, as he rolled up to whichever tube well needed servicing, with his ears almost blown off, he shone with the speed of his arrival.

Question 21.
The main purpose of paragraph 1 is to

A. characterize Nawab as a loving father.

B. outline the schedule of a typical day in Nawab’s life.

C. describe Nawab’s various moneymaking ventures.

D. contrast Nawab’s and Harouni’s lifestyles.

Question 22.
As used in sentence 7 of paragraph 1, the word "kicks" most nearly means

A. thrills.

B. complaints.

C. jolts.

D. interests.

Question 23.
The author uses the image of an engineer at sea (in sentence 3 of paragraph 2) most likely to

A. suggest that Nawab often dreams of having a more exciting profession.

B. highlight the fact that Nawab's primary job is to tend to Harouni's tube wells.

C. reinforce the idea that Nawab has had many different occupations in his life.

D. emphasize how demanding Nawab's work for Harouni is.

Question 24.
Which choice best supports the claim that Nawab performs his duties for Harouni well?

A. Sentence 4 of paragraph 2 ("By his . . . Lahore")

B. Sentence 3 of paragraph 3 ("The landowner . . . ahead")

C. Sentence 2 of paragraph 4 ("In your . . . should")

D. Sentence 3 of paragraph 7 ("I've . . . years")

Question 25.
In the context of the conversation between Nawab and Harouni, Nawab's comments in paragraph 4 ("Sir . . . beg you") mainly serve to

A. flatter Harouni by mentioning how vast his lands are.

B. boast to Harouni about how competent and reliable Nawab is.

C. emphasize Nawab's diligence and loyalty to Harouni.

D. notify Harouni that Nawab intends to quit his job tending the tube wells.

Question 26.
Nawab uses the word "bridegroom" (in sentence 4 of paragraph 7) mainly to emphasize that he's no longer

A. in love.

B. naive.

C. busy.

D. young.

Question 27.
It can reasonably be inferred from the passage that Harouni provides Nawab with a motorcycle mainly because

A. Harouni appreciates that Nawab has to work hard to support his family.

B. Harouni sees benefit to himself from giving Nawab a motorcycle.

C. Nawab's speech is the most eloquent that Harouni has ever heard.

D. Nawab threatens to quit if Harouni doesn't agree to give him a motorcycle.

Question 28.
Which choice provides the best evidence for the answer to question 7?

A. Sentence 1 of paragraph 8 ("And . . . crux")

B. Sentence 2 of paragraph 8 ("He didn't . . . him")

C. Sentence 2 of paragraph 10 ("He even . . . gasoline")

D. Sentence 2 of paragraph 11 ("He could . . . business")

Question 29.
The passage states that the farm managers react to Nawab receiving a motorcycle with

A. disgust.

B. happiness.

C. envy.

D. indifference.

Question 30.
According to the passage, what does Nawab consider to be the best result of getting the motorcycle?

A. People start calling him "Uncle."

B. He's able to expand his business.

C. He's able to educate his daughters.

D. He can spend more time with his wife.

THANK YOU!!!

You have completed Condition C.

APPENDIX E: Preference and Experience Survey

Pre-Task Survey for: Reading Comprehension in Two Accommodated Reading Tasks with College Students with Reading Disabilities

Pre-Test Questions / Only Asked Before Initiating the First Task

1. In order to **best** understand written material, which is the best way for you to understand text? (Please circle one.)

   I understand best reading it to myself.

   I understand best using assistive technology, text to speech software.

   I understand best having a person read text to me.

2. Do you usually use assistive technology to read text to you? (Please circle one.)

   YES, I usually use assistive technology to read to me.

   NO, I DO NOT usually use assistive technology to read to me.

3. Do you usually use a person to read text to you? (Please circle one.)

   YES, I usually a person to read text to me.

   NO, I DO NOT usually a person to read to me.

4. Do you think being able to use assistive technology for all reading tasks would help you understand material better?

   YES, I think being able to use able to use assistive technology for all reading tasks would help me understand material better.

   NO, I DO NOT think being able to use assistive technology for all reading tasks would help me understand material better.

5. Do you think being able to use a person to read to you for all reading tasks would help you understand material better?

   YES, I think being able to use able to use a person for all reading tasks would help me understand material better.

   NO, I DO NOT think being able to use a person for all reading tasks would help me understand material better.