1-1-2011

Divided Timed and Continuous Timed Assessment Protocols and Academic Performance

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Walden University
2013

Abstract

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by

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MS, California State University, 1991

BS, Brigham Young University, 1975

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Psychology

Walden University

June 2013

Abstract

Children from a low socioeconomic status (SES) are exposed to numerous stress factors that are negatively associated with sustained attention and academic performance. This association suggests that the timed component of lengthy assessments may be unfair for students from such backgrounds, as they may have an inability to sustain attention during lengthy tests. Research has also found academic disparities between gender. The purpose of this quasi-experimental study was to investigate the relationship between continuous and divided timed tests in terms of student test scores, with additional assessments incorporating gender. Two charter schools from a suburban Idaho school district were the sources of the convenience sample. Fifth grade students were tested in groups of approximately 30. The research questions for the study concerned the relationship between continuous and divided assessment protocols and Texas Assessment of Knowledge and Skills (TAKS) test scores for low- versus non-low-SES students and among gender. The hypothesis was that there would be a statistically significant difference in TAKS scores between continuous and divided assessments. An ANOVA was used to determine whether a statistical relationship existed between test scores and test protocol by gender. ANOVA results indicated no significant differences in math test scores between test protocols and among gender, suggesting that increased collaborative efforts between families and schools may mitigate factors associated with attentional and academic deficits among students from low-SES environments. The results of this study may be helpful for communities as they develop curricula that may close the academic gap among students of all SES backgrounds.

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Dedication

I dedicate this dissertation to students and educators who wish to investigate and add to the body of knowledge information that may enhance educational outcomes among low-SES and non-low-SES students. Further, I dedicate this work to students who wish to make learning and investigating a lifetime experience.

Acknowledgments

I would like to thank the following individuals for their support, encouragement, and untiring help as I completed this study. First, to my wife, Anne, who continually inspires and assists me in achieving my goals and helping me become a better man, student, and professional. She is a God-given blessing in my life. I could not have completed this arduous journey without her. Second, to my dissertation chair, Dr. Michael Johnson, who is perhaps the best professor I have encountered during my academic career. His ability to motivate, assist, correct, and teach is unsurpassed. He truly represents the epitome of excellence in the teaching profession.

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Chapter 1: Introduction to the Study

Focus of the Study

Test reliability is associated with the degree to which a test consistently measures the knowledge it is supposed to measure. Test length, specifically the timed component of a test, may affect children's ability to attend (Meyers, 2008). Texas public schools have used the timed Texas Assessment of Knowledge and Skills (TAKS; a criterion-referenced standardized assessment program) to assess student achievement since 2003. Texas will change its standardized assessment to the State of Texas Assessment of Academic Readiness (STAAR; a criterion-referenced standardized assessment program). Both fifth grade assessments use a continuous timed protocol of 4 hours. Research suggests that elementary students may not be able to sustain attention for more than 35-40 minutes (Chaudhuri & Behan, 2004; Ruff & Lawson, 1990).

While all elementary students may have an inability to sustain attention for lengthy periods, students from low socioeconomic status (SES) environments may have a greater inability to demonstrate sustained attention (Breznitz & Norman, 1998; Farver, Xu, Eppe, & Lonigan, 2006; Mezzacappa, 2004; Schneider & Eisenberg, 2006). If testing protocols are too lengthy, standardized assessments may be in part testing a student's ability to attend rather than testing content knowledge alone. Therefore, lengthy assessments may be unfair for students in low-SES environments.

Research suggests an association between attention and performance (Friedman et al., 2007; Polderman, Boomsma, Bartels, Verhulst, & Huizink, 2010). This association is especially evident among students of low-SES areas and may be due to environmental

factors (Farver et al., 2006). There is little evidence identifying a relationship between the timed component of assessments that divide test questions over multiple days (divided) and one-day (continuous) assessments in terms of student test scores. In this study, I investigated the relationship between continuous and divided timed tests among fifth grade students in mathematics in Boise, ID charter schools in terms of test scores. Additionally, I investigated the aforementioned relationships in low- and non-low-SES environments, as well as for students of different genders.

The intended population was fifth grade students from Houston, TX Title-I (i.e., low-SES) and high-SES schools from suburban areas. Low-SES and disadvantaged schools are defined by U.S. government poverty guidelines (U.S. Department of Health & Human Services, 2009) and Title I classifications (U.S. Department of Education, 2005). Obtaining a community partner for this study proved to be more difficult than expected. After a 5 month search for data collaboration, it was necessary to extend the search for a collaborative partner outside of Texas. Subsequently, a Boise, ID charter school system was found and willing to collaborate with this study. A brief background of this study is provided in the following section.

Background of the Study

Ackerman and Kanfer (2009) posited that schools are spending greater classroom time on testing because school systems are under increasing pressure for students to perform well on standardized assessments. Test accommodations are routinely offered to students with learning disabilities (LD) and not offered to those students who are either not identified as LD or not formally diagnosed. One group of students that is at particular

risk of being negatively impacted by such classroom policies is students of low-SES. Research suggests there are many students of low-SES who are not formally diagnosed with LD (Stichter, Randolph, Gage, & Schmidt, 2007). Students of low-SES not diagnosed with LD may benefit from test accommodations similar to those accommodations offered students classified as LD.

Behavioral, learning, physical, and psychological difficulties impede learning and assessment of elementary school children from low-SES areas (Bradley et al., 2000). Research attests that students are different in terms of development and physical-psychological disorders (whether or not diagnosed) and are affected differently by environmental stressors (Mezzacappa, 2004). Extended time modifications are provided for many LD students, but modifications are not provided for general student populations in which individuals may have attention difficulties but have not been formally diagnosed with ADHD (Texas Education Agency, 2010). Students may have attentional problems but not meet the formal criteria for an ADHD diagnosis. Providing test accommodations to these students may improve the validity of standardized tests.

Attention is associated with academic outcomes (Akinbami, Liu, Pastor, & Reuben, 2011). Additionally, it appears that children from low-SES environments who are exposed to stress show poorer attention (Reese & Gallimore, 2000). School systems that wish to assess students in a valid manner must adequately accommodate students who are LD in terms of standardized testing protocols. However, there are students who are not labeled as LD, have attentional deficits, and may benefit from accommodations similar to those afforded to students formally labeled LD (Stichter et al., 2007).

The thesis of this study is that a divided testing protocol might have higher validity than a continuous testing protocol among students from low-SES households. While there is a plethora of research regarding extended time accommodations, there appears to be only one study involving a divided testing protocol. The following section provides an overview of the literature that supports the thesis of this study, addressing attention theory, the bioecological model, attention deficits, family environment considerations, cognitive fatigue, and test accommodations.

Brief Review of the Literature

Attention theory (Ward, 2004), and its application to low-SES students, provided the conceptual framework for this study. Although there are many theorists who have studied attention, Treisman's (1960) theory of early selection and attenuation appears to be a model that, in part, offers a valid explanation for attentional processes. Attention theory integrates a number of psychological constructs and is subsequently discussed.

Sustained attention is defined as the ability to focus and direct cognitive activity on a specific stimulus over time (Finnerman, Francis, & Leonard, 2009). Research suggests that sustained attention is positively associated with academic achievement (Razza, Martin, & Brooks-Gunn, 2010) and negatively associated with task duration (Gunzelmann, Moore, Gluck, Van Done, & Dinges, 2011). Additionally, sustained attention is associated with environmental factors (Razza et al., 2010). *Mind wandering* is associated with sustained attention and is defined as a lapse of attention that negatively affects performance (Mcvay, Meier, & Touron, 2009) and may very well be more prevalent during lengthy tasks such as standardized school assessments.

Attentional difficulties appear to create academic handicaps. Specifically, research suggests a negative association between attention deficit hyperactivity disorder (ADHD) symptoms and academic achievement (Friedman et al., 2007). The rate of ADHD symptoms appears to be increasing among children aged 5-17 years. However, estimates may be underestimations because there are many children who exhibit ADHD symptoms but are not formally diagnosed (Akinbami, Liu, Pastor, & Reuben, 2011).

SES (Kishiyama, Boyce, Jimenez, Perry, & Knight, 2008), racial-ethnic group membership (Annunziata, Hogue, Faw, & Liddle, 2006), and family environment (Bradley & Corwyn, 2002; Gregory & Rimm-Kaufman, 2008) are associated with academic achievement and executive function. Poverty and stressful environments appear far too frequently in low-SES environments (Raver & Kintzer, 2002). Farver et al., (2006) posited that children from low-income homes are at greater risk in terms of academic, social, and behavioral difficulties compared to children from higher SES environments.

Cognitive fatigue is posited to affect attention and is observed among all children who are exposed to lengthy academic tests (Ackerman & Kanfer, 2009). Finally, it appears that there are other factors associated with attention, including home chaos, parental support, excessive noise levels, and maternal responsiveness. These factors will be delineated in Chapter 2.

The literature appears to suggest that extended time accommodations are among the many strategies used by school districts for children who are LD. Unfortunately, most of these studies were done with secondary students. Few studies have been done with

elementary-age students (Waltz, Albus, Thompson, & Thurlow, 2000).

Many LD students benefit from time accommodations. Specifically, extended time accommodations appear to improve test performance among children who have learning disabilities (Elliot & Marquart, 2012; Perlman, Borger, Collins, Elenbogen, & Wood, 1996). Other research suggests that an extended time accommodation does not improve test scores.

Extended time accommodations are not offered to all classrooms even though there may be students without a formal LD diagnosis (TEA, 2010). Finally, it appears that there is little research regarding another form of time accommodation, namely divided timed testing (Waltz et al., 2000). In this study, I attempted to add information that addresses this deficiency.

Problem Statement

Do standardized assessments evaluate students' content knowledge alone or students' ability to attend? In Texas public schools, academic achievement is measured using time-limited standardized tests. According to Razza and Brook-Gunn (2010), there is an association between attention and performance among all students. Moreover, Razza and Brook-Gunn posited that students from low-SES environments are at increased risk for attentional difficulties due to environmental factors. Although research suggests an association between extended time accommodations and standardized test scores, there is little evidence of relationships between different test protocols and student test scores.

The standardized test system appears to test young students' ability to attend

because factors such as children's attentional abilities and cognitive fatigue affect test outcomes. Chunking (dividing learning material into smaller pieces) is efficacious in teaching because it helps in the retrieval of information stored in memory (Bodie, Powers, & Fitch-Hauser, 2006). Chunking test questions may help children's test outcomes. Research on the use of chunking test questions over multiple days on standardized tests among elementary age students appears limited. There is a plethora of studies that address test accommodations among students with and without learning disabilities, but little research has been done among low-SES groups where divided timed test accommodations are used. Extending time on standardized tests is one type of accommodation and is subsequently addressed.

Extended time accommodations are currently used in numerous states for students with learning disabilities (Duncan et al., 2007; Thurlow, House, Boys, Scott, & Ysseldyke, 2000). Perhaps there are many students who have symptoms of LD who have not been diagnosed or students who have symptoms of LD but do not meet enough of the diagnostic criteria to be formally labeled LD. These students might benefit from test accommodations. The literature suggests that many children from low-SES environments present with deficits in executive functioning, particularly in terms of attentional skills (Farver et al., 2006). Offering divided test sessions without extending time to students with and without learning disabilities may mitigate cognitive fatigue and improve test validity. Potential benefits from divided testing may be comparable to the benefits of extended time accommodations among students with disabilities.

Divided test protocols do not necessarily mean extending time, however.

Extended time accommodations have mixed results in terms of improving academic outcomes. Specifically, some studies suggest no benefit of extended time while others suggest greater benefit such as higher test scores for students without learning disabilities than students with learning abilities (Chiu & Pearson, 1999). Additionally, most studies appear to have been done with college- and postsecondary-age students. Fewer studies have been conducted with elementary-age students. Extending time may have the disadvantage of increasing cognitive fatigue as test length increases. Therefore, divided testing protocols as compared to extending time alone may mitigate cognitive fatigue factors.

Additional factors appear associated with academic outcome, including family and environmental factors (Bradley et al., 2000). As there are many children who are not diagnosed with learning disabilities (Stichter et al., 2007), children from low-SES backgrounds may be at an academic disadvantage in terms of attentional ability.

Test accommodations that improve the validity of assessing academic achievement help in the academic placement of students. Offering divided test sessions may mitigate test bias and thus improve the validity of student testing. The next section addresses the variables selected for this study and the study's design.

Variables to Be Considered

The predictor variable, when assessing the relationship between testing protocol and student scores on the TAKS, was the testing protocol. For the divided protocol (experimental groups), the entire assessment was divided into three equal portions in terms of both time (3 consecutive days, 80 minutes per day) and number of questions.

The control group completed the standardized test in a single session (continuous protocol, 4 consecutive hours). The criterion variable was student scores on the TAKS. In both situations, a trained educator administered the TAKS.

This study investigated whether a difference exists in mean test scores between the control and experimental groups. It was hypothesized that there was a statistically significant difference between the divided and continuous groups in terms of mean test scores among low-SES students. It was also hypothesized that there was no statistically significant difference between test protocols in terms of mean test scores among non-low-SES students. Further, it was hypothesized that there was a statistically significant difference by gender between the two test protocols within each SES area. All tests were administered by a trained educator. A detailed description of the current study's procedures is found in Chapter 3.

Study Design

A quasi-experimental design was used to study the relationship between the predictor and criterion variables. That is, classrooms were assigned to either divided protocol or continuous protocol groups. Sampling was performed using a convenience-sampling procedure. TAKS assessment results from elementary schools in the Boise, ID area were included. These schools encompass suburban populations. The divided protocol assessment was administered over 3 days (80 minutes/day), while the continuous protocol was given on 1 day over 4 hours.

Research Questions

The first question that guided this research was as follows: "Is there a significant

relationship between continuous and divided assessment protocols and TAKS test scores for low-SES and non-low-SES students?" The second question that guided this research was as follows: "Is there a significant relationship between test protocols and test scores with respect to gender?"

Null Hypothesis

The null hypothesis for this research was that mean scores on the TAKS would be statistically equivalent between divided and continuous assessment protocols for low- and non-low-SES elementary students. Additionally, assessment protocol mean scores for the boys would be statistically equivalent with the mean scores for girls among low- and non-low-SES elementary students.

Alternative Hypothesis

The alternative hypothesis for this research was that mean scores on the TAKS would be statistically different between the divided and continuous assessment protocols for low- and non-low-SES elementary students. Additionally, the mean scores for the boys would be statistically different from the mean scores for girls among both low and non-low-SES groups.

The aforementioned hypotheses are nondirectional. Two-tailed hypothesis tests are the most widely accepted method for hypothesis testing (Gravetter & Wallnau, 2007). Hypothesis testing for this study used a nondirectional hypothesis because the literature appeared to suggest varied test outcomes when considering test accommodations.

The literature search performed for the purposes of this dissertation uncovered only one study that addressed multiple-day testing sessions (Waltz et al., 2000). This

study was conducted with middle-school students. The results suggested that there was no significant association between multiple-day testing and performance among students with learning disabilities. There is a lack of research regarding divided test protocols among elementary age students from low-SES environments. The purpose of this study is presented in the following section.

Study Purpose

This study was intended to explore the relationship between testing protocols (i.e., divided or continuous) and student achievement. The data came from results of fifth grade math TAKS tests at Boise, ID charter schools. I used a quasi-experimental design where classrooms were assigned to a divided protocol group or a continuous protocol group. This method eliminated the possibility of systematic bias. Questions and testing time for the divided group were spaced over three periods. This study was grounded in the theory of attention by Treisman (1960) and Bronfenbrenner's bioecological model of development. Both are summarized in the following section.

Theoretical Base

This research was based on Treisman's (1960) theory of attention and Bronfenbrenner's (2005) theory on bioecological human development. Each theory has important implications for this study because student outcomes appear to be associated with attention and environmental factors. Moreover, environmental factors are associated with childhood development.

Treisman's Attention Theory

Treisman's theory of attention suggests that humans cannot attend to all sensory

input at the same time (Ward, 2004). One attends to stimuli of choice. Moreover, directed attention occurs because of a filtering process. Further, competing sensory input is attenuated rather than eliminated as suggested by Broadbent's model of attention (Ward, 2004). Essentially, sensory material first passes through an attenuating filter, followed by a semantic analysis filter leading to selected input for attention. Unattended material appears to be stored in a temporary buffer store.

Bronfenbrenner's Bioecological Theory of Human Development

Child development can partially be understood using Bronfenbrenner's bioecological model. According to Bronfenbrenner (1979), there are different levels of environmental influences that affect children's development. Attentional and executive function abilities are part of this developmental model. Research suggests an association between SES, memory, attention, and academic outcomes (NICHD Early Child Care Research Network, 2003). An understanding of bioecological influences on childhood development is important when investigating the effectiveness and validity of protocols in the academic testing arena.

Definition of Terms

Attention deficit hyperactivity disorder (ADHD): According to the fourth edition (text revision) of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM IV-TR; APA, 2000), individuals with the attentive type of ADHD have at least six of the following symptoms: does not give careful attention to detail or makes careless mistakes, has difficulty keeping attention on tasks, appears not to be listening when spoken to directly, fails to finish assignments or does not follow directions, has organizational

difficulties, avoids or does not want to engage in activities that require mental effort, often loses tools needed for activities, is easily distracted, and is forgetful in activities.

Cognitive fatigue: Cognitive fatigue can be defined as a decline in alerting, orienting, and executive attention. Moreover, when cognitive fatigue occurs, there is a failure to maintain performance level on a task that requires sustained effort (Holtzer, Shuman, Mahoney, Lipton, & Verghese, 2011).

Sustained attention: The ability to focus attention over time while maintaining alertness to direct cognitive activity, attending to multiple sources of information, and selectively choosing among matters of importance (DeGangi & Porges, 1990; Ward, 2004).

Executive attention: The management of information in short-term memory that blocks distracting information.

Socioeconomic status: An individual's hierarchal social state that includes the following variables: education, income, environment, and place of residence.

Test accommodations: The modified test formats, assistive technology devices, and different test environments (i.e., divided and continuous time) that are intended to assess a student's true abilities (TEA, 2012).

Texas Assessment of Knowledge and Skills (TAKS): "The Texas Assessment of Knowledge and Skills (TAKS) assessments are designed to measure the extent to which a student has learned and is able to apply the defined knowledge and skills at each tested grade level" (TEA, 2012).

Assumptions

Research suggests there are many students in low-SES areas who are not formally diagnosed with learning disabilities (Stichter et al., 2007). Many of these students could benefit from test accommodations. Behavioral, learning, physical, and psychological difficulties impede the learning and assessment of elementary school children from low-SES areas. Standardized testing protocols appear to assess all students as if they were the same. Research attests that students are different in terms of individual development, environmental stressors, and physical-psychological disorders (whether or not diagnosed). Accommodations such as extended time are provided for students with disabilities covered under the Individuals with Disabilities Education Act or Section 504 of the Rehabilitation Act (TEA, 2010).

Limitations of the Study

There were several limitations inherent in this study. The primary difference between a true experimental and a quasi-experimental design is group assignment of participants. Random sampling is not practical in the school system. Thus, this study used a quasi-experimental design with control and experimental groups. Therefore, generalizations cannot be made from the data and results of this study.

Student motivation appears to be a factor in academic success, particularly in terms of standardized testing. Students know that school district benchmark exams do not affect middle school placement. This study used a school benchmark exam; therefore, there was no way to know who was “trying” (i.e., giving his or her best effort) during testing.

Another limitation of this study was sample demographics. Although approximately 30% of the sample were classified as low-SES, they were not from urban communities, where stress factors among low-SES students are often higher than in suburban populations. Sample size was a major consideration. The extreme difficulty in obtaining a large sample with a medium effect size was unknown to me at the initiation of this study.

Integrity issues were another concern with this study. Typically, standard protocols do not allow the possibility of communication between students during the exam. Students taking the continuous test may have leaked information to students taking the divided protocol. Finally, this study involved the use of results from the mathematics portion of the TAKS. Conclusions regarding testing protocols and attention cannot be generalized across other content areas. While there are inherent limitations with this study, this study is intended to contribute to the body of knowledge on standardized test outcomes in terms of low-SES children. Specifically, the significance of this study is postulated in the next section.

Significance of the Study

It appears that standardized tests help school districts determine academic achievement, quality of instruction, and future grade placement-advancement. Specifically, the TAKS or STAAR measures a student's mastery of the state-mandated curriculum (TEA, 2010). Accommodations are used to assess academic performance among students who meet eligibility requirements for LD. However, there may be students who do not qualify to receive accommodations because they have not been

formally diagnosed with LD or who do not meet diagnostic criteria.

Research suggests an association between attention and academic outcomes (Razza et al., 2009). Standardized testing may test a child's ability to attend, in addition to content mastery. Family and social environments affect attention. Children who are formally diagnosed with ADHD appear to benefit from accommodations that mitigate attentional difficulties during testing. There appears to be an increasing number of students who have attentional difficulties who are not diagnosed and receive no accommodations (Stichter et al., 2007).

Time modifications are among the many accommodations used in public school systems. While the use of extended time modifications has been used for students with LD, the literature review for this dissertation found limited studies for alternative time modifications. This study investigated an association between divided and continuous testing protocols among elementary-age students.

If students from low-SES environments were given the option to take a divided standardized test, their scores might better reflect their true academic ability (i.e., improve the validity of the TAKS).

Summary and Transition

Chapter 1 introduced the focus of this research, which was to investigate a possible association between divided and continuous test protocols among low-SES fifth grade students. Additionally, the background of the study and a brief review of the literature were presented in terms of Treisman's (1960) theory of attention and Bronfenbrenner's (2005) theory on bioecological human development.

Chapter 2 details attention theory with particular emphasis on attentional control, sustained attention, and focus. Additionally, Bronfenbrenner's theory on bioecological human development will be discussed pertaining to environmental factors affecting attention. Chapter 2 addresses ADHD, family-environmental factors, cognitive fatigue, and extended time accommodations. The literature review provides the background information that supports this research study concerning divided test accommodations among students from low-SES environments.

Chapter 3 discusses the current study's methodology, including research design, sample and population, demographics, sample size and sampling method, data collection specifics, and statistical analysis.

Chapter 4 contains the results of the statistical analysis and the interpretation of the data collected. Chapter 5 contains a discussion of the results, implications of the study, implications for positive social change, and suggestions for future research.

Chapter 2: Literature Review

Introduction

Chapter 2 addresses attention theory and bioecological models of human development. Additionally, ADHD and family-environment issues are presented, followed by a discussion on cognitive fatigue. Finally, extended-time accommodations are presented, followed by a summary section.

Standardized tests may be biased in terms of a student's ability to attend. Research suggests an association between attention and performance (Friedman et al., 2007; Polderman et al., 2010). Environmental factors are also associated with attention (Bradley & Caldwell, 1984). Research suggests an association between SES and attentional abilities among children (Mezzacappa, 2004). It appears that test accommodations are beneficial for students with LD, but there are little data regarding the benefits of test accommodations among elementary-aged children from low-SES groups who have not been formally diagnosed with LD. In this study, I explored a specific type of test accommodation (divided timed testing) among elementary students from low- and non-low-SES areas. Gender differences in these areas were also considered.

The literature review search used a multidisciplinary data search engine within the Walden University portal. Specifically, the EBSCO, Academic Search, and ProQuest search engines were used. Search terms such as *attention*, *standardized test accommodations*, *academic test bias*, *human development*, *memory*, *executive function*, and *cognitive fatigue* are examples of the type of terms that were used in the search.

Academic articles, specific article-referenced citations, and academic books represent the scope of this literature search.

There is a plethora of research devoted to studying test accommodations among students with and without disabilities. *Testing accommodations* refer to the methods used that differ from standard test protocols that allow students with disabilities to demonstrate academic competence without performance being masked by their disabilities. Accommodations appear to include modification of test presentation, test settings, and timing (Fuchs, Fuchs, & Capizzi, 2005). Extending time is a typical test accommodation used in public school systems. Controversy exists as to whether extended time accommodations increase scores for general and special education students alike. Studying divided testing protocols among elementary school students may provide important data for normalizing test scores between students with and without disabilities.

It appears that over 15% of the general education population of school-aged children experience challenges in the areas of social, behavioral, and academic performance that may not be diagnosed (Stichter et al., 2007). These students might benefit from test accommodations similar to accommodations offered to students diagnosed with disabilities. Testing should be equitable and valid. That is, tests should evaluate the true abilities of students with and without disabilities. Studies such as this proposed dissertation are designed to evaluate the efficacy of test accommodations for students who do not have a diagnosed disability but are at risk of experiencing the challenges listed above.

This literature review provides the background supporting the hypothesis that offering divided timed administration of academic tests enhances standardized test scores and therefore test validity among children from various socioeconomic backgrounds, regardless of their designated disabled/nondisabled status. This review first addresses concepts of attention including selectivity, focus, sustained, alerting, and orienting. Additionally, attention deficit hyperactivity disorder (ADHD) is discussed in terms of its affects on academic outcomes. Evidence is also identified that enhances our understanding of the myriad of factors that affect attention and academic performance.

Family environment is a primary factor associated with academic achievement and a child's ability to pay attention in school. Additional factors such a cognitive fatigue and stress will be reviewed. I begin with a discussion of the literature addressing theories of attention.

Attention Theory

Attention is a cognitive process whereby individuals selectively focus on a specific stimulus in the environment while ignoring other stimuli (Dowsett & Livesey, 2000). Other factors associated with attention and cognitive functioning include planning skills (Barkley, 2000), and environment (Blair, 2000). Various researchers have incorporated these constructs into their theories of attentional processes.

Broadbent (1958) theorized that the attentional system has a finite capacity and operates on a "single channel" with unattended channels filtered out. Treisman (1960), however, posited that extraneous or unattended stimuli could intrude into the attended channel (attenuation). Deutsch and Deutsch (1963) suggested that all stimuli inputs are

fully available and processed rather than filtered or attenuated. They argued that extraneous stimuli not processed are quickly lost. Current neurophysiological studies suggest that Treisman's theory of early selection and attenuation have prevailed. Additional theorists have added information to explain the human attentional system.

Cowan (1995) argued that the attentional system incorporates an episodic buffer component. The buffer component addresses levels of attention, forward planning, monitoring of progress to the desired end goal, and feedback. Uncontrolled (unconscious) or controlled (conscious) information processing involves a series of coordinated actions including focus, shifting attention, selectivity of stimuli, and sustained attention (Ebert & Kohnert, 2011; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). Mirsky and colleagues (1991) suggested that focus is the ability to select target information from varying stimuli for processing and balances awareness between closely focused-on and unattended stimuli.

Focus is also associated with control mechanisms (attentional control) such as the central executive, phonological loop, and visuospatial scratchpad (Ward, 2004). Working memory and problem solving are examples of attentional control and the executive processes (Friedman et al., 2007; Fuchs et al., 2006; Gathercole et al., 2008). Judgment and individual predispositions affect focus and the decision-making process. Shifting is the ability to change attentive focus in a flexible manner. Hanania and Smith (2010) posited that decision-making differentially weighs, classifies, and controls presented stimuli. One specific aspect of attention is vigilance (sustained attention) that affects students' academic performance.

Sustained attention is the capacity to maintain alertness, direct cognitive activity, and focus over time. Moreover, it is associated with the frontal and parietal lobes of the brain (Finneran et al., 2009; Ward, 2004). Focusing over a long enough period is essential to effectively complete a desired task. DeGangi and Porges (1990) suggested that sustained attention requires focused attention among distracters, attending to multiple sources of information, and selectively choosing between matters of importance. Sustained attention is linked with (a) clinical disorders such as ADHD and (b) executive function difficulties including planning, effortful control, working memory, and inhibitory control. Additionally, sustained attention is developmental and is associated with environmental factors (Razza & Brook-Gunn, 2010). Finally, in a study by Preston, Heaton, McCann, Watson, and Selke (2009), sustained attention predicted variance in math scores and played an important role in academic outcomes. There are additional factors associated with the attentional process, such as mental energy, mental fatigue, concentration, alerting, orienting, and inattention.

Mental energy regulates information processing and behavior. Deficits in this system appear as mental fatigue and reduced concentration. The mental energy system includes alertness, sleep and arousal balance, mental effort (i.e., starting, continuing, and completing tasks), and performance consistency (i.e., reliable and predictable flow of energy over time). *Alerting* and *orienting attention* refer to maintaining a state of preparedness for effortful processing and disengaging focus between presenting stimuli, respectively.

Executive attention refers to the processes involved in goal-directed behavior including planning, anticipating, selecting, initiating and maintaining purposeful behavior, monitoring outcomes, and modifying behavior (Mezzacappa, 2004). As demands on executive functioning increase, working memory and academic performance are negatively affected (Ackerman, Kanfer, Shapiro, Newton, & Beier, 2010). Further, complex academic skills like mathematics (requiring higher cognitive processes) are negatively associated with attention problems (Polderman et al., 2010).

Inattentive behavior may result in social, family, and academic difficulties. Brown, Weatherholt, and Burns (2010) posited that children's attention is positively associated with executive function. Developing children who have deficits in attention are easily distracted by external stimuli and may miss relevant information. There are many children who have been either misdiagnosed or do not meet the full criteria for clinically diagnosed ADHD but still have attention-related academic difficulties (Andrade, Brodeur, Waschbusch, Stewart, & McGee, 2009). These children appear to be at risk for social and academic challenges. The following section will address the specifics of ADHD and academic difficulties.

Attention Deficit Hyperactivity Disorder

Over 15% of the general population of school-age children appear to face challenges related to social competency and associated behavior that interferes with students' abilities to attend and fully engage in academic activities (Stichter et al., 2007). According to the DSM IV-TR (APA, 2000), children with attention difficulties become easily distracted, fail to pay attention to details, and rarely follow instructions carefully.

Attentional control systems appear compromised in these children. These children may be handicapped in terms of social and educational outcomes.

Hyperactivity and other symptoms of ADHD are associated with poor school performance. According to Polderman et al., (2010), attentional difficulties predict academic problems and lower scores on achievement tests. Moreover, Polderman and colleagues argued that there is a negative relation between inattentiveness and academic achievement after controlling for IQ, SES, and comorbid disorders.

Temporal processing deficits may explain the link between hyperactivity and poor academic achievement. ADHD appears to be associated with executive functioning deficits, lower IQ scores, and academic problems (Barkely, 1997; Friedman et al, 2007; Polderman et al., 2010). Genetic factors appear to account for 75% of the ADHD variance across childhood (Hart et al., 2010; Kovas et al., 2007). However, Nikolas and Burt (2010) posited that environmental influences are an additional factor when considering the etiology of ADHD symptoms' domains. Neuropsychological theories address a causal mechanism between ADHD, cognitive impairments, and cortical regions associated with attentional control.

Froehlich et al. (2007) posited that children from low-income families are also more likely to fulfill criteria for ADHD than children from higher income families. Children from low-income families are more likely to be diagnosed with an attention deficit disorder (Amone-P'Olak et al., 2009; Schneider & Eisenberg, 2006). It appears that the rate of ADHD is increasing among children ages 5-17 years.

In particular, there was an increase from 7.8% to 9.5% in the rate of ADHD from 2003 through 2007 across most racial and ethnic groups and among children from low-SES groups. Specifically, ADHD prevalence has increased to 10% among children from families with income less than 100% of the poverty level, and to 11% for those with family income between 100% and 199% of the poverty level in the United States. Additionally, ADHD was more than twice as common among boys as among girls (13.2% versus 5.6%). Finally, high rates of ADHD prevalence were found among multiracial children (14.2%) and children covered by Medicaid (13.6%; CDC, 2010). The aforementioned prevalence rates are based on parental reports and health care providers' diagnoses. Actual numbers may be greater, as there are many individuals with ADHD symptoms who are never diagnosed (Akinbami, Liu, Pastor, & Reuben, 2011).

There appear to be additional constructs that help the understanding of improvement in a student's social and academic difficulties. While attention is an important construct for understanding student test-taking outcomes, the bioecological theory of development posited by Bronfenbrenner (1979) helps to explain the influences of ecological systems on attention. Bronfenbrenner's biological theory of development is discussed next.

Bioecological Model of Human Development

Bronfenbrenner developed an ecological systems theory to explain how environment affects child development. Moreover, the ecological model suggests that individuals' knowledge and development are affected by the support and structure of the society in which they live (Bronfenbrenner, 1979). Bronfenbrenner postulated different

levels of the environment: the microsystem, mesosystem, exosystem, and macrosystem. The *microsystem* is the immediate environment of the child that includes relationships and organizations in close proximity to the child. Child actions, reactions, and temperament interact with the environment, affecting healthy growth. The interactions within the microsystem are labeled the *mesosystem*. The *exosystem* is defined as other people and places that are external to the child but exercise an influence, such as extended family, community, and so forth. The *macrosystem* consists of remote places and people that exercise influence over the child, including cultural values, economy, and government.

Research suggests an association between low-SES environments and children's academic outcomes (Farver et al., 2006). Standardized tests appear not to take the environment into consideration when analyzing test results. Bronfenbrenner's ecological theory posits that instability and unpredictability in children's environments are destructive to children's development and their academic success (Bronfenbrenner, 1979). By investigating the child's environment, one can glean important information when trying to interpret children's academic outcomes, particularly standardized test results. A case can be made that standardized tests may be biased because the environment affects children's social, developmental, and academic skills and standardized tests do not account for these effects. In the following section, I discuss specific environmental factors that are associated with children's academic success. Specifically, family environment factors within the microsystem will be addressed.

Family Environment Considerations

The ability to voluntarily inhibit behavior (effortful control) has been shown to be a marker for attention problems (Foley, Graham, & McClowry, 2008; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Problem behavior is predicted by lower executive attention skills, lower effortful control, and family environment (Willcutt et al., 2005). Effortful control requires attention skills such as inhibition and attentional focusing that are necessary for school success.

School success is typically measured by academic grades and standardized assessments, and it is heavily influenced by family environments (Annunziata et al., 2006).Teachers and the education system cannot control for various home environmental factors associated with low academic achievement. The literature suggests an association between (a) the qualities of family environments and (b) low academic achievement, and tests of mental development (Bradley & Caldwell, 1984). Mezzacappa (2004) posited that the combination of environment and development is associated with IQ, school readiness, school achievement, alerting, and executive attention.

It appears that families that engage in behaviors that encourage children's cognitive development (i.e., reading, explaining events, give-take conversations, and providing stimulating and enriching experiences) are more successful academically (NICHD, 2003). Mezzacappa (2004) argued that socially advantaged families engage in the aforementioned behaviors. Children with these experiences appear to show greater proficiency in accuracy, speed of responding, attention orienting, and executive attention. Additionally, there are other factors associated with attention.

Specific factors within the family environment that affect sustained attention include maternal involvement, single parenting, maternal depression, genetics, and low parental education (Bradley et al., 2000; Dilworth-Bart, Khurshid, & Vandell, 2007; Hart et al.; Kovas et al., 2007). Additional environmental influences associated with attention include family experiences, socioeconomic status, and cognitive stimulation during the preschool and early school ages (NICHD Early Child Care Research Network, 2003). Parents from low-SES households may be less effective in developing children's human capital (i.e., academic and social skills) due to fewer resources and poorer resource availability.

Children from disadvantaged families have poorer cognitive development, may suffer from attention deficits, appear to have a greater risk for low academic achievement, and are at risk for school-related difficulties including those related to academic performance and social behavior (Breznitz & Norman, 1998; Farver et al., 2006; Mezzacappa, 2004; Schneider-Eisenberg, 2006). Research suggests that there are deficits in selective attention and attentional control among young children from lower SES backgrounds compared to children from higher SES backgrounds (D'Angiulli, Herdman, Stapells, & Hertzman, 2008; Norman,& Breznitz, 1992). Children with attention problems and those whose environments are inundated by negative emotions, home chaos, and poor social skills have lower academic achievement (McLelland, Morrison, & Holmes, 2000).

The degree of home chaos (i.e., noise, unstructured stimulation, and unpredictability) has been shown to predict parent reports of poor attention behaviors

(Dilworth-Bart et al., 2007; Dumas et al., 2005; Evans, 2003; NICHD Early Child Care Research Network, 2003). Home chaos is associated with impulsivity, conduct problems, delinquency, reduced cognitive ability, poor academic competence, and reduced attention spans (Johnson, Martin, Brooks-Gunn, & Petrill, 2008).

Bronfenbrenner's bioecological system theory holds that child development is understood within the context of the child's relationships with his or her environment (Bronfenbrenner, 2005; Bronfenbrenner & Evans, 2000). Understanding Bronfenbrenner's model along with the work of Shamama-tus-Sabah and Gilani (2011) helps to explain how home chaos interferes with proximal processes between developing humans, persons, objects, and symbols in the immediate environment.

Overcrowding, high noise levels, and sleep loss are associated with home chaos. Additionally, these factors contribute to parental stress, parenting difficulties, and are negatively associated with sustained attention (Ackerman & Brown, 2010; Evans, 2003). Specifically, work by Hambrick-Dixon (2002) suggested that long-term exposure to high noise levels results in interference of young children's attention and memory skills. Results of their study are consistent with western and nonwestern culture studies that indicate mean differences among children from high and low chaotic families in terms of attention and school problems as perceived by parent and teachers. Finally, anxiety and stress are important factors when one considers the association between home environment and children's academic success and are addressed in the next section.

The literature is replete with studies regarding gender factors and attention. Moreover, there appears to be mixed data in terms of gender considerations. Further,

gender differences were not found in impulsivity, academic performance, social functioning, and fine motor skills (Ardial, Rosselli, Matute, & Inozemtseva, 2011; Gaub & Carlson, 1997). Specifically, research suggests non-significant gender differences in terms of mathematical abilities (Else-Quest, Hyde, & Linn, 2010). Additionally, research that suggests no gender differences in cognitive profiles among ADHD children (Bauermeister, et al., 2007; Yang, Jong, Chung, & Chen, 2004). Other studies indicate boys were more severely affected than girls with regard to ADHD symptoms including problem behaviors (Thorell & Rydell, 2008).

Anxiety and Stress Factors

Stress is another factor that negatively impacts children's academic functioning. Moreover, economic disadvantaged families are exposed to numerous stress factors (Reese & Gallimore, 2000). Poverty, disorderly homes, overcrowding, and poor health care characterize low-SES environments. Each of these factors appears to affect children's school success (Raver & Kintzer, 2002). Farver and colleagues (2006) further argued that maternal stress is associated with attention problems primarily for middle-aged children. Additionally, there appears to be a negative association between attention-concentration and children whose mothers were exposed to high levels of stress during pregnancy (Gutteling, De Weerth, & Buitelaar, 2004.).

Anxiety and stress factors appear to be associated with children's psychological well-being and academic achievement (Fields & Prinz, 1997). It appears that there is a causal link between anxiety and later psychopathology (Leung, Yeung, & Wong, 2010). Family income and length of time spent living under economically stressed conditions

also increase the risk for psychological and behavioral problems and poor academic performance (Breznitz & Norman, 1998). In addition to environmental stress, heightened anxiety is associated with school examinations, unsatisfactory performance, parental demands for excellence, making comparisons with classmates, and testing time pressures (Burnett & Fanshawe, 1997).

Cortisol and its effects in the medial and dorsolateral prefrontal regions of the brain negatively affect attention, are related to stress, and result in poor executive functioning (Lupien, King, Meaney, & McEwen, 2001). Children from lower SES backgrounds present with higher salivary cortisol levels than children from high SES backgrounds. Moreover, cumulative exposure to high stress factors and high levels of cortisol are related to depression, cognitive deficits, and poor learning and memory (Brunner et al., 2006; Lupien et al., 2001). Lower levels of cortisol appear to affect cognitive processes differently. Bugental, Schwartz, and Lynch (2010) posited that lower cortisol levels in infancy are associated with higher scores in short-term memory processing among later aged children.

Trauma is a factor associated with stress and may include events such as domestic and community violence, crime, and life-threatening diseases. These events are especially evident in low-SES environments. Additionally, trauma may be transmitted to children from parents through emotional unavailability, verbal communication, and behavior (Eng, Mulsow, Cleveland, & Hart, 2009). According to the fourth edition (text revision) of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM IV-TR; APA, 2000),

symptoms of posttraumatic stress disorder (PTSD) are associated with poor concentration, hypervigilance, and other negative psychological-physiological symptoms.

The ability of children to perform adequately is in part, associated within the environments in which they spend their time (Gregory & Rimm-Kaufman, 2008). The environment where children spend their time impacts development in terms of brain structures such as the frontal lobes and reticular activating system and affects abilities such as sustained attention and impulse control (Dilworth-Bart et al., 2007).

It appears the research suggests numerous family and environmental protective factors associated with children's attentional abilities. These factors may help mitigate and protect against detrimental influences. The following section addresses the home environment, family cohesion, parental involvement, self-regulation (S-R), and parenting style in terms of protective factors.

Mitigating and Protective Factors

Family cohesion and parental monitoring are factors that play a role in children's level of functioning and academic success. Family cohesion is defined as emotional bonding between family members. Parental monitoring refers to parental structure in the home, school, and community that is tracked by parents. Research by Annunziata et al. (2006) suggested that family cohesion and parental monitoring are correlated with school engagement. Other factors including SES, parental routine, parent-child relationship, and a supportive environment of encouragement affect attention among students and impact the general well-being of children across many world societies (Bradley & Corwyn, 2002).

Parenting style is associated with children's attentional abilities and academic success. In particular, authoritarian parenting style is associated with family poverty, parental low SES, and parents' low educational attainment (Flouri, 2007). Flouri posited that authoritarian style appears to impede academic development due to factors such as under development of autonomy and self-direction, reduction in self-confidence, and feelings of personal distress and inadequacy.

Self-regulation (S-R) is another factor associated with academic success. Temperament and cognitive attentional skills are associated with academic achievement (Froehlich et al., 2007). Moreover, S-R is a component of temperament that refers to the emotional, motor, and attentional abilities that help suppress inappropriate behavior during instruction (Miech, Essex, & Goldsmith, 2001). Miech and colleagues suggested that low-SES children have lower levels of S-R that affects school adjustment and academic outcomes. In a qualitative study by Brown and Burns (2010), the researchers found that child attention behaviors, S-R, and home environment are additive in their predictive relation to parent reports of problem attention behaviors.

Stressful relationships in the home environment are negatively associated with academic performance (Murray-Harvey, 2010). Supportive relationships however, and specifically parental support, show a very strong indirect association with academic performance and relate to effective social, affective, and academic domains (Leung et al., 2010). It appears that parental involvement and support appears to be related to children's social and academic outcomes and begins in infancy.

Protective factors provided by parents lessen the chance of school failure even when children are exposed to social risk factors i.e., poverty, single parenthood, large households, low parental education unemployment, and low-income (Burchinal, Roberts, Zeisel, & Rowley, 2008). Parents help children develop cognitive and S-R abilities that are significantly related to children's socio-emotional adjustment (Muthukrishna & Borkowski, 1995). Positive-parenting and quality home environments predict better socio-emotional and academic outcomes and buffer against the effects of high-risk environments (Jones, Forehand, & Brody, 2002). Positive-parenting appears to influence academic outcomes because it affects children's abilities to maintain attention and inhibit behavioral impulsivity. Parent awareness and intervention may mitigate risk factors associated with low-SES environments.

Maternal responsiveness and cognitive stimulation are positively related to attention. Moreover, family environment, maternal behavior, and parental attitudes are associated with individual differences in infants' abilities to sustain attention and inhibit impulsive responding (Bradley et al., 2000). Particularly, parental behaviors such as scaffolding and academic preparation (i.e., reading together, counting objects, structured play) help infants and developing children learn to sustain attention (i.e., playing with toys, stories, social encounters, and other activities). Additionally, the time children participate in academic endeavors and learning activities is predictive of academic outcomes. Therefore, family environment predict children's ability to regulate their attention by the preschool years, and those attention processes predict achievement and

social outcomes for children later in life (Bradley et al., 2000; Shonkoff & Phillips, 2000).

Racial-ethnic group membership and SES are associated with academic achievement (Burchinal et al., 2000). Burchinal and colleagues posited that racial group membership is not an inherent risk factor but the product of cumulative experience including forms of racial discrimination, oppression, negative school-home experiences, racial profiling, mother-child interactions, and low expectations. Gregory, Rimm-Kaufman (2008) found that low-income families mitigated risk factors when early care predominated. Gregory and Rimm-Kaufman further suggested that mother-child interactions, measured in kindergarten, can predict educational success in high school.

In addition to family environmental influences, an understanding of the *cognitive fatigue* (CF) construct is important when one considers attentional processes. CF is associated with attention and discussed in detail in the following section.

Cognitive Fatigue

In academic areas, students must perform well to compete for grade and course placement. Students must avoid off-task thoughts and continue to exert effort, when cognitively fatigued, to maintain optimum performance. According to Ackerman and Kanfer (2009), increasing CF occurs as time-on-task increases. Moreover, when there is a high level of cognitive effort required, CF is negatively related to affect and positively associated with physiological changes including drowsiness, impaired concentration, and somatic pain. Further, personality and motivational traits factors are associated with CF and may mitigate performance outcomes when test sessions last for several hours. Rest or

engagement on a different task can mitigate the effects of CF during prolonged test conditions (Ackerman et al., 2010).

Ackerman and Kanfer (2009) used the Scholastic Aptitude Test (SAT) to determine the association between length of test and test performance in terms of CF. Results indicated a negative association between test time and performance. From a test-takers point of view, students experienced CF during longer tests with concomitant reported reduction of effort. The research by Ackerman and Kanfer involved older students who perhaps have learned various coping and test taking strategies and therefore, showed no negative association between test-time length and test performance. Younger children may not have mastered such strategies, show reduced effort, and may perform worse under long testing conditions. Ackerman and Kanfer argued that personality traits, achievement motivation, competitiveness, anxiety, reduced sleep, confidence, and emotions play a role in a student's CF experience. Finally, they posited that fatigue and outcomes might be related to student expectations and prior experience with testing.

The literature suggests that there is a plethora of test accommodations including types, format, implementation strategies, and time allotment (Sireci, Li, & Scarpati, 2006). Time accommodation is a specific accommodation used with LD students. The following section addresses the specifics of time accommodations.

Time Accommodations

According to Heinonen et al. (2011), motivation, task engagement, specific test conditions, and setting affect children's performance on cognitive tasks. Heinonen and

colleagues argued that attention is a critical factor when evaluating differences between children who exhibit good or poor test-taking abilities. Moreover, decrements in test-taking performance (i.e., attentiveness) occur after 35 minutes of testing (Chaudhuri & Behan, 2004). Further, greater decrements in test-taking behavior appeared during later half of test sessions compared to the first half of tests for both children with and without attentional difficulties. It is posited that increased test length is positively associated with fatigue, ability to cooperate, and test outcome expectations. Offering extended time appears to help LD student's test performance abilities (Perlman, 1996).

Extant theory holds that students with disabilities perform lower than students without disabilities (Elliott, Bielinski, & Thurlow, 1999). A particular accommodation (i.e., extended time), for students with disabilities, appears to improve test performance compared to students with no disabilities (Perlman et al., 1996; Sireci et al., 2006). Further, children with ADHD symptoms represent a significant proportion of the student populations who receive test accommodations such as extended time (Pariseau, Fabiano, Massetti, Hart, & Pelham, 2010).

Students with ADHD have impaired executive functioning i.e., inhibition, slower response time, and show reduced sustained attention (Stins et al., 2005). Moreover, students' difficulties with executive functioning appear to translate to overall performance deficits. These children often present with behavioral, executive functioning, and academic difficulties that negatively affects academic performance resulting in poor reading and math standardized test scores (Loe & Feldman, 2007; Raggi & Chronis, 2006). Loe and colleagues argued that ADHD students complete their work

with increased accuracy under shorter timed conditions. Since attention reduces as test time progresses, dividing tests into smaller segments appears to be a plausible test and valid accommodation.

While there is a plethora of literature regarding the efficacy of extended time accommodations for special education students of varying ages (Munger & Loyd, 1991), there is research that suggests different outcomes. Some researchers posited that varying timed conditions showed no effect on performance outcomes among students with and without disabilities (Pariseau et al., 2010). Specifically, Preston et al. (2009) suggested that students with learning difficulties in math performed better when tested using a continuous timed protocol compared to a control group of students who had extended time. They posited that perhaps the children with ADHD used in their study did not show improved performance when given extended time because students with ADHD use their time more efficiently when knowing they had a time limited test.

Preston et al. (2009) also found that the rate of accurate problem completion increased during continuous timed protocols. Students with ADHD may work more efficiently during a shorter time allotment than when they have longer tests with more items. Dividing tests into shorter durations over multiple days (divided time), while retaining the full allotment of test items, may be a plausible solution for increased performance outcomes and improved test validity.

A review of the literature revealed only one study that used a divided timed test protocol. As of 2000, 26 states allowed extra time accommodations for statewide testing by offering divided timed protocols for students with disabilities on the Minnesota Basic

Standards Test in reading comprehension (Waltz et al., 2000). Waltz and colleagues studied dividing a standardized test into multiple-day sessions and allowed unlimited time during each session. This study involved middle school students from rural and urban schools in Minnesota. Students were selected based on their special needs versus general education status.

The results suggested that general education students performed worse when taking the test over multiple days. There was no significant association between multiple-day testing and performance among students with learning disabilities.

Summary

Chapter 2 reviewed pertinent theoretical aspects of attention and socioeconomic factors associated with attention difficulties. Attention is associated with academic outcomes including standardized test results among students. Research suggests that family and societal factors impact attention in developing children. Further, those factors associated with deficits in attention appear to be more prevalent among students from low-SES environments. While test accommodations are provided for students with disabilities (i.e., learning disabled, ADHD), there are many students who may benefit from test accommodations who are not identified and formally diagnosed. Leveling the academic playing field is an appropriate strategy for public school education among general and special population students, not by lowering performance of general education students, but by increasing the performance of special education students and those not identified as LD.

Various researchers have discussed and postulated theoretical perspectives regarding attention. Treisman's theory of early selection and attenuation with partially processed unattended stimuli appear to be the predominant theoretical base grounding much of the existing research addressing attention (Treisman, 1960). One of the important components of attention is *vigilance* (sustained attention).

Deficits in attentional processing are associated with poor academic performance. Numerous factors affect sustained attention that place low-SES children at a disadvantage in terms of academic skills necessary for success. Research appears to suggest a negative association between ADHD and academic achievement. Moreover, it appears that ADHD diagnoses are increasing in prevalence among children ages 5-17 years (Akinbami, & Reuben, 2011).

The literature suggests a positive association between family environment and academic achievement. Families who engage in behaviors that encourage children's cognitive abilities tend to have children who are more successful academically at school (NICHD, 2003). However, many students from low-SES homes are not provided with the necessary resources for educational success (Morgan, 2009). Moreover, economically disadvantaged children are exposed to numerous stress factors that are negatively associated with sustained attention. Stressful environments include overcrowding, poor health care, authoritarian parenting styles, chaos, trauma, lack of parental involvement, and additional physiological-psychological difficulties. Elevated levels of each of the aforementioned factors are associated with lower executive attention skills and academic performance.

Gender differences among children with and without attentional difficulties appear non-significant in terms of language and cognitive abilities. Boys however appear more affected by ADHD symptoms than girls in terms of problem behaviors and family burden.

CF appears to be associated with executive processing and affects testing outcomes. Additionally, CF is associated with the ability to sustain cognitive effort during testing conditions. Periodic breaks or engagement on different tasks appears to mitigate the effects of CF.

Many researchers argue for a negative association between test length and academic performance. The test accommodation of extending time for improved performance has mixed results. Students with disabilities and children from low-SES groups appear to be at a disadvantage when testing, in part due to sustained attention deficits. While extended time is the predominant intervening intervention, there is little literature regarding divided test session accommodations that may mitigate negative effects of CF and sustained attention difficulties.

The literature is replete with studies that address the need to accommodate students who are at a disadvantage in terms of standardized testing. Due to the importance the education system places on test scores, determining appropriate strategies is of utmost importance. It appears that only one study was performed regarding a divided test session accommodation. Moreover, there appeared to be limited studies involving elementary age children in terms of test accommodations except for extended-

time considerations. Further, those studies appeared to focus only on students with disabilities.

The concept of test accommodation has particular efficacy when considering low-SES children who have attention intrinsic deficits or come from environments that may create cognitive deficits in terms of their ability to attend and adequately perform. This study attempted to add information to the body of knowledge concerning test accommodations among low-SES elementary students. Specifically, it attempted to explore whether a divided timed test accommodation affects student test scores from low-SES environments who may have attentional difficulties but are not formally diagnosed with LD.

Chapter 3: Research Method

Introduction

Chapter 3 includes a discussion of the research design, sample, and sampling method. Moreover, this chapter includes a description of collected data, the method of data analysis, the protection of human subjects, and confidentiality issues.

Research Design and Approach

The purpose of this study was to determine if there was a significant association between two different testing protocols (i.e., continuous and divided) and test outcomes among low- and non-low-SES fifth grade students. Moreover, this study tested the research hypothesis that tests scores on the TAKS would be statistically different between continuous and divided assessment protocols among low- and non-low-SES fifth grade students in mathematics. Further, this study tested the hypothesis that there would be a statistical difference by gender in terms of test scores among low- and non-low-SES groups. To test this hypothesis, this research used a quasi-experimental design where classrooms were assigned to either a treatment group (i.e., divided protocol) or control group (i.e., continuous protocol). This method eliminated the possibility of systematic bias. This approach used a quantitative and inferential design and statistical analysis. Moreover, it may be considered a quasi-experiment because the predictor variable was not manipulated and there was no random sampling.

Population and Procedures

A convenience-sampling procedure was used that involved recruiting students from charter schools in the Boise, ID area. These schools served suburban populations

classified as low- and non-low-SES. Low-SES individuals are defined as such by U.S. government poverty guidelines (U.S. Department of Health & Human Services, 2009) and Title-I classifications (U.S. Department of Education, 2005).

In order to recruit participants, proposals were disseminated to a charter school director in the Boise, ID area. The Boise area uses various standardized tests as benchmark exams throughout the year. Typically, parents do not sign consent forms for student participation in classroom benchmark assessments (CBA). Assent and consent are implied within the context of school-administered CBA assessments. The CBA assessment period was used for this study. Students diagnosed with LD or ADHD were not excluded from participation in this study.

Sample Size

The population mean and sample mean differences, the variability of scores, and sample size affect the hypothesis test. Moreover, the basic elements of hypothesis testing include sample statistics, estimate of error, test statistics, and alpha level. Further, it appears that a specific hypothesis test does not evaluate the size of a treatment effect. In this study, the power of the statistical test helped in understanding the chance that the test would correctly reject the null hypothesis. Finally, power is influenced by effect size, sample size, alpha level, and differences inherent in one-tailed versus two-tailed tests. In this study, a sample size calculator helped to determine the sample size given a certain alpha, power, and sensitivity (Gravetter & Wallnau, 2007).

The sample size for this study was determined by using g*power 3.1. (Faul, Erdfelder, Lang, & Buchner, 2007). It appears that research regarding test

accommodations uses large sample sizes with large effect size. Cohen identified a large effect size as .80 (Gravetter & Wallnau, 2007). The g*power analysis for the current study used .05 for alpha, .95 for beta, and 0..80 for effect size. A minimum total sample size of 54 participants resulted from the analysis. It appears this sample size provided adequate power when using an ANOVA statistical procedure.

Procedure

Students were tested in school classrooms in groups of approximately 18-25 students. Two schools that were similar in demographics were chosen. Low-SES students totaled 29% of the fifth grade census in the schools selected for this study. One school participated in the study using the divided protocol, while the second school participated using the continuous protocol. The current method of benchmark testing in these schools was the continuous protocol.

Teachers were trained in standardized testing procedures using Idaho testing standards. It appeared that Idaho testing standards were similar to TEA standards. Students in the continuous testing condition were given 4 hours to complete the exam. Students in the divided protocol condition were given 80 minutes each day for three days to complete the exam. The divided exam was separated into three portions of an equal number of questions in the same order presented on the continuous exam. Students were allowed restroom breaks only one time per 80 minutes during the continuous protocol. In the divided protocol condition, students were taken to the bathroom immediately before the testing began.

Teachers implemented TEA-approved proctoring procedures during both testing protocols. Teachers were not allowed to read test questions to the students or coach students during the assessments. Test booklets and answer sheets were kept by the teacher and given to the director after each testing session. The director delivered, in person, the answer sheets to school personnel responsible for data entry and scoring. Test booklets and answer sheets were coded in order to include demographic data. These materials were kept in a secure place determined by the school director and in accordance with valid TAKS testing procedures.

Data Collection and Instruments

A separate answer sheet was provided each day for the divided testing protocol. One answer sheet was provided for the continuous protocol. The released version of a fifth grade TAKS was the instrument used for this study. Testing commenced during the first term of the 2013 academic year. The Walden University IRB approval number was 10-30-12-0147925.

Data Storage

Teachers delivered test booklets and answer sheets to the director immediately following the completion of each test. The data collected were transferred to a school computer and stored on a flash drive. The flash drive was accessible via a password known only to me. The data was analyzed using SPSS. Finally, the data were deleted following SPSS analysis and dissertation approval (i.e., no later than 24 hours following approval).

Data Analyses

Descriptive Analysis

Once the data were transferred to SPSS for analysis, the samples were analyzed to determine means and standard deviations of the criterion variables. Descriptive statistics were used to identify the sample's distribution among the variables of interest including skewness and kurtosis. Once the descriptive data analysis was performed, inferential analysis commenced.

Inferential Analysis

It was theorized that providing divided test accommodations to low-SES students would increase their overall test scores relative to those students of similar low-SES who took the TAKS under the usual continuous protocol. It was further theorized that non-low-SES students' test scores would show no statistical difference between the divided and continuous test protocols. Additionally, it was theorized that test scores for boys would be statistically higher than test scores for girls among both SES groups. The goal of inferential analysis was to measure the amount of variability between and within the samples. ANOVA was used to divide the total variability into two components: between-treatment variance (i.e., measuring the differences between sample means between treatment conditions) and within-treatment variance (i.e., providing a measure of variability within each treatment condition).

Summary

Chapter 3 discussed the research design and approach to this study. The population from which samples were obtained was discussed, along with sample size

determination. The procedure for data collection, data storage, and different data analyses protocols were also delineated. Chapter 4 will address the results of this study. Chapter 5 will present the discussion, conclusions, and recommendations.

Chapter 4: Results

Introduction

Chapter 4 addresses data analysis and provides tables for demographics, descriptive statistics, and data from tests of between-subjects effects. Additionally, the study hypotheses are discussed in terms of statistical results. Finally, a summary is provided with an introduction to Chapter 5.

This study explored the relationship between testing protocols (i.e., divided or continuous) and student achievement. Specifically, the purpose of this study was to determine if there was a significant association between two different testing protocols (i.e., continuous and divided) and standardized math assessment (TAKS) test outcomes among low- and non-low-SES fifth grade students. Moreover, this study tested the research hypothesis that tests scores on the TAKS would be statistically different between continuous and divided assessment protocols among low- and non-low-SES fifth grade students and between both genders in mathematics.

Originally, I planned to sample fifth grade students from Houston, TX school districts. After attempting collaboration with more than 10 school districts and their respective elementary schools from September 2012 to January 2013, I was unable to obtain collaboration. Therefore, it was necessary to contact school districts outside of Texas.

I found a charter school system in the Boise, ID suburban area. In the schools sampled from this system, 29% of students were classified as low-SES. The sample size was limited to 58 students in two schools: Liberty Charter School and Legacy Charter

School. Each school's fifth grade classes participated in either the continuous or divided math TAKS test protocol.

I investigated whether charter schools would be more amenable to data collection collaboration for this study. Additionally, I obtained information from professional contacts regarding a specific progressive charter school system in the Boise, ID area. The study design required student participants from both low- and non-low-SES areas. The Legacy and Liberty Charter Schools reported a census indicating that approximately 30% of students represented the low-SES student population and were willing to participate in this study. Moreover, it appeared that the sample size of 58 fifth grade students provided adequate power when using an ANOVA statistical procedure. An interest letter, summary of the study, and data use agreement were sent to the director of these charter schools. After receiving a positive response and reviewing Boise, ID statutes, I made changes to the IRB application and received approval to collect data.

This study was designed to answer two research questions. The first question was "Is there a significant relationship between continuous and divided assessment protocols and TAKS test scores among low-SES and non-low-SES students?" The second question was "Is there a significant relationship between test protocols and test scores with respect to gender?" This research used a quasi-experimental design where classrooms were assigned to either a treatment group (i.e., divided protocol) or control group (i.e., continuous protocol). The results of this study are reported in tabular and narrative form.

Data Analysis

Data were analyzed using a univariate analysis of variance (ANOVA) procedure.

The alpha level was established at .05. A total of 58 students from two classrooms involving two different schools participated in this study.

Of the total number of participating students, nearly two-thirds (64%) were male and nearly three-fourths (71%) were classified as non-low SES. The average student age was 10.7 years, with students 10 years of age and older comprising 97% of the sample.

I obtained data from two schools (Liberty Charter School and Legacy Charter School) from the Boise, ID area. Data from students tested under the continuous protocol were obtained from Liberty Charter School. Data from students tested under the divided protocol were obtained from Legacy Charter School. Data were examined to determine whether there was a difference in mathematics test scores between the two testing protocols and between genders among low- and non-low-SES students. ANOVA and an analysis of covariance (ANCOVA) results were used to determine if there were significant differences between the two testing protocols.

Sample and population means were compared for both the continuous and divided testing protocols. The predictor variable, when assessing the relationship between testing protocol and student scores on the TAKS, was the testing protocol. The criterion variable was student scores on the TAKS. The hypotheses for this study were as follows:

$H_{0:}$ Mean scores on the TAKS will be statistically equivalent between divided and continuous assessment protocols among low- and non-low-SES elementary students. Additionally, the assessment protocol mean scores for the boys will be statistically equivalent with the mean scores for girls among low- and non-low-SES elementary students.

$H_{1:}$ Mean scores on the TAKS will be statistically different between the divided and continuous assessment protocols among low- and non-low-SES elementary students. Additionally, the mean scores for the boys will be statistically different from the mean scores for girls among both low- and non-low-SES groups.

An analysis of covariance (ANCOVA) was run to determine the effect of two different testing protocols and TAKS test scores after controlling for SES and gender. The predictor variable, when assessing the relationship between testing protocol and student scores on the TAKS, was the testing protocol. The criterion variable was student scores on the TAKS. Additionally, a univariate analysis of variance (ANOVA) was used to identify any between-group differences in mean scores on the TAKS mathematical test in two testing protocols for low- and non-low-SES students and for male and female students. Descriptive statistics are displayed in Table 1. Tests of between-subjects effects are displayed in Table 2.

Table 1

Descriptive Statistics

Protocol	SES	Gender	Mean	Std. Deviation	N
Continuous	Low SES	Male	33.8571	7.05759	7
		Female	35.0000	5.29150	3
		Total	34.2000	6.30344	10
	Non-Low SES	Male	32.6875	11.60298	16
		Female	32.1667	8.56543	6
		Total	32.5455	10.66247	22
	Total	Male	33.0435	10.28007	23
		Female	33.1111	7.40683	9
		Total	33.0625	9.44231	32
Divided	Low SES	Male	26.3333	13.57694	3
		Female	27.0000	12.56981	4
		Total	26.7143	11.85628	7
	Non-Low SES	Male	32.1818	7.76940	11
		Female	33.2500	7.22595	8
		Total	32.6316	7.35762	19
	Total	Male	30.9286	8.99969	14
		Female	31.1667	9.26217	12
		Total	31.0385	8.93748	26
Total	Low SES	Male	31.6000	9.34761	10
		Female	30.4286	10.32565	7
		Total	31.1176	9.45967	17
	Non-Low SES	Male	32.4815	10.04747	27
		Female	32.7857	7.52614	14
		Total	32.5854	9.16781	41
	Total	Male	32.2432	9.74225	37
		Female	32.0000	8.37257	21
		Total	32.1552	9.19535	58

Note. Dependent variable = test score (44 max. possible).

Table 2

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	433.316[a]	7	61.902	.706	.667	.090	4.939	.272
Intercept	42079.519	1	42079.519	479.671	.000	.906	479.671	1.000
Protocol	165.964	1	165.964	1.892	.175	.036	1.892	.271
SES	46.964	1	46.964	.535	.468	.011	.535	.111
Gender	107.416	1	107.416	1.224	.274	.024	1.224	.192
Protocol * SES	179.022	1	179.022	2.041	.159	.039	2.041	.289
Protocol * Gender	87.422	1	87.422	.997	.323	.020	.997	.165
SES * Gender	81.488	1	81.488	.929	.340	.018	.929	.157
Protocol * SES * Gender	39.872	1	39.872	.455	.503	.009	.455	.101
Error	4386.287	50	87.726					
Total	64789.000	58						
Corrected Total	4819.603	57						

Note. Dependent variable = total raw score.
[a]*R* Squared = .090 (Adjusted *R* Squared = -.038). [b]Computed using alpha = .05,

Hypothesis 1

The null hypothesis stated, “the mean scores on the TAKS will be statistically equivalent between divided and continuous assessment protocols among low- and non-low-SES elementary students.”

A 2 X 2 X 2 (protocol X SES X gender) factorial analysis of variance tested the effects of testing protocol on TAKS test scores. Results indicated no significant main effects for the protocol factor, $F(1,50) = 1.89$, $p = .18$. Further, results indicated no significant main effects for the SES factor, $F(1,50) = .54$, $p = .47$. Students who took the continuous protocol TAKS test showed no significant difference in test scores ($M = 33.1$) compared to students who took the divided protocol TAKS test ($M = 31.0$). Additionally, low-SES students who took the continuous protocol TAKS test ($M = 34.2$) showed no significant difference in test scores ($M = 34.2$) compared to low-SES students who took the divided protocol TAKS test ($M = 26.7$). Finally, after adjusting for SES, there was no statistically significant difference in test scores between the two testing protocols, $F(1,54) = .347$, $p = .558$, partial $\eta^2 = .006$. Therefore, I failed to reject the null hypothesis. Mean scores on the TAKS were statistically equivalent between divided and continuous assessment protocols among low- and non-low-SES elementary students.

Hypothesis 2

The null hypothesis stated, “the mean scores on the TAKS will be statistically equivalent between divided and continuous assessment protocols for male and female students.” Results indicated no significant main effects for the gender factor, $F(1,50) = 1.22$, $p = .27$. Male students who took the continuous protocol TAKS test showed no

significant difference in test scores (M = 33.0) compared to female students who took the continuous protocol TAKS test (M = 33.1). Additionally, male students who took the divided protocol TAKS test showed no significant difference in test scores (M = 30.9) compared to female students who took the divided protocol TAKS test (M = 31.2). Finally, after adjustment for gender, there was no statistically significant difference in test scores between the two testing protocols, $F(1,54) = .011$, $p = .918$, partial $\eta^2 = .000$. Therefore, I failed to reject the null hypothesis. Mean scores on the TAKS were statistically equivalent between continuous and divided testing protocols for male and female students.

Answers to Research Questions

The two research questions of this study were as follows: Is there a significant relationship between continuous and divided assessment protocols and TAKS test scores among low-SES and non-low-SES students? Is there a significant relationship between test protocols and test scores with respect to gender? Based on the results of the ANOVA, I failed to reject the null hypotheses. I concluded that there is no significant relationship between the continuous and divided testing protocols in terms of test scores. Additionally, I concluded that there is no significant relationship between the two protocols and gender in terms of test scores.

These results suggest that low-SES fifth grade elementary students do not perform better if they are provided a test accommodation of a divided test protocol. Additionally, fifth grade boys and girls appear to perform equally well when a one-sitting test (continuous) is compared to a multiple-day (divided) testing format. Therefore, a

reasonable conclusion is that a multiple-day (divided) test accommodation does not significantly affect test scores in terms of SES and gender.

Summary

In this section, the data collected for this study were presented and analyzed. Based on the results of the statistical analysis, the answers to the two research questions are as follows: There was no significant relationship between continuous and divided assessment protocols and TAKS test scores among low-SES and non-low-SES students. Further, there was no significant relationship between continuous and divided assessment protocols and TAKS test scores by gender. The test results lead me to conclude that offering an accommodated (divided) testing protocol to general education students does not significantly affect test scores in terms of SES and gender.

In Chapter 5, I will discuss these findings and their implications for social change. Further, Chapter 5 will address conclusions of the study and recommendations for future study.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to examine the relationship between mathematical TAKS test scores and testing protocols among low- and non-low-SES fifth grade elementary students by gender. Specifically, I compared test scores of two groups of fifth grade students who took the TAKS math test using one of two testing protocols, namely a continuous or divided protocol. A quantitative, quasi-experimental research design was used in this study. I used ANOVA to determine if there was a significant difference in test scores between students taking the continuous and divided test protocols for low- and non-low-SES students and for male and female students. Additionally, I used ANCOVA to determine if was a significant difference in test scores between students taking the continuous and divided test protocols after controlling for gender and SES.

In this chapter, the results are discussed and interpreted in the context of Treisman's (1960) theory of attention and Bronfenbrenner's (2005) theory on bioecological human development. Additionally, this chapter contains a discussion of limitations of the study, implementations for social change, recommendations for further action, future study suggestions, and conclusions.

Interpretation of the Findings

The literature suggests that test accommodations are beneficial for students with and without learning disabilities. There are little data, however, regarding the benefits of test accommodations for elementary-aged children from low-SES groups who have not been formally diagnosed with LD. Extended time can be a typical test accommodation

used in public school systems. There appears to be little literature regarding another form of accommodation among students not diagnosed with LD, namely divided (multiple-day) testing.

Ward (1960) discussed Treisman's theory of attention and suggested that humans attend to stimuli of choice and that this attentional focus occurs due to a filtering process. Moreover, Treisman posited that external stimuli can influence attentional control. Specifically, sustained attention is necessary for academic tasks such as assessment exercises. Other theories have been developed in an attempt to explain attention in young children. For example, Bronfenbrenner (1979) developed an ecological systems theory to explain how the environment affects child development and attentional abilities. He posited that the microsystem (i.e., the immediate environment) of a child influences the child's attentional growth and development. Research suggests that the child's environment is associated with his or her academic outcomes, as partially evidenced by results on standardized tests.

Deficits in attention may be prevalent among students from low-SES environments. Moreover, it appears that students from low-SES homes are not provided with the necessary resources for educational success partially determined by academic test outcomes. Standardized tests may be biased in terms of time for completion in favor of students who do not exhibit attentional difficulties.

The original proposal for this study involved collaboration with Texas school districts to obtain data regarding two different testing protocols. The research question was "Is there a significant relationship between standardized test scores and test protocols

for low-SES students and for male and female students?" After 5 months and 10 contacted school districts, I was unable to obtain a collaborative partner in Texas. Therefore, it was necessary to extend the search for a collaborative partner outside Texas.

I found a charter school system in the Boise, ID suburban area. In the schools sampled, approximately 30% of students were classified as low-SES. The sample was limited to 58 students in two schools: Liberty Charter School and Legacy Charter School. Each school's fifth grade classes participated in either the continuous or divided math TAKS testing protocol.

The results of the study did not support the alternative hypothesis suggesting that low-SES fifth grade students would perform better when tested using a divided protocol. Additionally, the results suggested that male and female students' test scores were statistically equivalent. There are a number of factors that may explain these results, including sample size, demographics, and test-taking stress factors among students.

Sample Size

The probability of finding a significant difference in a sample given between-group differences for a specific sample size is called *power*. Specifically, the power of a statistical test is the probability that a researcher will correctly reject a false null hypothesis. Additionally, the greater the power, the greater the likelihood of finding a significant difference between groups. Factors that have an influence on power are sample size, effect size, and alpha level (Gravetter & Wallnau, 2007). I used an alpha level of .05, which appears consistent with social science and education research. The convenience sample size obtained was 58 students. This study failed to find a significant

difference between sample groups - perhaps due, at least in part, to the small sample size. Sample demographics are additional factors associated with the results of this study.

Participant Considerations

Generally, SES factors include a family's income and family members' education and occupation. Moreover, the literature suggests inequities in access to and availability of resources among low-SES families in urban areas (Morgan, 2009). SES was solely determined by student access to free and reduced-price lunches in this study. Specific factors associated with low SES were not considered.

The convenience sample used for this study only included low-SES students from a White middle-class suburban area. Children from low-SES households in urban areas develop academic skills more slowly where low literacy environments, chronic stress, limited literacy resources, and emotional distress exist (Morgan, Farkas, Hillemeier, & Maczuga, 2009). A more diversified sample (i.e., low-SES students from urban areas where families are exposed to numerous additional stressors), might have resulted in significantly different test scores between testing protocols.

Aikens and Barbain (2008) posited that school systems in low-SES communities typically are under-resourced and affect young students' academic progress. Additional detrimental factors associated with lower academic success in low-SES communities include parents' lack of financial resources for books, computers, and tutors (Orr, 2003). Factors such as high unemployment and migration of the best teachers affect the quality of education in low-SES communities (Muijs, Harris, Chapman, Stoll, & Russ, 2009). In

addition to familial and community factors, the quality of schools is associated with academic success.

The literature appears to suggest a number of factors associated with improvement in the quality of schools in low-SES urban neighborhoods. Schools that focus on improving teaching and learning, create an information-rich environment, build a learning community, offer continuous professional development, involve parents, and increase funding and resources affect academic quality in low-SES schools (Muijs et al., 2009). Children with higher SES backgrounds are more likely to be proficient on tasks of addition, subtraction, ordinal sequencing, and math word problems than children with lower SES backgrounds (Coley, 2002). The results of this study were not consistent with the literature that associates low-SES students with lower test scores.

Teaching Methodology

Charter schools may provide parents with an alternative education choice. According to Hassel, Hassel, and Abeidinger (2011), there exists controversy about the contribution of charter schools in the United States. Many educators, parents, and students attribute increased academic success to the charter school's approach to learning. It appears there are a plethora of examples of low-SES students who enter school years behind their peers. Research suggests that charter schools can narrow the academic gap for these students by providing programs that promote hard work, no excuses, parental involvement, and innovative instructional methodology (Reardon, 2009). Additionally, Richwine (2010) found that charter schools can offer substantial benefits to students and families, particularly in low-SES communities.

The aforementioned factors may have played a significant role in terms of the statistically nonsignificant results of this study. The Harbor School method of instruction, one of many charter school methodologies, provides an atmosphere conducive to increased student outcomes. This model is an integrated model designed to improve the knowledge, skills, attitudes, and dispositions of students. The elements of the model are subsequently delineated.

Key elements between students, teachers, and parents include instructional fidelity, school leadership, increased parent participation, required second language study, piano lessons, enriched gifted and talented services, and improved integration of community in the learning process. In particular, the math program uses a fast-paced, direct teaching method. Under this method, students are led to achieve essential and accelerated objectives in a repetitive manner using recitation and group choral responses. Liberty and Legacy Charter Schools and other similar charter schools operate with the freedom to experiment with new curricula and maintain a program with proven success. Students classified as low and non-low-SES may have benefited from charter school pedagogy.

Kaylor and Flores (2008) found that students from low-SES groups reported higher levels of academic effort when they were enrolled in programs such as those offered in charter schools. It appears that the students who participated in this study were more prepared for the TAKS because of the charter school methodology. Thus, better prepared students and participation in a reduced stress learning environment with

improved student participation and attitudes are plausible reasons for the non-significant differences in test scores between testing protocols.

Test-Taking Stress

Test-taking stress is evident among students when one considers the current spotlight on academic achievement measured by standardized tests. Chronic student stress is associated with lower outcomes, particularly in terms of students taking standardized assessments (Grant, Compas, Thurn, McMahon, & Gipson, 2004; Kaplan, Liu, & Kaplan, 2005). Conner, Pope, and Galloway (2009) posited that many students feel stressed about schoolwork, particularly standardized tests. Moreover, they suggested that the students interviewed reported school-related factors as causing more stress than other life stressors, including family dynamics. It is possible that the mathematics testing situation in this study did not evoke the same degree of stress as school and district standardized assessments. Students might have intuitively known that these were practice tests and not ones that "counted." Thus, test scores obtained in this study might be at least partially a result of reduced test-taking stress. Finally, classroom interventions may be associated with this study's test scores, as explained below.

Beilock (2011) suggested that simple interventions such as providing psychological preparation and addressing student attitudes can reduce achievement gaps among at-risk students. These interventions appear to be associated with the charter school philosophy and evident among students who participated in this study. Students in this sample may have been more prepared through innovative content mastery and psychological interventions. Thus, students may have been more prepared to take the

TAKS (practice form) and performed equally well in terms of the divided and continuous protocols.

Additional stress factors associated with standardized tests among young students are the perceived benefits, implications, and use of test scores. It appears that students who take standardized assessments have an inherent interest in performing well. Future academic placement, competition, parental expectations, and school demands place an enormous amount of stress on young students. Strauss (2009) found that students realize the importance of test scores in terms of their future, their teachers' reputation, and the reputation of their school. The testing milieu in this study may have been interpreted as "practice" and therefore may not have evoked the degree of stress evoked on district "test day." Students may have been more relaxed and may have performed better than on actual standardized test day.

Limitations of the Study

Many schools appear to be "under the gun" to perform well, partly as determined by standardized test scores. After contacting 10 school districts over 5 months, I found that none of the school districts were willing to collaborate in the study. Those who responded cited time constraints as the primary reason for denial of collaboration. In fact, one district approved the study but respectfully declined 1 week prior to data collection, citing school time constraints as faculty prepared for the actual year-end standardized assessments. It was necessary to amend the proposed data source to include a charter district in another state where time constraints did not preclude collaboration. This

dilemma represents a limitation of the study, namely finding enough collaborative partners for a larger sample.

Another limitation was sample demographics. The sample obtained was representative of a suburban school district. Although approximately 30% of the sample were classified as low SES, they were not from urban communities, where stress factors among low-SES students are often higher than in suburban populations. The sample therefore may not have fully addressed the problem and hypotheses herein.

Sample size is a major consideration. Increasing the sample size may increase the power of the study. The extreme difficulty in obtaining a large sample with a medium effect size was unknown to me at the initiation of this study.

Finally, it is difficult to generalize the findings of this study to non-charter-based schools. Charter schools appear to offer innovative and improved teaching methodologies compared to non-charter schools (NICHD, 2003). Students may be better prepared in charter schools, have more academic resources, participate in less stressful environments, and therefore have better test score outcomes.

Recommendations

To fully investigate the implications of providing multiple-day testing protocols to general education students, further research is necessary. School districts have numerous time constraints. Researchers should begin recruiting school districts for study collaboration at least 1 year prior to potential data collection. It is also recommended that researchers obtain a larger sample representing suburban and urban populations. The sample should include public, charter, private, and home schools.

Implications for Positive Social Change

The nonsignificant statistical results herein must be interpreted within the context of sample demographics. Low- and non-low-SES students in charter schools from a White suburb performed equally well in both testing protocols. Moreover, there was no significant relationship between continuous and divided assessment protocols.

Bronfenbrenner's ecological systems theory helped to explain how environment affects child development. Moreover, the ability of children to perform adequately is in part associated with the environments in which they spend their time (Gregory & Rimm-Kaufman, 2008). Research suggests an association between attention and performance (Friedman et al., 2007; Polderman et al., 2010). Specifically, attentional abilities are developed within the child's ecological systems, particularly at home and school (Bradley & Caldwell, 1984). Finally, research suggests an association between SES and attentional abilities among children (Mezzacappa, 2004). It appears that family and school interventions can mitigate factors associated with academic deficits. The following section addresses positive social change implications within the context of Bronfenbrenner's ecological systems theory in family and school environments.

School Environment

This study's purpose was to determine whether students from low-SES environments had better standardized test scores if they were given the option to take a divided standardized test and thus reflect their true academic ability. Specifically, studying divided testing protocols among elementary school students may provide important data for normalizing test scores between students with and without disabilities.

Even though I failed to reject the null hypothesis, the study revealed important implications regarding school environments.

On some level, this study helped to show possible advantages charter schools have over public schools in terms of student preparation for standardized tests. The charter school system methodology may offer the milieu that closes the attentional and academic gap among students from various SES groups and among students who have attentional difficulties but are not formally diagnosed. The test results in this study appear to substantiate the efficacy of some progressive charter school academic programs..

This study showed that students from low-SES environments perform equally well with non-low-SES students when they are provided with academic tools to acquire necessary skills. Public schools and particularly teachers may help students prepare and successfully traverse high stress standardized tests if they implement teaching pedagogy gleaned from innovative charter schools. Thus, teachers may level the academic playing field in the classroom. The development of appropriate test taking strategies along with improved content mastery at school may mitigate factors associated with attentional and academic deficits among students from low-SES environments.

Ackerman and Kanfer (2009) argued achievement motivation, competitiveness, anxiety, confidence, and emotions play a role in students' cognitive experience. Moreover, they posited that fatigue and outcomes might be related to students' expectation and prior experience with testing. The Harbor School method is used by the schools sampled in this study. A general discussion of their method is subsequently addressed.

The Harbor School method of instruction implements teaching methodologies that mitigate the aforementioned effects. Specifically, they help students develop a sense of personal accountability and responsibility for their performance at home and at school. Expectations are consistent throughout the day in terms of work habits. Students develop a sense of pride in their work and are provided opportunities for service to school and community. Moreover, the Harbor School methodology offers a unique approach to learning. Accelerated curricula, consistent chunking of content that is repetitive each day, multi-sensory learning experiences (i.e., rhyming, skits, chanting, and a variety of technologies), and intense parental involvement are consistent with the Harbor School method. Indeed, students in the schools sampled consistently teach students how to effectively manage their time on tests, encourage a learning atmosphere with reduced anxiety, increase motivation, and successfully build student confidence (Rolling Hills Public Charter School, 2009).

A social change implication is that the pedagogy in some progressive charter schools has a direct and close association with the communities they service and thus improves academic performance among all students including those from low SES environments. This implication cannot be generalized to the population but serves as a springboard for future research in urban school systems.

Home Environment

Children with attention problems and those whose environments are inundated by negative emotions, home chaos, and poor social skills have lower academic achievement (McLelland et al., 2000). These particular problems appear to be mitigated in this study.

The results of this study appear to validate research concerning the association between academic performance and the environments where students spend their time.

Family environment is a primary factor associated with academic achievement and a child's ability to pay attention in school (Annunziata et al., 2006; Mezzacappa, 2004). Students in this sample appeared to develop in families and communities that provided the necessary resources for developmental and academic growth. Concomitantly, attentional skills may have been more fully developed. This appeared evident among low- and non-low-SES students when considering their standardized test scores. It appears that families and schools that together engage in and promote behaviors that encourage children's cognitive development are more successful academically (NICHD, 2003).

Community Participation

The charter schools used in this study spend a great deal of time collaborating with communities and parents in developing and implementing programs that help improve student development and academic outcomes. Families and public schools may well study and implement strategies that improve attention and academic outcomes similar to those strategies observed in the charter schools selected for this study.

Time Factors

Another implication is test taking time efficiency. Preston et al. (2009) suggested that students with learning difficulties in math performed better when tested using a continuous timed protocol compared to a control group of students who had extended time. They posited that perhaps the children with ADHD used in their study did not show

improved performance when given extended time because students with ADHD use their time more efficiently when knowing they had a time limited test. They also found that the rate of accurate problem completion increased during continuous timed protocols. I observed a similar effect when I analyzed the results in this study.

Enrollment

Another implication may be that students from low-SES areas and perhaps those students with or without a learning disability were not enrolled in the schools used in this study. Since enrollment in the Idaho charter schools is based on a lottery system, parents may have drawn an unlucky lottery number. Additionally, parents may have chosen to not enroll their children in the charter school system for a number of reasons including the system's academic rigor, lack of extensive intramural sports participation, and so forth.

Test-Taking Strategies

Finally, the schools used in this study appear to teach strategies that improve test taking skills. It appears that learning test-taking strategies improve test outcomes. Perhaps urban schools should increase emphasis on developing strategies among all students such that time is not a factor when considering test outcomes.

Conclusions

This study intended to determine if standardized TAKS tests may be biased in terms of time constraints placed on young students. Specifically, the study investigated whether a divided test protocol would be an appropriate accommodation to help students from low-SES environments improve their mathematics test scores on standardized

assessments. It was determined that there was no significant association between test protocols and test scores among low- and non-low-SES fifth grade students by gender. Further research is necessary to determine if these results are generalizable to urban populations and public schools not classified as a charter schools.

Charter Schools

It is important to look at the overall impact of charter schools on academic achievement compared to traditional public schools. Charter school strategies, methods of enrollment, and enrollment demographics are but a few of the questions further research may address. Charter schools are based on contractual relationships between schools, government entities, and parents. Moreover, it appears charter schools are not held to government applied statutes that govern, curriculum, staffing, and budgets. With that said, there appears mixed consensus as to charter school effectiveness and their benefits to parents and students.

Clark, Gleason, Tuttle, and Silverberg (2011) studied charter school impact on student achievement in a randomized large and diversified sample among middle school age students. They posited that charter schools did not offer an advantage over traditional public schools in terms of academic achievement. However, the impact of charter schools serving disadvantaged students in urban areas was significantly positive. Moreover, their results showed charter schools positively impacted math achievement among low SES students in urban areas. Charter schools may impact these students because of more effective policies, teaching methodologies, and increased community and parent

collaboration. Specific strategies among some successful charter schools are subsequently discussed.

Merseth, Cooper, Roberts, Tieken, and Wynne (2009) studied schools that instituted programs and policies that helped parents and schools become more academically successful. These schools provided wrap-around services, incentives for parent-teacher conferences held in the home or at parent's convenience, and relied on parent contracts for volunteer work. Further, parent volunteers participated in non-traditional activities such as school beatification and maintenance that empowered parents, and increased parents self-efficacy. The general emphasis was on increasing involvement by parents and community.

Another study by Smith, Wohlstetter, Kuzin, and Pedro (2011) found that successful charter schools in urban areas provided students with increased safety, discipline, and rigorous academic requirements. The charter schools selected for their study had an atmosphere of collaboration. Moreover, they provided communal faculty workrooms, instituted peer observation policies, required weekly lesson planning, and mandated regular evaluation processes. Finally, they were reported to maximize the use of time during the school day, used a variety of lesson formats, and implemented a universal design curriculum.

The strategies used at the charter schools sampled in this study are similar to those employed by those schools in the aforementioned studies. Perhaps as traditional public schools learn from and implement similar strategies, urban and low-SES students will reap the benefits with increased academic performance. Hopefully, this study is a starting

point for future research in urban and rural areas. Researchers and educators must continue to find and implement teaching methods and strategies that improve educational outcomes of our children.

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Curriculum Vitae

DAVID PERUCCA

SUMMARY OF QUALIFICATIONS

Exceptional interpersonal and teaching skills acquired through academic and practical experience. Teaching/training in areas of psychology, mathematics, & science. Masters level education in counseling psychology with experience in therapeutic intervention, teaching. Ph.D. candidate, psychology. Highly energetic, enthusiastic, and personable.

EMPLOYMENT

Lone Star College-North Harris 2013-Present
Math Instructor

Cypress Creek Hospital 2011-Present
Emergency room and intensive care psychiatric evaluations in Houston area medical-surgical hospitals. Placement of patients in appropriate in-patient and out-patient psychiatric facilities. Member of emergency room team including physicians and psychiatrists.

Individual/Marriage/Family Therapist: 1990-2005
Therapist/Counselor. Conducted personal and group psychological interviews and therapy. Family and individual counseling. Multiple intervention modalities utilized. Teaching, seminar presentation and public speaking prevalent.

Brookhaven College 1994-1996
Adjunct teacher of psychology. Courses taught including;
Introduction to psychology, general psychology, applied psychology, and social psychology.

1st Step University Tutoring 2005-2011
Owner/ Licensed Director of pre-school facility. Tutoring remedial math through high school. Training and education of teachers and staff. Curriculum writing, lesson plans and implementation.

Humble Independent School District 2009-2011
5th Grade Math/Science. Highly qualified
teacher in Humble ISD.
(Title I School).

Brigham Young University 1973-1976
Undergraduate teaching assistant. Grading, lab instructor, classroom

chemistry instructor.

EDUCATION

Brigham Young University	B.S. Chemistry	1975
Cal. State University	M.S. Counseling	1991
Walden University	Ph.D. Psychology	2008-Current

PROFESSIONAL LICENSES

Texas Licensed Marriage/Family Therapist (LMFT)
Texas Certified Teacher Grade 4-8 Math/Science