

THE IMPACT OF RACE AND SOCIOECONOMIC STATUS ON THE READING  
COMPREHENSION GROWTH TRAJECTORIES OF ADOLESCENTS

by

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Dedicated to God Almighty, who is forever faithful; to my virtuous husband, Brian, for his continual love and patience; and to my close-knit family that persistently encouraged me to follow my dreams—I love you all more than you will ever know.

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## ABSTRACT

The purpose of the current study was to examine features of adolescent reading comprehension trajectories and make within-person and between-person analyses of growth that occurs during the high school grades. Racial and socioeconomic group differences of the adolescent reading trajectories were also investigated and compared. This examination allowed the researcher to make inferences regarding the extent to which sociocultural factors impact reading proficiency as adolescents advance through the upper grades. The sample consisted of 225 students in grades 8, 9, and 10 who attended an urban high school in the southeastern region of the United States. Within the sample, 39% of the students self-identified as Caucasian, 42% as African-American, 9% as Hispanic, and 10% as multiracial. Approximately 29% of the total sample qualified for reduced-price lunch. Latent growth curve modeling was performed through AMOS v21 to determine model fit and growth parameters of the reading trajectories. Overall adolescent reading trajectories exemplified linear growth, and demonstrated a negative correlation between the intercept and slope parameters. This confirmed that students with lower starting reading abilities experienced more rapid growth during adolescence, indicating a narrowing reading achievement gap during the high school years. Racial association and socioeconomic status had a significant impact on the intercept, but no significant impact on the reading growth trajectories. This finding revealed that students of different racial associations and socioeconomic levels experience equivalent reading comprehension growth during adolescence.

*Keywords: adolescent reading, race, socioeconomic status*

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## CHAPTER I: INTRODUCTION

The value of literacy is irrefutable, but standardized achievement tests have revealed low nationwide performance among adolescents in basic content areas, such as reading (Alliance for Excellent Education, 2011). As reported by the Nation's Report Card in 2015, about 34% of eighth grade students and 38% of twelfth grade students performed at or above the proficiency threshold in reading (U.S. Department of Education, 2015). The racial breakdown of reading proficiency is even more staggering. In eighth grade, 44% of Caucasian students, 21% of Hispanic students, and 16% of African-American students demonstrated grade level reading proficiency. In twelfth grade, 47% of Caucasian students, 23% of Hispanic students, and 16% of African-American students demonstrated grade level reading proficiency (U.S. Department of Education, 2015). While much of America's youth is struggling to read proficiently, a substantial achievement gap exists between the Caucasian and minority populations in the United States.

### **National Historical Trends of the Reading Achievement Gap**

The academic achievement gap started receiving national attention during the Civil Rights Era of the 1960s. In 1965, data collected by the U.S. Census Bureau revealed that African American adolescents were academically 2.4 years behind their Caucasian counterparts on measures of reading comprehension at grade six, 3.3 years behind at grade nine, and 4.5 years behind at grade 12 (Coleman, 1966). According to the research findings, minority students in grades 6-12 fell progressively behind white students on measures of reading comprehension as they grew older and advanced through school.

The National Assessment of Educational Progress (NAEP) began reporting trends on student achievement data in the 1970s among Caucasian and African-American students (Barton & Coley, 2010). Between 1971 and 1980, there was an overall narrowing of the reading achievement gap between African American and Caucasian student populations at every age tested, with the most substantial gains occurring among 9 and 13 year olds (Rampey, Dion, & Donahue, 2009). The narrowing of the achievement gap between African American and Caucasian students in both reading and mathematics continued throughout the 1980s among the 13 and 17 year old age groups (Barton & Coley, 2010).

Starting in the 1990s, the National Educational Assessment of Educational Progress (NAEP) included data on the Hispanic population in the national reporting of reading achievement gaps. Between 1990 and 2000, the reading gap between students of different racial backgrounds remained unchanged among 9 year olds, but seemed to widen among 13 and 17 year olds (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009). During the 1990s and early 2000s, national data seemed to paint an unclear picture regarding the reading achievement gap trends between Caucasian and minority student populations, as evident through a suspected widening of the gap in the 1990s, but narrowing in the early 2000s among 9, 13, and 17 year olds. No clear detectable trends of the achievement gap have been confirmed since 2010 (Barton & Coley, 2010; Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009).

### **Adoption of Standardized Testing to Monitor Comprehension Growth**

Government initiatives and legislation have prompted states to adopt accountability systems that measure academic development and identify existing gaps in

student achievement (Braden, 2002). Standardized tests are designed to facilitate the measurement of student performance with reliability and objectivity, while producing results that reveal overall trends in the academic achievement gap (National Center for Education Statistics, 2013; Phelps, 2000). The nationwide systematic approach to standardized assessments was adopted in the 1980s as a response to the publication of *A Nation at Risk*, which portrayed the American educational system as deficient in comparison to its global competitors (Gardner, 1983). The public education reform movement of the 1980s ushered in extensive assessment measures for students, teachers, and schools in order to identify and accompany areas of academic growth and improvement (McNeil, 2000).

Standardized testing and accountability received a significant boost at the turn of the 21<sup>st</sup> century with enactment of *No Child Left Behind* (NCLB) legislation in 2001. Cited as the most dramatic change in national legislation since the 1960s, the NCLB Act increased the size and power of accountability systems through annual standardized testing mandates designed to improve student achievement (Bloomfield & Cooper, 2003). One intended aim of the NCLB legislation was to identify existing gaps within the student population between different subgroups (“Achievement Gap”, 2004). Since the enactment of NCLB legislation, there have been nationwide increases in the assessment of basic math and reading skills among both elementary and secondary students (Dee & Jacob, 2011).

**Benchmark Assessments.** In order to track student progress and ensure that academic growth is occurring at an acceptable pace for all student groups as defined by national legislation, school systems administer different types of periodic tests and

benchmark assessments (Olson, 2005). General outcome measures (GOMs) evaluate student progress toward curricular objectives over long periods of time in a standardized fashion (Deno, 2003; Shapiro, Keller, Lutz, Santoro, & Hintze, 2006). Benchmark assessments are one type of GOM frequently administered in K-12 schools that have been used since the 1970s (Tindal, 2013). Benchmark assessments are usually administered tri-annually (i.e., fall, winter, and spring) to examine collective school growth and identify students at risk for academic difficulties (Graney, Missall, Martinez, & Bergstrom, 2009).

Benchmark assessments evaluate individual growth and detect small changes in student performance over time (Betts, Reschley, Pickart, Heistad, Sheran, & Marston, 2008; Graney, Missall, Martínez, & Bergstrom, 2009). The student's growth rate, or estimates of slope, is a central indicator of the effectiveness of existing instruction (Yeo, Fearing, & Christ, 2011). The benchmark, evaluation, and reflection process aids in the management of individualized education growth, and is a key component of identifying students that are at risk for academic failure (Mercer & Keller-Margulis, 2015; Tindal, 2013).

### **Skills Measured by Standardized Reading Assessments**

There are several skills that are measured by standardized tests, and the component of reading that is assessed depends upon the age of the student. The most common types of assessments used in the elementary grades to examine reading growth are measures of oral reading fluency and maze comprehension tasks (Busch & Reschly, 2007). Oral reading is interpreted as an indicator of reading competence in the early grades (Fuchs, Fuchs, Hosp, & Jenkins, 2001). An oral reading fluency (ORF) task

assesses decoding and fluency skills, by gauging the number of correct words read aloud in a minute (Fuchs et al., 1993). ORF is considered an effective indicator of reading, but does not signify comprehension or understanding (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Duke & Pearson, 2008). Therefore, ORF benchmark assessments are deemed as more appropriate for students in grades 1 – 3 (Wayman, Wallace, Wiley, Ticha & Espin, 2007). Maze comprehension tasks assess multiple aspects of reading, such as decoding, fluency, vocabulary, and reading comprehension, by measuring a student's ability to silently identify word choices that best fit within a reading passage in three minutes (Fuchs et al., 1993). Because a maze assessment is a more global indicator of reading proficiency, it is deemed as more appropriate for students in grades 3 – 8 (Fuchs et al., 1993; Wayman, Wallace, Wiley, Ticha & Espin, 2007). Reading benchmark assessments administered beyond eighth grade usually entail passage-based comprehension questions that assess foundational skills, such as word recognition and fluency, linguistic skills, such as contextual vocabulary and structural analysis, and literary skills, such as inference making and sequential comprehension (Renaissance Learning, 2014).

### **Factors that Impact Reading Proficiency**

There are several factors that impact reading and play a role in reading proficiency, such as early print exposure, foundational reading ability, and vocabulary skills (Cunningham & Stanovich, 1997; Oakhill & Cain, 2007). Early print exposure and the amount of time in which a child engages with reading during the early years impact their overall knowledge and reading proficiency (Cunningham & Stanovich, 1997; Hart & Risley, 1997; Mol & Bus, 2011). Hart and Risley (1995) reported noticeable cleaving between strong and weak readers to emerge as early as three years old. Cunningham and

Stanovich (1997) conducted a ten year study with a sample of fifty-six students and found that first grade out-of-school print exposure as measured by the Author Recognition Test (ART) was reliably linked with a .58 correlation to eleventh grade reading comprehension, as measured by the Nelson-Denny Comprehension subtest. A meta-analysis of 99 studies indicated that print exposure has a moderate correlation of .36 with reading comprehension among students in grades 1 – 12 (Mol & Bus, 2011).

In order for students to become proficient readers in the upper grades, adequate foundational skills must develop during the early years (Cunningham & Stanovich, 1997). The National Reading Panel (2000) considered phonemic awareness, phonics, fluency, vocabulary, and comprehension as the five critical foundational components of reading. Children are expected to shift from decoding and word recognition to vocabulary acquisition and text comprehension in grade 3 (Aarnoutse, van Leeuwe, Voeten, & Oud, 2001). This transition is also known as the switch from “learning to read” to “reading to learn” (Chall, 1983). Basic reading skills and comprehension skills develop simultaneously, therefore it is important to have a strong reading foundation in order for inferencing ability to appropriately emerge (Oakhill & Cain, 2007). Foundational skills, such as phonemic awareness, phonics, and fluency, play a greater role in reading proficiency in the elementary grades than in the middle or high school grades (Cromley & Azevedo, 2007; Sugate, S, 2016).

Vocabulary knowledge greatly impacts reading and comprehension development as well. Elleman, Lindo, Morphy, & Compton (2009) conducted a meta-analysis of 37 studies and reported that vocabulary knowledge has a 0.43 correlation with reading comprehension. It was also confirmed that vocabulary instruction has a moderate effect



size of improving student's passage level comprehension with custom measures ( $d = 0.50$ ), and a small effect size with standardized measures ( $d = 0.10$ ). Unlike in younger populations, it has been confirmed that vocabulary knowledge and reading comprehension are closely associated through a bidirectional relationship among older populations (Cain & Oakhill, 2001; Fuchs, Compton, Fuchs, Bryant, Hamlett & Lambert, 2012). The development of vocabulary skills reinforce comprehension, which in turn strengthens vocabulary. Studies that have exclusively examined adolescent populations have confirmed that vocabulary knowledge is the greatest determinant of reading comprehension among students in the seventh, eighth, and ninth grades (Cromley & Azevedo, 2007; Oslund, Clemons, Simmons, Smith, Simmons, 2016). At the adolescent stage of development, vocabulary knowledge exceeds the influence of other reading components and greatly aids in reading comprehension.

### **Purpose of the Study and Research Questions**

Reading proficiency and development is critical. Various programs have been created for the sole purpose of facilitating literacy growth and reducing the achievement gap among various student groups (Ed Tech Action Network, 2007). The early detection of reading problems is often prescribed with long term interventions that extend into the high school years (Espin, Wallace, Lembke, Campbell & Long, 2010). Therefore, it is critical to analyze the overall components of adolescent reading trajectories. The purpose of the current study was to examine characteristics of adolescent reading comprehension trajectories and make within-person and between-person comparisons of growth that occur during the high school grades.

This research reveals the extent to which sociocultural factors impact reading proficiency among adolescents as they advance through the upper grades. It also helps to determine whether the reading achievement gap is closing during the latter years of formal schooling. Research that addresses the tri-annual reading growth of elementary age students is replete, but scant among the high school adolescent population (Espin, Wallace, Lembke, Campbell & Long, 2010; Graney, Missall, Martinez & Bergstrom, 2009; Nese, et al., 2012). By conducting research at the classroom level, the following research questions will be further explored:

1. What is the shape of high school adolescent reading trajectories?
2. What is the relationship between initial reading status and the growth rate among adolescents?
3. What is the impact of socioeconomic and/or racial group membership on adolescent reading growth?

## CHAPTER II: LITERATURE REVIEW

This chapter provides a review of the work already published regarding the characteristics of reading trajectories, growth rate associations, and culturally-influenced achievement gap measurements. Culturally influenced indicators include components such as racial association, socioeconomic status, and language spoken in the home. Because so few studies exist that measure reading comprehension growth exclusively among adolescents in high school, most of the literature review addresses primary studies that include elementary and middle school age populations. The overall components of elementary age reading development will be later compared to the findings of the current study, which exclusively examines adolescent reading development. The expected contrast between the characteristics of elementary versus high school reading growth will demonstrate the need for more research that exclusively entails adolescent samples in order to learn more about adolescent reading development.

### **Mixed Findings of Reading Trajectory Shapes**

Research has suggested that the functional form of growth trajectories vary depending upon the age of the students, the ability level of the students, the component of reading that is assessed, and the statistical method that is used to conduct the analysis (Deno, et al., 2001; Nese et. al, 2013). Several researchers that examine reading growth among students in the early grades evaluate oral reading fluency, since it has been deemed as the best overall predictor of reading proficiency (Shinn, Good, Knutson, & Tilly, 1992). On the other hand, researchers that examine reading growth among upper elementary, middle school, or high school students tend to evaluate their performance on

cloze or passage comprehension tasks (Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993; Rescorla & Rosenthal, 2004).

**Detections of Linear Reading Growth.** Studies from the 1990s and early 2000s cited within-year oral reading fluency development during the elementary grades as linear (Deno, et al., 2001; Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993). Fuchs, Fuchs, Hamlett, Walz, and Germann (1993) analyzed the within-year reading growth of 117 students in grades 1 – 6, and used the Ordinary Least Squares (OLS) method to fit a regression line to the data, and determine if reading trajectories were more linear or quadratic. The research team concluded that oral reading fluency growth was more linear for the entire sample in grades 1 – 3, and more linear for over 80% of the sample in grades 4 and 5. It was also concluded that passage comprehension growth as measured by the maze task was more linear for over 80% of the sample in grades 2 - 5 (Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993). Deno, et al (2001) employed a larger sample of over 2,500 students in grades 1-6 to analyze within-year growth patterns for both students with learning disabilities and the typically developing population. Using ordinary least squares regression, the research team also concluded that within-year reading growth was linear for students in the elementary grades (Deno, et al, 2001).

More recent studies have used latent growth modeling to conclude reading growth in the elementary and middle school grades as linear (Chong, 2009; Low, 2013). Chong (2009) analyzed reading comprehension trajectories of 593 students whose first language was English (L1) and 153 students whose second language was English (L2) from the 4<sup>th</sup> to the 7<sup>th</sup> grade. Latent growth modeling revealed that the trajectories of both groups favored linear, rather than quadratic, patterns of growth (Chong, 2009). Low (2013)

analyzed the reading comprehension trajectories of 773 students whose first language was English (L1) and 182 students who spoke English as an additional language (L2) from 2<sup>nd</sup> to the 7<sup>th</sup> grade. Multi-group latent growth analysis revealed that the trajectories of both groups better reflected a linear pattern of growth.

**Detections of Non-linear Reading Growth.** Other recent researchers have used multilevel data methods to conclude that within-year oral reading fluency development in the elementary years more closely resemble non-linear patterns of growth (Christ, Silberglitt, Yeo & Cormier, 2010; Nese et. al, 2012; Nese et. al, 2013). Ardoin and Christ (2008) analyzed the within-year oral reading fluency trajectories of 86 second grade students with a 2 (semester) x 3 (growth estimate) repeated measures MANOVA. It was determined that growth occurs more rapidly during the fall semester than the spring semester, and in a nonlinear pattern, among second graders (Ardoin & Christ, 2008). Graney, Missall, Martinez, and Bergstrom (2009) analyzed the reading growth of 442 students in 3<sup>rd</sup> through 5<sup>th</sup> grades across two academic years. The research team employed a 3 (grade level) x 2 (time) repeated measures ANOVA and concluded that students across all grade levels demonstrated nonlinear reading growth, with more rapid growth occurring during the spring semester compared to the fall semester (Graney, Missall, Martinez, & Bergstrom, 2009).

Researchers that have employed large sample sizes with thousands of participants have also identified non-linear reading trajectories from various reading measures (Christ, Silberglitt, Yeo & Comer, 2010; Keller-Margulis, Clemens, Im, Kwok, & Booth, 2012). Christ, Silberglitt, Yeo and Comer (2010) analyzed the rate of oral reading growth among 4,824 students in grades two to six. The research team used a linear

mixed model procedure (LMM) and concluded that oral reading growth was cubic for students in the general education population, but linear in some cases for the special education population. Shin, Davison, Long, Chan and Heistad (2013) analyzed the comprehension growth rates of 2,517 students in 4<sup>th</sup> to 7<sup>th</sup> grade. Using linear growth modeling, the team concluded that reading growth patterns were nonlinear. The curvilinear trends of this study suggest that reading comprehension growth may slow down over time. Keller-Margulis, Clemens, Im, Kwok, and Booth (2012) analyzed the reading growth of 6,321 students in 3<sup>rd</sup> through 5<sup>th</sup> grade. Multi-level piecewise modeling indicated no significant differences in reading growth across the semesters while students were in 3<sup>rd</sup> and 5<sup>th</sup> grade, but faster rates of reading growth was detected in the fall semester of 4<sup>th</sup> grade.

Nese, et al. (2012) used hierarchical linear modeling to examine the oral reading fluency trajectories of 2,465 students in grades 3-5, and concluded that growth was non-linear, with greater growth occurring in the fall than the spring. Two years later, the research team conducted a similar experiment to the 2011 study on reading development, but expanded the sample to include middle school students. Nese, et al. (2013) modeled the development of oral reading fluency for 1,448 students in grades 1 through 8 over the span of ten months. Data were collected on eight different testing occasions throughout the school year, and the research revealed that overall oral reading fluency development among students in the elementary and middle grades more closely resembled quadratic growth, as compared to linear or cubic patterns. Reading growth was particularly more curvilinear in grades 2, 3, 4, 6, and 7, more linear in grades 1 and 5, and more cubic in grade 8 (Nese, et. al, 2013). The findings of the study suggested that linear growth

expectations may be unrealistic for reading development in the primary grades, since sporadic growth is more closely modeling quadratic trends.

Recent studies that have included high school students in examinations of reading comprehension development have also reported non-linear growth (Beecher, 2011; Petscher, Kershaw, Koon, & Foorman, 2014; Rescorla & Rosenthal, 2004). Rescorla and Rosenthal (2004) utilized the growth in Test of Cognitive Skills (TCS) and the Comprehensive Tests of Basic Skills (CTBS) to measure the eight year reading achievement of 328 students in 3<sup>rd</sup> through 10<sup>th</sup> grade (CTB/McGraw-Hill, 1983). The team used hierarchical linear modeling to determine that reading growth was linear in the early elementary grades, then transformed to a more curvilinear shape in the later elementary grades (Rescorla & Rosenthal, 2004). Because this study included an adolescent sample, it demonstrated the changing nature of the reading comprehension growth capacity of students as they progress throughout school. Beecher (2011) also included older student groups, and analyzed annually collected archival data on the reading comprehension development of 206 students as they advanced from kindergarten to twelfth grade. Latent growth curve analysis was used to conclude that reading trajectories among students in kindergarten to twelfth grade were quadratic in form, indicated through curvilinear downward slopes (Beecher, 2011).

### **Unverified Relationship between Reading Ability and Growth**

Research has indicated that high, medium, and low ability students all make progress over time, but perform differently and grow at different rates (Rescorla & Rosenthal, 2004). A negative correlation between initial status and growth is characterized by a lower starting proficiency level that yields more rapid growth. A

positive correlation between initial status and growth is characterized by a higher starting proficiency that yields more rapid growth. The examination of multiple data points with advanced statistical methods, such as structural equation modeling, have enabled researchers to more accurately examine the relationship between initial status and rate of growth (Acock & Fuzhong, 1999).

**Detections of Positive Correlations.** Some researchers have indicated a positive relationship between the initial status and growth of students in the lower elementary grades (Aikens & Barbarin, 2008; McCoach, O'Connell, Reis & Levitt, 2006). McCoach, O'Connell, Reis and Levitt (2006) analyzed the reading trajectories of over 8,000 students from kindergarten to first grade. The research team reported a positive relationship between the students' fall kindergarten reading scores and kindergarten growth, as evident in higher initial scores yielding faster growth; but reported a negative relationship between the students' fall kindergarten reading scores and first grade growth, as evident in lower initial scores yielding faster growth. The research team concluded that the gap between students from a higher and lower socioeconomic status widened during kindergarten. Aikens and Barbarin (2008) analyzed the reading trajectories of over 3 million students from kindergarten to third grade and found that students from a higher economic status started off as better readers, and progressed more rapidly than students from a lower socioeconomic status.

**Detections of Negative Correlations.** Other researchers have indicated a negative correlation between initial status and growth when students in the upper elementary and middle grades are included in the sample (Beecher, 2011; Rescorla & Rosenthal, 2004; Shin, Davison, Long, Chan & Heistad, 2013). Rescorla and Rosenthal



(2004) examined 328 children in third through tenth grade over the eight year period, and determined that children in third grade with a low initial status, made faster progress in reading achievement over time. While there was statistically significant variability in the linear growth curves of individual students, the actual variation in the slopes across individuals was minimal (Rescorla & Rosenthal, 2004). This study suggests that students experience comprehension growth at equivalent rates.

Beecher (2011) administered the Peabody Individual Achievement Test and analyzed the development of comprehension skills of 206 students from kindergarten to twelfth grade placed in two different groups, according to their special education or general education status (Dunn & Markwardt, 1970). The researcher detected a negative relationship between the intercept and slope means among both groups of students, which indicated that children who started at a lower reading proficiency grew faster than children who started at a higher proficiency. Beecher (2001) also detected a negative relationship between the intercept and slope means between groups of students separated according to their socioeconomic status. Children who experienced greater financial hardship had lower levels of reading achievement, but experienced more rapid growth than children with a higher economic standing that qualified for paid lunch (Beecher, 2011).

Corroborating with the findings of Rescorla and Rosenthal (2004) and Beecher (2011), Shin, Davison, Long, Chan and Heistad (2013) analyzed the comprehension growth rates of 2,517 students in 4<sup>th</sup> to 7<sup>th</sup> grade, and concluded that the relationship between initial reading status and growth was negative. The researchers separated students who received free or reduced lunch from those who qualified for paid lunch, and

reported negative associations that slightly increased over time, insinuating the achievement gap between these groups of students may slightly widen as they progress through school (Shin, Davison, Long, Chan & Heistad, 2013).

Some studies have detected positive correlations between the intercept and slope parameters of reading growth, and others have detected negative correlations. This indicates that students are experiencing sporadic and gradual comprehension growth at different developmental stages. The inconclusive outcomes are likely due to the age characteristics of the examined samples, the specific reading skills measured by the different tests, or the delineation of how the sub-samples were divided (Aikins and Barbarin, 2008; Shin, Davison, Long, Chan & Heistad, 2013). The mixed findings in the literature warrant additional research.

### **Sociocultural Factors Impacting the Reading Achievement Gap**

Several associated variables, which are both dynamic and esoteric, often impact reading achievement and one's academic potential (Zimmerman, Schütte, Taskinen, & Köller, 2013). Poverty, negative attitudes toward school, low intrinsic motivation, learning disabilities, and various other risk factors impact standardized testing performance (Benner, 2013; Reardon, Arshan, Atteberry, Kurlaender, 2010). Low academic achievement contributes to feelings of inferiority, poor behavior, high levels of stress, and excessive anxiety or depression among adolescents (Alexander-Passe, 2006; Awad, 2007; Zimmerman, Schütte, Taskinen, & Köller, 2013). These types of educational setbacks may cause students to lose confidence, which negatively impacts their motivation and future academic performance. The two associated variables that are addressed in the current study are socioeconomic status and racial association.

**Socioeconomic Status.** Socioeconomic status (SES) refers to a student's accessibility of financial, social, cultural, and human capital resources (Cowan et. al, 2013). Components of SES include parental educational attainment, parental occupational status, adjusted household income, and measures of neighborhood or school resources (Cowan et. al, 2013; Magnuson, & Duncan, 2005). Researchers have verified a significant link between socioeconomic status and measures of cognition, school achievement, and emotional well-being (McCoach, O'Connell, Reis and Levitt, 2006; Sirin, 2005). Approximately 52.4% of all students in U.S. public schools qualify for free and reduced-priced lunch, which poses a problem because of the significant relationship between economic disadvantage and low academic performance (National Center for Education Statistics, 2011; Sirin, 2005; White, 1982).

McCoach, O'Connell, Reis and Levitt (2006) analyzed a nationally representative sample of over 8,000 kindergarteners and reported a moderate positive correlation of .390 between socioeconomic status and the children's reading ability scores on a fall assessment. Although a correlation was detected, the construct of reading in kindergarten mostly involves phonemic awareness, phonics, and decoding, rather than actual comprehension (Suggate, 2016). Therefore, the implications of this study cannot be transferred to a different age group. But within the selected sample, the team concluded that socioeconomic status had a minimal impact on reading growth while school was in session, and a larger impact over the summer months (McCoach, O'Connell, Reis & Levitt, 2006). The finding of the expanding achievement gap in reading during the summer months between high and low income students is also consistent with the

conclusion of a 39 study meta-analysis that examined summer learning loss in reading (Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996).

Sirin (2005) published the most recent wide-scale meta-analysis and reported a correlation of .299 between socioeconomic status and achievement. According to the 2010 Florida Comprehensive Assessment Test, two-thirds of high SES students passed the exam while two-thirds of low SES students failed the exam (Baker & Johnston, 2010). Sirin (2005) also observed a strengthened relationship between these two variables as students grew older and progressed through school. Socioeconomic forces produce the most dramatic gap in achievement starting in the 7<sup>th</sup> grade, with the gap plateauing at the high school level (Caro, McDonald, & Willms, 2009; Sirin, 2005).

Other researchers have inculcated the poverty of the broader school community as a determinant of low student achievement (Potter, 2013; Saven, 2015; Uline & Tschannen-Moran, 2008). Saven (2015) demonstrated that student demographic variables accounted for the majority of variance in reading growth, but district demographic characteristics and the number of dollars spent were significantly correlated with the growth in academic achievement of those who qualified for special education services. The work of Potter (2013) further illuminates the impact of the broader school community by revealing that only 1.1% of low income schools are cited as top performers (Potter, 2013). Uline and Tschannen-Moran (2008) concluded that inadequate facilities and an overall unfavorable school climate may play a role in low student achievement.

The link between school conditions and student achievement was heavily explored in the early 1980s, as researchers noted physical characteristics such as building

quality, lighting, thermal comfort, air quality, and school laboratories to have a correlational impact on student achievement (McGuffey, 1982). More recently, disparities at the school level were detailed in *Savage Inequalities: Children in America's Schools*, as it was noted that children who attended poorly funded schools were often plagued with overcrowding, unsanitary conditions, inadequate educational supplies, and poor quality teachers (Kozol, 1991). Uline and Tschannen-Moran (2008) found that when learning is taking place in an inadequate facility, the educational environment is less likely to be perceived as orderly and serious, and often lacks a strong emphasis on academics. Beyond the physical features of school facilities, other psychological influences of school environments have the potential to negatively impact student achievement, such as the learning climate, teacher behavior and attitudes, principal leadership, and community ties (Uline & Tschannen-Moran, 2008). Minorities and those from underprivileged backgrounds overwhelmingly attend these types of schools, which obstruct educational attainment and social improvement (Kozol, 1991). The negative impact of school-related poverty perpetuates other societal ills for those trapped in the cycle.

Several researchers have verified socioeconomic status to be significantly associated with the differing growth trajectories of student achievement (Entwistle, Nisbet, & Bromage, 2005; McCoach, O'Connell, Reis, & Levitt, 2006; Juel, 1988). Many schools use evidence-based reading programs to deliver reading instruction, but many of the programs facilitate different reading growth rates for students of different socioeconomic levels (Crowe, Conner, & Petscher, 2009). On measures of oral fluency, first grade students from a lower SES that used either the Open Court, Reading Mastery,

Scott Foresman, or Harcourt commercial reading programs grew slightly less and read five fewer correct words per minute by the end of the year than their more affluent peers (Crowe, Conner, & Petscher, 2009). Economic hardship has the potential to mediate academic growth and the effectiveness of certain curricula.

The academic difficulty a student experiences can be traced to processes and experiences beyond the realm of the classroom (Hart & Risley, 1995; Reardon, 2011). Children from economically disadvantaged homes begin grade school with weaker literacy skills than those from more privileged backgrounds (Hart & Risley, 1995). The achievement gap between students at the 90<sup>th</sup> and 10<sup>th</sup> percentile of the family income distribution is nearly twice as large as the black-white achievement gap (Reardon, 2011). A student who struggles to read by the end of first grade will likely struggle to read throughout the rest of the elementary years (Wyner, Bridgeland, & DiIulio, 2007). Early reading difficulties are the bedrock of later academic struggles, and can pose long lasting barriers to educational achievement.

**Racial Association.** Racial association is defined as a sense of group identity based on the perception that one shares with a particular racial heritage (Helms, 1990). The impact of race on academic achievement has been a major topic of concern over the past fifty years (Henderson, 1975; Jeynes, 2014). Governments have since allocated millions of dollars to public education in efforts to offset the impact of poverty on learning and achievement, which disproportionately affects certain racial groups (Dills, 2006). The achievement gap in reading performance between Caucasian and African-American students converged over the 1970s and 1980s, but has widened since 1992 (Haycock, 2001; National Center for Education Statistics, 2013). Beyond the school

level, racial inequity is still evident in the society at large through household incomes and the unequal allocation of resources. In 2013, the median family income in the United States was \$58,270 for Caucasian families, \$40,963 for Hispanic families, and \$34,598 for African-American families (U.S. Census Bureau, 2014). Students who experience economic disadvantage are less likely to reach or maintain high levels of academic achievement, compared to students from more privileged families (Wyner, Bridgeland, & DiIulio, 2007). School systems are expected to overpower the latent influences of family income and home life, all of which can either augment or abate the educational experience.

Racial background impacts several components of reading achievement for younger students in the elementary grades (Hintze, Callahan, Matthews, & Williams, 2002; Klein & Jimerson, 2005). Hintze, Callahan, Matthews, and Williams (2002) examined potential bias in oral reading fluency between 1,700 African American and Caucasian children from first to third grade. They controlled for age, gender, and socioeconomic status. The research team found no significant difference in the regression lines of African American and Caucasian children, and concluded that the predictive capabilities of the reading measure did not vary as a function of race. When the research team separated the ethnic groups, it found that oral reading fluency explained 58% of the variance in reading comprehension for African American students and 30% for Caucasian students, indicating potential cultural bias (Hintze, Callahan, Matthews, & Williams, 2002). This demonstrates that other unobserved variables that are associated with oral reading fluency may be operating in predicting reading comprehension to a greater magnitude among Caucasian students than African American students.

Klein and Jimerson (2005) conducted a similar study examining the way in which reading performance fluctuated on account of group membership. The team found potential bias in oral reading fluency measures between Hispanic and Caucasian children. The research team composed no controls on other demographic variables, such as age, gender, or socioeconomic status and reported bias in the function of home language. Slope bias in home language accounted for an additional 6% of the variance in reading scores (Klein & Jimerson, 2005). Furthermore, it was revealed that the oral reading fluency of Hispanic students whose home language was Spanish was overestimated, and the oral reading fluency of Caucasian students whose home language was English was underestimated. Unified regression formulas that are used in the assumption that one test predicts another may contain prediction errors for some cultural groups.

Racial background also impacts several components of reading achievement for adolescent students in the upper grades (Alliance for Excellent Education, 2008; Dixon-Román, Everson & McArdle, 2013). In 2015, approximately 20% of eighth grade students from low-income families read at or above the proficient level of reading, compared to 47% of their more affluent counterparts (Alliance for Excellent Education, 2016). Within the bounds of ethnicity, roughly 16% of African-Americans and 23% of Hispanic-Americans read proficiently by the twelfth grade, compared to the 47% of Caucasian twelfth graders that did so (U.S. Department of Education, 2015). A graduating student's ability to comprehend complex texts is a strong predictor of his or her performance in college level math and science courses (Alliance for Excellent Education, 2016).



Some researchers have suggested that ethnicity is a stronger force in comparison to indicators of family income on standardized testing measures (Diamond & Onwuegbuzie, 2001). The impact of family income on SAT scores is approximately two times as large for high school students who identify as African-American compared to those who identify as Caucasian (Dixon- Román, Everson & McArdle, 2013). The number of jobs in the U.S. economy that require post-secondary education increased from 28% in 1973 to nearly 61% in 2015 (Alliance for Excellent Education, 2016). Therefore, many minorities may be at risk of working predominately low wage jobs for the entirety of their lives and abstained from the middle class on account of poor literacy skills.

Though a noticeable achievement gap persists among students of different racial backgrounds, a rigorous curriculum has been found to improve the academic performance of minority students (Jeynes, 2015). From 1997 to 2009, the number of rigorous Advanced Placement courses offered to students increased by 500%, with Hispanic students leading enrollment growth at 467% (Judson & Hobson, 2015). A rigorous curriculum exposes students to substantive content, complex problem solving, and meaningful writing assignments (Matsumura, Slater, & Crosson, 2008).

### **Lack of Consensus Regarding Achievement Gap Trends**

Reading trajectories appear to vary depending on the age, ability level, and grouping characteristics of the students in the sample. The way in which the achievement gap is conceptualized also seems to have an impact on a researcher's conclusion of its general trends. Though researchers lack a consensus on whether the achievement gap is slightly expanding or shrinking, they generally agree that growth trajectories across

different student groups are remarkably similar (Beecher, 2011; McCoach, O'Connell, Reis & Levitt, 2006).

**Widening Achievement Gaps.** Researchers have reported widening reading proficiency gaps among certain groups on both measures of oral fluency and comprehension in the elementary grades (Abedi et al., 2005; Aikens & Barbarin, 2008; Christ, Silberglitt, Yeo & Cormier, 2010; McCoach, O'Connell, Reis, & Levitt, 2006). Between 1990 and 2000, the National Educational Assessment of Educational Progress (NAEP) assessed the racial achievement gap and reported a widening reading comprehension gap among Hispanic 9 year olds, as compared to their peers. Of all the 9 year olds assessed nation-wide, the average reading score increased four points among both Caucasian and African-American student groups, but decreased six points from 194 to 188 for the average Hispanic student. There were also widening reading proficiency gaps detected among both African American & Hispanic 13 year olds, as compared to their Caucasian counterparts. The average reading score increased four points from 262 to 267 for a Caucasian student, slightly increased three points from 238 to 241 for a Hispanic student, and decreased three points from 241 to 238 for an African American student. Abedi et al. (2005) also reported divergence in reading proficiency among primary age students classified by cultural characteristics. He examined the growth trajectories of thousands of students from 3<sup>rd</sup> to 8<sup>th</sup> grade, and reported widening performance gaps between bilingual and non-lingual students on a reading comprehension measure that included autobiography, expository, and literary texts.

McCoach, O'Connell, Reis, and Levitt (2006) indicated that the achievement gap between students from a high and low socioeconomic status widens during the first two

years of school in kindergarten and first grade. The research team analyzed the reading growth of over 8,000 students from kindergarten to first grade on reading assessments that included measures of letter recognition, phonemic awareness, word reading, vocabulary, and comprehension (McCoach, O'Connell, Reis, & Levitt, 2006). Aikens and Barbarin (2008) also indicated a growing achievement gap between the poorest and most affluent students as they advanced from kindergarten to third grade. The research team analyzed the reading trajectories of over 3 million students who completed both multiple choice and open ended question reading that measured letter and word recognition, phonemic awareness, receptive vocabulary, and listening comprehension (Aikens & Barbarin, 2008).

Widening reading proficiency between students of different ability levels has also been reported among students in the elementary grades (Christ, Silberglitt, Yeo, and Cormier, 2010; Shin, Deno, & Espin, 2000). Shin, Deno, and Espin (2000) examined a sample of 43 second graders. They concluded that among students with different starting ability levels, the gap between high and low achievers grew larger over the course of one academic year.

**Narrowing Achievement Gaps.** The NAEP assessments have revealed converging reading gaps have been reported in the elementary, middle, and high school grades (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009; Shin, Davison, Long, Chan, & Heistad, 2013; Silverman, et al., 2015). Shin, Davison, Long, Chan, and Heistad (2013) displayed narrowing reading comprehension gaps in an overall sample of 2,517 students from 4<sup>th</sup> to 7<sup>th</sup> grades. The participants took the reading portion of the Northwest Achievement Level Test (NALT), which measured their vocabulary, literal

comprehension, and inferential comprehension at each grade level (Shin, Davison, Long, Chan & Heistad, 2013).

The NAEP also showcased how the racial reading gap slightly narrowed among 9, 13, and 17 year olds between 1999 and 2009 (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009). Among 9 year olds, the average reading score increased eight points from 186 to 204 for an average African American student, and increased seven points from 221 to 228 for an average a Caucasian student. Among 13 year olds, increased nine points from 238 to 247 for an average African American student, increased three points from 245 to 248 for an average Hispanic student, and increased one point from 267 to 268 for an average Caucasian student. Within this time period among 17 year olds, the average reading score of an African American student increased two points from 264 to 266, while it remained unchanged at 295 for the average Caucasian student (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009).

Silverman et al. (2015) confirmed convergence of cultural reading proficiency gaps among from the 2<sup>nd</sup> to the 5<sup>th</sup> grade by classifying students based on spoken home language. The research team analyzed the reading trajectories of 207 students who spoke English as their primary language (L1) and 170 students who spoke English as their second language (L2) over the course of four years. The participants completed a reading comprehension assessment during the fall and spring of each year that contained passage comprehension questions and cloze comprehension tasks. The research team noted that the native English speakers started at a higher proficiency level than the English language learners, but a diminishing achievement gap emerged over the course of the four years between the two groups of students (Silverman et al., 2015).

**Sustaining Achievement Gaps.** Several researchers have reported evidence of sustaining, rather than widening or narrowing, reading gaps in both the upper and lower grades (Bast & Reitsma, 1997; Hemphill & Vanneman, 2011; Nese et al., 2012; Rampey, Dion, & Donahue, 2009). Between 1990 and 2000, the National Educational Assessment of Educational Progress (NAEP) reported the reading gap between students of certain racial backgrounds remained unchanged among 9 year olds. Within the nationally tested group, the average reading score increased from 217 to 221 for a Caucasian student and it increased the same amount from 182 to 186 for an African American student (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009). The racial reading gap within the 17 year old group reflected similar degrees of continuity. NAEP reported reading declines among all ethnic groups in this age bracket between 1990 and 2000, with the smallest average decrease of two points from 297 to 295 for a Caucasian student, and a slightly larger decrease of three points from 267 to 264 for an African American student (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009).

Researchers have also reported evidence of sustaining reading gaps between high and low ability students that are classified according to socioeconomic status (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Nese et. al, 2012). Nese et al. (2012) found that students receiving free-reduced lunch began the school year with lower oral reading fluency scores, but obtained within-year growth rates similar to other students between grades 3 – 5. The research team examined the oral reading fluency growth of 2,465 students over the course of the three years to formulate their conclusion (Nese et. al, 2012).

Several researchers have examined sub-samples distinguished by primary spoken language, and concluded that the reading achievement gap is constant between those of different linguistic backgrounds (Chong, 2009; Low, 2013; Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou & Snow, 2011). Chong (2009) used latent growth analysis to conclude the reading comprehension growth trajectories of English (L1) and English (L2) students from 4<sup>th</sup> – 7<sup>th</sup> grade were similar. The researcher evaluated the reading performance of 593 students whose first language was English (L1) and 153 students whose second language was English (L2). The decoding, vocabulary, comprehension, and scanning ability was tested over a four year period on account of the Stanford Diagnostic Reading Test. Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou, and Snow (2011) confirmed no significant variation across student ability levels from 5<sup>th</sup> – 7<sup>th</sup> grade, when classified into groups based on language spoken at home. The research team analyzed the vocabulary, sentence, and passage reading comprehension growth of 55 language minority adolescents over the three year period, and indicated continuity since they mostly stayed on the same trajectory. In corroboration, Low (2013) used latent growth analysis to determine persistence in reading comprehension performance over a six year academic period between English (L1) and English (L2) students. The research team assessed the word recognition, word reading fluency, decoding, spelling, and reading comprehension ability of 773 students whose first language was English (L1) and 182 students who spoke English as an additional language (L2) from 2<sup>nd</sup> to the 7<sup>th</sup> grade. The sustaining gaps in comprehension between high and low ability readers signified that initial reading proficiency did not substantially influence growth potential.

Researchers have also deemed a sustainable reading proficiency gap between students of different ability levels (Catts, Bridges & Little, 2008; Francis, Shaywitz, Stuebing, Shaywitz & Fletcher, 1996). Catts, Bridges, Little and Tomblin (2008) used latent growth analysis to determine that the initial reading level of students in the 2<sup>nd</sup>, 4<sup>th</sup>, 8<sup>th</sup>, and 10<sup>th</sup> grade with language impairments significantly differed from those with typical language. Though the initial reading levels differed, the trajectory shapes between the two groups were similar. Francis, Shaywitz, Stuebing, Shaywitz, and Fletcher (1996) concluded that students in grades 1 – 9 scoring in the 25<sup>th</sup> percentile in reading demonstrated rates of growth consistent with average readers. The research team analyzed the results of 403 students who took the Woodcock-Johnson Psychoeducational Test Battery, which included word identification, decoding, and passage comprehension assessments. It is unclear if time remedies the achievement gap, due to the current lack of consensus in the existing literature. Table 1 demonstrates the key findings of the primary studies featured in the literature review.

Table 1.

*Primary Article Findings from the Literature Review*

Article	<u>Reading Trajectory Shape</u>		<u>Sample Age</u>	
	Linear	Non-Linear	Grade 1 - 7	Grade 8 - 12
Deno, et al (2001)	✓		✓	
Rescorla (2004)*		✓	✓	✓
Ardoin (2008)		✓	✓	
Graney (2009)		✓	✓	
Chong (2009)	✓		✓	
Christ (2010)		✓	✓	
Beecher (2011)*		✓	✓	✓
Keller-Margulis (2012)		✓	✓	
Nese, et al. (2012) (2013)		✓	✓	
Shin (2013)		✓	✓	
Low (2013)	✓		✓	
Petscher (2014)		✓	✓	✓
	<u>Ability &amp; Growth Relationship</u>		<u>Sample Age</u>	
	Positive	Negative	Grade 1 - 7	Grade 8 - 12
Rescorla (2004)*		✓	✓	✓
McCoach (2006)	✓		✓	
Aikens (2008)	✓		✓	
Beecher (2011)		✓	✓	
Shin (2013)		✓	✓	
	<u>Achievement Gap</u>			<u>Sample Age</u>
	Widening	Narrowing	Sustaining	Grade 1 - 7    Grade 8 - 12
Shin (2000)	✓			✓
Abedi et al. (2005)	✓			✓
McCoach (2006)	✓			✓
Aikens (2008)	✓			✓
Catts (2008)*			✓	✓
Rampey (2009)*	✓		✓	✓
Christ (2010)	✓		✓	
Hemphill (2011)*	✓	✓	✓	✓
Nese et al. (2012)			✓	
Low (2013)			✓	
Shin (2013)		✓	✓	
Silverman et al. (2015)		✓	✓	

Note. Each Article is cited by the lead author's name; \*denotes a study that examined various age groups or an age range that spanned both groups



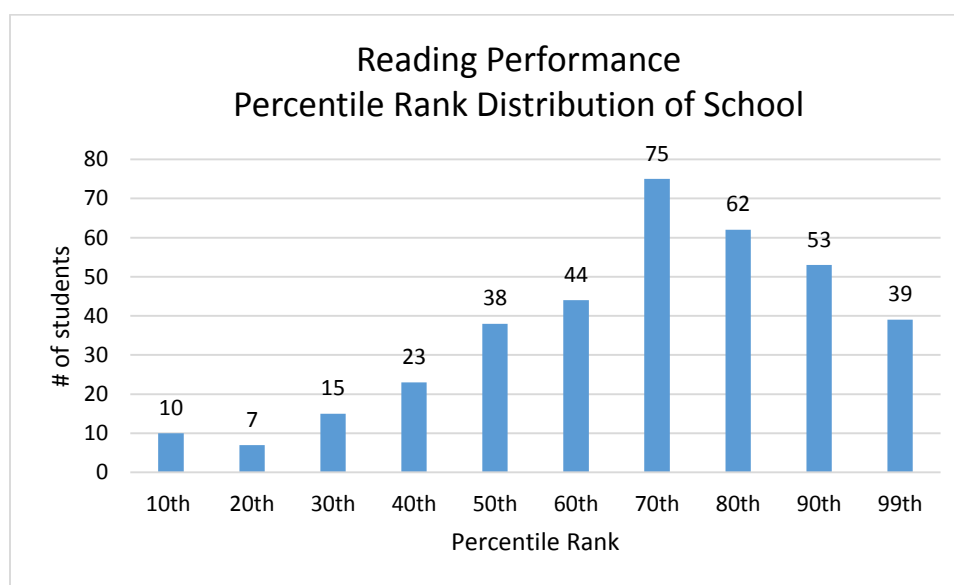
## **Summary**

Researchers that study reading comprehension growth typically study younger students in the primary grades (Graney, Missall, Martinez & Bergstrom, 2009; Nese, et al., 2012). Previous empirical studies have examined reading trajectories using various types of statistical analyses to highlight achievement gaps, but there is minimal research that examines this phenomenon among adolescents in high school (Kigel, McElvany, & Becker, 2015; Nese, et al., 2013; Wei, Liu, & Barnard-Brak, L., 2015). By examining the reading trajectories of adolescent students in grades 8 – 10 using latent growth modeling, it will be possible to determine the following: (a) the shape of high school adolescent reading trajectories; (b) the relationship between initial reading status and growth rate among adolescents; (c) the impact of socioeconomic and/or racial group membership on adolescent reading growth. These results will allow the researcher to make general comparisons of adolescent reading characteristics and growth to that of younger students, based on the evidence found in the literature review among elementary age students.

### CHAPTER III: METHODOLOGY

#### Setting

The study took place in an urban high school that enrolled 366 students in the southeastern region of the United States. The school utilized selective admissions criteria and screened students based on their 8<sup>th</sup> grade standardized test scores, middle school course grades, and school counselor recommendation. The school offered 17 honors courses and 15 Advanced Placement courses. The school also contained a substantial amount of high performing students, as evident by the school's standardized reading comprehension scores. Figure 1 features the school's percentile rank distribution on the nationally norm-referenced STAR reading test.

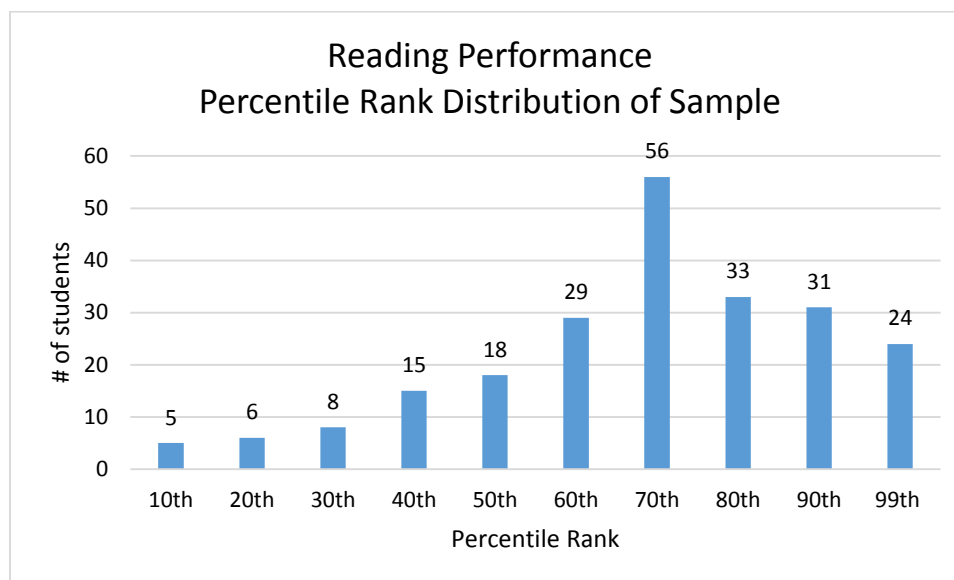


*Figure 1.* Reading Performance Percentile Rank Distribution of School

## **Participants**

Participant eligibility criteria for the current study included self-identifying as either Caucasian, African-American, Hispanic, or Multiracial and completion of at least five of the six standardized reading tests that were administered over the two year academic period. The data were collected as a part of a benchmark assessment series administered by the school district during the 2013-2014 and 2014-2015 academic school years. The standardized reading comprehension scores of 225 students between grades eight through ten were evaluated for the study. The sample was composed of 110 (49%) males and 115 (51%) females. At the onset of the data collection, 90 (40%) students were in the eighth grade, 76 (34%) were in the ninth grade, and 59 (26%) were in the tenth grade. The reading performance percentile rank distribution of the sample resembled that of the school. A total of 11 (5%) students scored below the national 20 percentile rank, 23 (10%) between the 21 – 40 national percentile rank, 47 (21%) between the 41 – 60 national percentile rank, 89 (40%) between the 61 – 80 national percentile rank, and 55 (24%) above the national 81 percentile rank.

Figure 2 features the sample's percentile rank distribution on the nationally norm-referenced STAR reading test.



*Figure 2.* Reading Performance Percentile Rank Distribution of Sample

In the current study, lunch status was used as a proxy for socioeconomic status. For the 2014-2015 school year, a household of four with an income of less than \$44,123 was eligible for reduced price-lunch, and a household of four with an income less than \$31,005 qualified for free school lunch (Income Eligibility Guidelines, 2014). Of the total sample, 159 (71%) qualified for paid lunch and 66 (29%) qualified for free or reduced/price lunch. The participant demographics for the study are featured in Table 2.

Table 2.

*Demographics of Study Participants*

Ethnic Group	Paid Lunch	Free/Reduced Lunch	N	Percentage
Caucasian	67	21	88	39.1
African-American	61	34	95	42.2
Hispanic	13	7	20	8.9
Multiracial	18	4	22	9.8
Total	159	66	225	100

Note. N = Sample Size

## **Instrumentation**

The STAR test is administered to students in grades 1 through 12 and provides reading proficiency and growth assessment data for each individual test taker. The software uses the calculated scaled score to determine the skills in which students have already mastered, and also those that are emerging or developing. The scaled score ranges from 0 to 1400, and is also converted to a percentile rank score to allow for the comparison of students across different grade levels. The STAR reading test has an overall reliability of .93, which is a measure of the psychometric consistency across the entire testing population. The STAR reading test reports an alternative form reliability of .80 for the upper high school grades, which is the degree to which different versions of the test correlate with one another for measurement consistency. The construct validity of the STAR tests is .82, which is an indicator of how closely the test is measuring the skills of interest. The construct validity was established by linking STAR data to that of another standardized reading comprehension instrument, the Degrees of Reading Power (DRP) assessment. Yoes (1999) linked the Rasch item difficulty scale of the two assessments, using nationwide samples of students in grades 3, 5, 7, and 10 who took both tests. The item-level factor analysis of the combined response data indicated that both the STAR and DRP assessment were measuring the same construct at each of the respective grade levels. The predictive validity of the STAR tests for state achievement tests is .82, which is the ability of the test to accurately predict student performance on a subsequent state or national achievement test of reading ability.

Renaissance Learning produces widely recognized reading and assessment software, including Accelerated Reader, English in a Flash, Read Now Power Up!, and

Fluent Reader. The STAR test is a norm-referenced reading test that aligns with Common Core content area reading standards (Common Core State Standards Initiative, 2010). The computer-adaptive test utilizes item response theory (IRT) to tailor and match item difficulty to the student's skill level. The comprehensive question bank contains over 5,000 items that have been field tested with a nationwide sample of participants to ensure accurate calibration. During each testing event, students will answer an average of 34 question items. Text passages that correspond with test item questions do not exceed 100 words.

According to the STAR test blueprint, the assessment targets four broad domains—foundational skills, language, literature, and informational texts (Renaissance Learning, 2014). The foundational skills domain assesses the underlying ability to master concepts of print, phonological awareness, word recognition, and fluency. The language domain assesses contextual vocabulary, word relationships, structural analysis, and connotation. The literature domain gauges the ability to identify key ideas and supporting details related to the plot, setting, or theme of a story, analyze the author's point of view and figurative language, integrate knowledge and ideas, and manage a broad range of text complexity. The informational text domain addresses inference-making and sequential comprehension, author's purpose and organization, and other features related to the development of independent reading.

### **Measurement Procedures**

The six reading comprehension tests were administered over a two year period on the following time schedule: Test 1 (T1) October of 2013, Test 2 (T2) December of 2013, Test 3 (T3) March of 2014, Test 4 (T4) October of 2014, Test 5 (T5) December of 2014,

and Test 6 (T6) March of 2015. The students completed the tests on school computers in their English classes. Each computer-adaptive reading test was individualized and contained different questions. Using item-response theory, the computer software incrementally generated students' questions according to the accuracy of their ongoing responses throughout the test. Each test was untimed and self-paced, and took students between 15 minutes and 45 minutes to complete the assessment.

### **Data Analysis Procedures**

A randomized test identification number was assigned to each student, who was referenced throughout the data analysis process by this number. The participants' sociocultural demographics were also coded. The race variables were coded as follows: Caucasian—1, Multiracial—2, African-American—3, and Hispanic—4. The socioeconomic variables were coded as follows: Paid Lunch—1, Free/Reduced Lunch—2. Before data analysis procedures were conducted, missing data were input with probable scores. The following measures contained randomly missing data: (T1) one missing score, (T2) one missing score, (T3) one missing score, (T4) three missing scores, and (T5) three missing scores. Missing data were manually replaced by the researcher using the mean imputation method, which entailed replacing the missing score with the sample mean score for each respective test. The sample mean score of 1122.20 was imputed for the one missing score for test 1, the missing score for Test 2 was replaced with 1162.78, the missing score for Test 3 was replaced with 1188.14, the four missing scores for Test 4 were replaced with 1148.97, and the three missing scores for Test 5 were replaced with 1184.81. The imputation method provides acceptable results and is convenient to implement (Alf, Larsen, & Lorenz, 2009).



Descriptive statistics were computed using IBM SPSS v.21. The mean and standard deviation of the test scores for the entire sample, as well as within each subgroup, was calculated. The mean value for each test was the average standardized reading score produced by students in the featured group. The performance means were plotted on a graph with separate lines classified by ethnicity as either Caucasian, African-American, Hispanic, or Multiracial, and by lunch status as either paid or free/reduced lunch. The plotting of the test performance means by demographic helped to demonstrate group differences in longitudinal reading growth. The standard deviation is a feature of dispersion, which measures the spread of the data. A low standard deviation, or one close to zero, indicates that the data points are close to the mean. A high standard deviation indicates the data points are spread out over a wider range.

**Trend Analysis.** To determine the shape of the reading trajectories, a trend analysis was conducted using the general linear model procedure in SAS 9.4. The software employed orthogonal contrast coefficients to confirm either a linear, quadratic, cubic, and/or quartic trend line for the standardized reading comprehension scores. Using general linear model (GLM), the results of the omnibus F-test reflects all possible differences between the means of the groups analyzed. A p-value below .05 indicates significance, or a close resemblance to the hypothesized trend. A linear trend contains no bends, a quadratic trend contains one bend, the cubic trend contains two bends, and the quartic trend contains three bends.

**Latent Growth Curve Analysis.** A type of structural equation modeling (SEM), known as latent growth curve analysis (LGC), was employed in the current study. SEM specifies relations among observed and latent variables, and is one of the most flexible

and commonly used tools among social scientists (Hoyle, 1995; Preacher, 2010). LGC analysis is able to equate time dependent relations into the analysis of variability across individuals. (Bast & Reitsma, 1998). In a linear growth model, individuals in a representative sample may be observed systematically on three or more occasions in either evenly or unevenly spaced intervals (Byrne, 2013). A growth curve that contains a minimum sample size of 200 or more at each time point is large enough to allow for the detection of person-level effects (Boomsma & Hoogland, 2001).

LGC modeling was performed through AMOS v21 to determine model fit and growth parameters of the reading trajectories. Key assumptions of the LGC model hold that the trajectory is linear and the observed variables are derived from a population distribution with similar kurtosis as a normal distribution. LGC models estimate initial performance (intercept), rate of growth (slope), structural slopes, and individual differences (variance) (Kline, 1998). In a LGC, the intercept and slope are latent factors that can indicate non-linear patterns of growth through a model fit test (Byrne & Crombie, 2003; Hox, 2010). The capability of quadratic modeling on latent traits is a benefit over ANOVA or multiple regression models. Growth models are more flexible than traditional longitudinal models because of their adept ability to manage missing data, unequally spaced time points, and skewed data (Curran, Obeidat & Losardo, 2010). The LGC model is also advantageous because it allows investigation of both the pre-existing and consequential conditions of change (Preacher, Wichman, MacCallum & Briggs, 2008). The enhanced statistical power and ability to account for measurement error make latent growth modeling ideal for the analysis of change over time.

**Model Creation and Model Fit.** LGC models were fit to the data to examine both explained and unexplained variance of reading growth in the repeated-measures data. Absolute fit indices, relative fit indices, parsimonious fit indices, and non-centrality based indices were used to determine model fit. The results of a  $\chi^2$  test is an absolute fit indicator. For large sample data sets, the  $\chi^2$  statistic is reported as a  $\chi^2$  to degrees of freedom ratio, with anything smaller than or equal to 3 indicative of acceptable fit (Carmines & McIver, 1981). The normed fit index (NFI) is an example of a relative fit index. This index compares the given model that is tested to an alternative baseline model. PCFI and PCLOSE are parsimonious fit indices. Parsimony adjusted measures favor simpler theoretical processes over more complex ones. The root mean square error of approximation (RMSEA) and the comparative fit index (CFI) are non-centrality based indices. These indices are used to gauge the match between the model's predictions and observed data (Preacher, Wichman, MacCallum & Briggs, 2008).

Once the original model was generated, modification indices revealed constraints that decreased the fit of the model. The equality constraint on the residual errors were removed, which improved model fit. Modification indices that did not substantially improve the model were not utilized. The first intercept parameter of the linear model was set to zero, representing initial reading achievement. The slope parameter denoting the comprehension growth was initially established as a standard LGC model (Bollen & Curran, 2006). Since the theoretical slope represented change over unequal time periods, time scores of 0, 1, 2.5, 6, 7, and 8.5 were assigned to represent the six benchmark tests administered in October 2013, January 2014, March 2014, October 2014, January 2015, and March 2015. Both the conditional and unconditional freed-loading LGC models

were considered to model overall differences in reading comprehension growth. To allow the variance of both the latent intercept and latent slope, the loadings were freed and the model was permitted to estimate the latent variables in relation to each other. In lieu of forcing the variables to model linear growth, the relationships of the intercept to the rates of change were calculated more accurately. All path modifications and changes to the model were tracked and reported.

**Model Estimation.** For the current study, individual differences in reading growth were detected by examining the mean and variances of the intercept and slope growth parameters (Bast & Reitsma, 1998). The correlation between the model parameters were examined to determine the relationship between the intercept (starting reading level), and the slope (rate of growth). If individuals with a higher intercept value yield a higher slope, the correlation has a positive relationship and is considered significant. If individuals with a higher intercept value yield a lower slope, the correlation has a negative relationship and is considered nonsignificant. The positive or negative relationship of the intercept to slope correlation is a determinant of the overall achievement gap either widening or narrowing.

Race, socioeconomic status, and the cross-domain influences of both, were added to the model to ascertain their relationship with the intercept and slope of reading comprehension growth. Racial association was represented in the model through the racial group in which the student self-identified. Student lunch status served as a proxy for socioeconomic status, and was represented in the model depending on whether the student qualified for paid or reduced-priced lunch. After plausible LGC models were built, the sociocultural variables of interest were utilized in the various models to assess

the statistical significance of the model parameters. While there was a correlation between the predictor variables (race and/or SES) and the outcome variable (reading score), several latent factors influenced the parameters and their correlations. A latent factor is any hidden or unobserved factor that impacts the measured variables. Examples of latent factors that may impact measured academic outcomes include, but are not limited to, parental support, quality of life, feelings of morale, sense of belonging, intrinsic motivation, perceived benefits of education, attitudes about school, testing anxiety, depression, and other psychological or sociological components (Bollen, 2002). The characteristics of each latent growth model was analyzed and compared.

## CHAPTER IV: RESULTS

**Descriptive Statistics**

Table 3 reports the observed sample means and standard deviations for the reading comprehension scores at each time point, categorized by racial association and lunch status.

Table 3.

*Sample Means and Standard Deviations for the Reading Tests*

Test	Caucasian		African-American	
	<i>n</i> = 67	<i>n</i> = 21	<i>n</i> = 61	<i>n</i> = 34
	Paid Lunch <i>M</i> ( <i>SD</i> )	F/R Lunch <i>M</i> ( <i>SD</i> )	Paid Lunch <i>M</i> ( <i>SD</i> )	F/R Lunch <i>M</i> ( <i>SD</i> )
T1	1222.82 (156.03)	1161.33 (211.89)	1084.51 (205.10)	1029.27 (223.79)
T2	1240.64 (166.93)	1193.86 (196.10)	1119.07 (199.52)	1081.99 (167.67)
T3	1270.05 (123.39)	1206.05 (186.29)	1157.10 (171.99)	1111.56 (189.48)
T4	1240.84 (168.92)	1162.43 (213.46)	1124.02 (198.80)	1074.12 (176.18)
T5	1273.48 (122.67)	1234.43 (178.46)	1135.48 (178.59)	1103.35 (217.45)
T6	1265.75 (138.17)	1184.52 (210.76)	1148.90 (178.16)	1109.91 (211.62)
Test	Hispanic		Multiracial	
	<i>n</i> = 13	<i>n</i> = 7	<i>n</i> = 18	<i>n</i> = 4
	Paid Lunch <i>M</i> ( <i>SD</i> )	F/R Lunch <i>M</i> ( <i>SD</i> )	Paid Lunch <i>M</i> ( <i>SD</i> )	F/R Lunch <i>M</i> ( <i>SD</i> )
T1	1017.39 (215.17)	918.48 (348.09)	1177.89 (156.66)	1043.25 (251.90)
T2	1128.39 (208.32)	974.43 (260.83)	1221.44 (184.01)	1168.25 (150.51)
T3	1111.31 (196.37)	1018.29 (300.56)	1225.83 (122.06)	1224.00 (151.67)
T4	1053.39 (229.42)	1013.29 (217.94)	1159.28 (229.13)	1107.50 (237.22)
T5	1144.00 (218.75)	994.29 (303.11)	1224.28 (151.56)	1172.00 (136.05)
T6	1114.08 (213.48)	951.14 (235.93)	1245.89 (144.60)	1193.75 (123.93)

Note. *M* = Mean. *SD* = Standard Deviation. FRL = Free/Reduced Lunch

At the onset of the reading benchmark testing series, Caucasian students who qualified for paid lunch scored the highest mean average of 1222.82, while Hispanic students who qualified for free/reduced priced lunch scored the lowest mean average of 918.48. By the sixth benchmark test, those same groups obtained the highest and lowest average reading scores of 1265.75 and 951.14, respectively.

Over the two year span, the widest dispersion of reading scores was obtained by Hispanic students who qualified for free/reduced lunch, with an average standard deviation of 277.74. The narrowest dispersion of reading scores was obtained by Caucasian students who qualified for paid lunch, with an average standard deviation of 146.02. Within every ethnic group assessed, students who qualified for paid lunch had on average higher scores and narrower range dispersions on the reading comprehension tests than those who qualified for free/reduced price lunch.

Over the two year period, growth characteristics between high and low income students were not consistent across ethnic groups. The average growth range of Caucasian students who qualified for paid vs. free/reduced lunch was 42.93 and 23.19, respectively. The average growth range of African American students who qualified for paid and free/reduced lunch was 64.39 and 80.65, respectively. The average growth range of Hispanic students who qualified for paid and free/reduced lunch was 96.69 and 32.69, respectively. The average growth range of multiracial students who qualified for paid and free/reduced price lunch was 68.00 and 150.50, respectively.

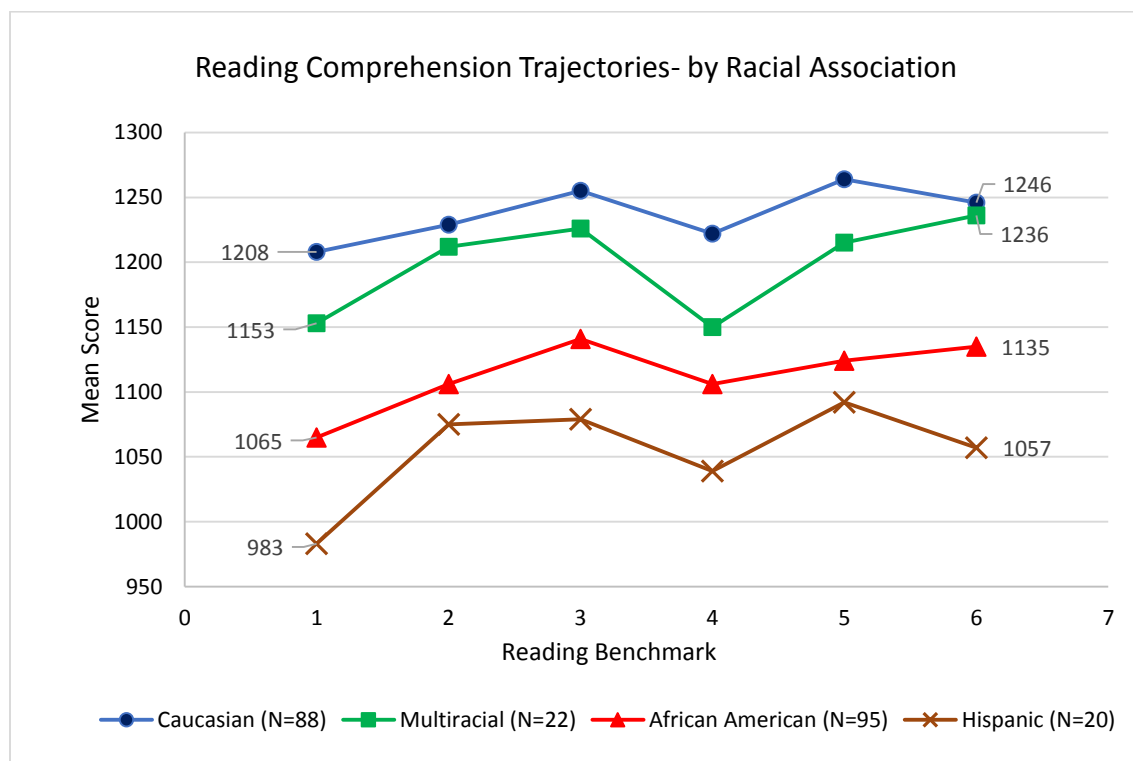
Economic disadvantage seemed to have a more impeding impact on the reading growth of Caucasian and Hispanic students, as compared to African American and multiracial students. Caucasian and Hispanic students who qualified for paid lunch

experienced greater reading growth over the two year period than their same race peers who qualified for free/reduced lunch. On the other hand, African Americans and multiracial students who qualified for free/reduced price lunch experienced greater growth over the two year period, than their same race peers who qualified for paid lunch.

Figure 3 demonstrates the mean reading comprehension scores achieved by all students on the six benchmark reading tests administered over a two year academic period. The students are grouped by ethnicity to employ a visual analysis of the way in which racial association impacts the reading growth trends. Within the sample, 88 students (39%) self-identified as Caucasian, 95 students (42%) as African-American, 20 students (9%) as Hispanic, and 22 students (10%) as multiracial. Students who self-identified as Caucasian started off with the highest mean score of 1208 for benchmark 1, and scored 1229, 1255, 1222, 1264, and 1246 on the successive benchmark reading tests. Students who self-identified as multiracial started off with the second highest mean score of 1153 on benchmark 1, and scored 1212, 1226, 1150, 1215, and 1236 on the successive benchmark reading tests. Students who self-identified as African-American started off with the third highest mean score of 1065 on benchmark 1, and scored 1106, 1141, 1106, 1124, and 1135 on the successive benchmark reading tests. Students who self-identified as Hispanic started off with the lowest mean score of 983 on benchmark 1, and scored 1075, 1079, 1039, 1092, and 1057 on the successive benchmark reading tests.



The reading comprehension growth trajectories for all students, grouped by racial association, are featured in Figure 3.

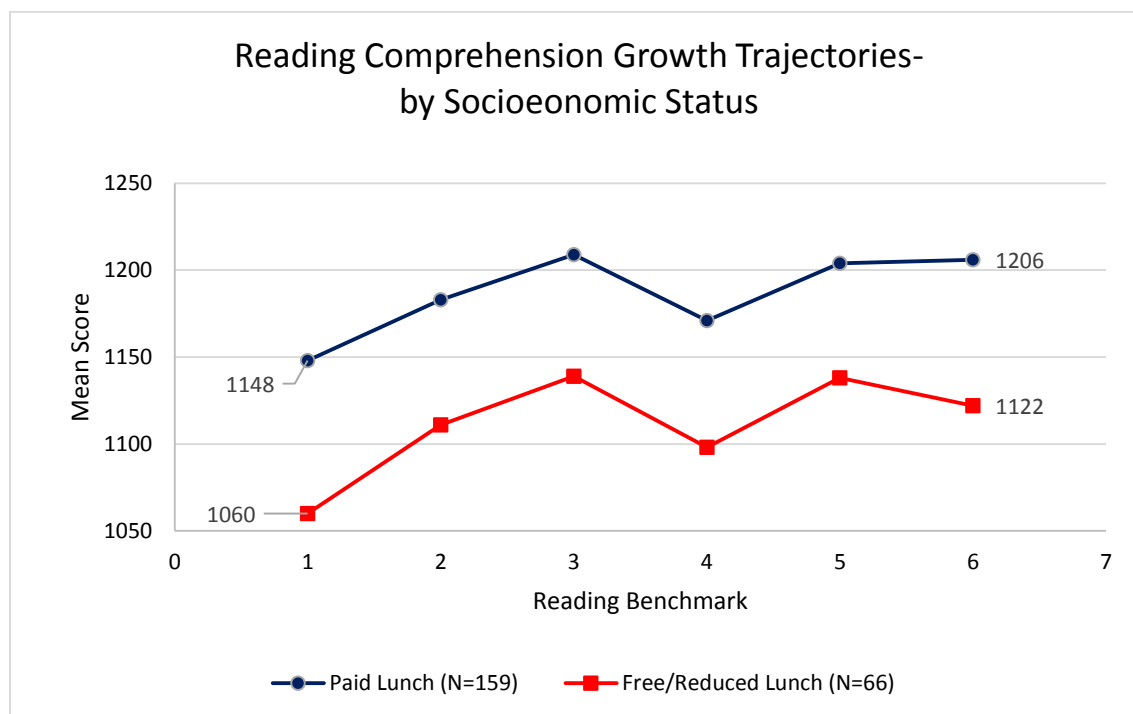


*Figure 3. Reading Comprehension Growth Trajectories by Racial Group*

Though students from different ethnic groups started at different reading levels at the beginning of each academic year, the overall growth pattern of all students were somewhat similar. The reading performance of the overall sample increased from benchmark 1 to benchmark 2, and again on benchmark 3. The reading performance of the overall sample decreased from benchmark 3 to benchmark 4, indicating loss of reading skills over the summer months. The reading performance of the overall sample increased from benchmark 4 to 5, and again on benchmark 6 for those who self-identified as African-American or multiracial.

Within the sample, 159 students (71%) qualified for paid lunch and 66 students (29%) qualified for free or reduced/price lunch. Students who qualified for paid lunch started off with the highest mean score of 1148 for benchmark 1, and scored 1183, 1209, 1171, 1204, and 1206 on the successive benchmarks. Students who qualified for free/reduced lunch started off with a lower mean score of 1060 on benchmark 1, and scored 1111, 1139, 1098, 1138, and 1122 on the successive benchmarks. Students were grouped by socioeconomic status to better examine the way in which economic factors impacts the reading growth trends.

Figure 4 demonstrates the mean reading comprehension scores achieved by all students, grouped by socioeconomic status.



*Figure 4. Reading Comprehension Growth Trajectories by Socioeconomic Status*

Though students of different socioeconomic levels started at different reading levels at the beginning of each academic year, the overall growth pattern of both groups of students were strikingly similar. The reading performance of the overall sample increased from benchmark 1 to benchmark 2, and again on benchmark 3. The loss of reading skills over the summer months was also evident in the breakdown of the sample by socioeconomic status, since the overall sample decreased from benchmark 3 to benchmark 4. The reading performance of the overall sample increased from benchmark 4 to 5, and again on benchmark 6 for those who qualified for paid lunch.

## Trend Analysis

To determine the shape of the reading comprehension trajectories, a trend analysis was conducted in SAS 9.4. A linear trend contains no bends, a quadratic trend contains one bend, a cubic trend contains two bends, and a quartic trend contains three bends. The software employed orthogonal contrast coefficients to confirm either a linear, quadratic, cubic, and/or quartic trend line for the standardized reading comprehension scores.

Among the standardized reading comprehension scores, there was a significant linear trend,  $F(1, 224) = 40.88, p < .01$ , a significant quadratic trend,  $F(1, 224) = 10.89, p < .01$ , and a significant cubic trend,  $F(1, 224) = 12.91, p < .01$ . The quartic trend did not meet the criteria for statistical significance,  $F(1, 224) = 3.68, p > .05$ . The data more closely fit the linear trend, followed by the cubic, then quadratic trend. The most reliable trend, the linear trend, indicated that reading comprehension performance increased proportionately at each time of measurement. Table 4 features the trend analysis table.

Table 4.

*Trend Analysis Table*

Contrast	Type III SS	F Value	Significance
Linear	344,594.82	40.88	< .0001*
Quadratic	86,663.13	10.89	.0011*
Cubic	103,921.71	12.91	.0004*
Quartic	28,887.02	3.68	.0562

Note. SS = Sum of Squares; \*denotes statistical significance

### **Latent Growth Curve Models**

The standardized reading scores of the full sample were modeled in a basic LGC model using AMOS. The basic LGC model demonstrated how the intercept and slope variables of interest influenced the reading comprehension scores at the six time points of measurement. The error variance corrected the measured model for random error, or served to absorb random variation in the reading comprehension scores for which no suitable predictors were provided. Latent variables E1 – E6 were unobserved, exogenous variables that indicated the amount of individual variance in the observed scores of the reading comprehension tests. T1 – T6 were the average reading scores from the six different reading tests, and also represented indicators of the latent variables that impacted reading performance at each of the different testing waves. The squares in the visual model represented observed variables and the circles represented latent variables. The latent slope and intercept indicated that there was some kind of underlying influence among reading comprehension measured at the six different time periods. The model's single arrowheads represented standardized regression paths and the double arrowheads represented correlations between variables. Figure 5 displays the schematic of the basic latent growth model.

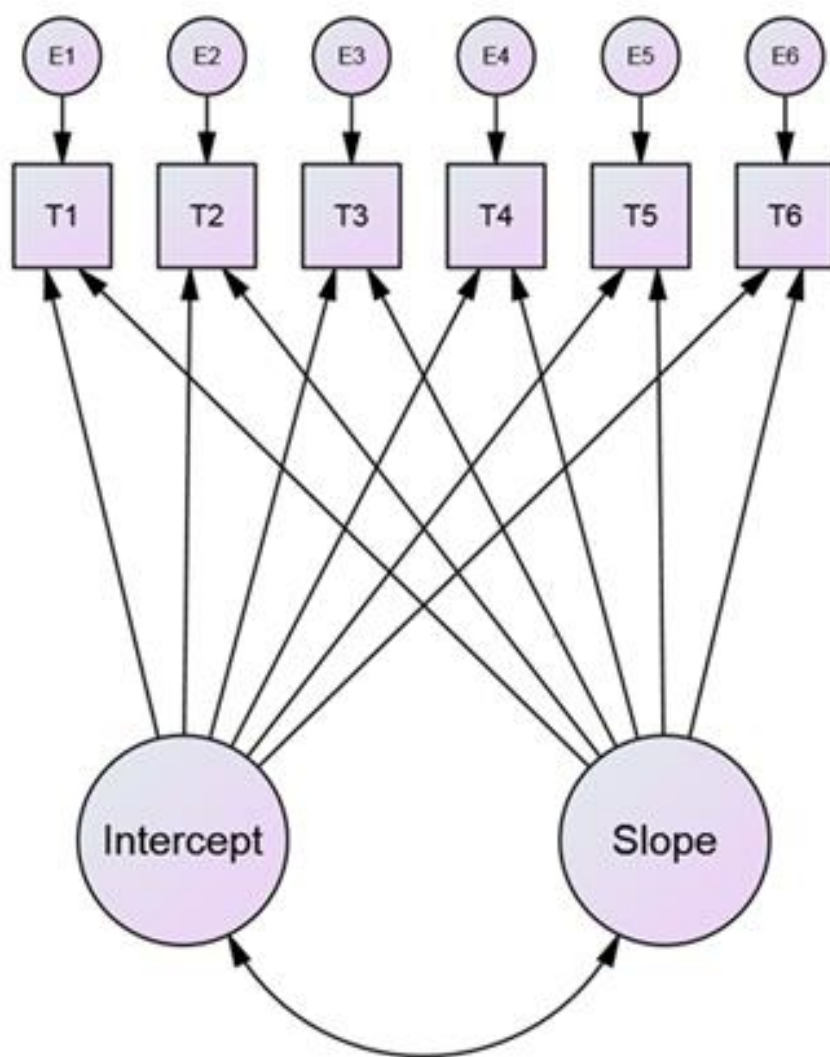


Figure 5. Basic Latent Growth Curve Model

**Goodness of Fit Indices.** Four models were created by the AMOS statistical software and fit to the data, which included a basic model, a model that accounted for the impact of race, a model that accounted for the impact of socioeconomic status, and a model that accounted for the shared impact of both race and socioeconomic status. Various fit indices were examined to ensure the goodness of fit for each of the models. Constructed models with a close fit have a broader impact, since the implications of the theory can be applied to practice and other real-world scenarios. Theoretical models that poorly fit the data should not be used by the researcher to make real-world implications.

The models employed in the current study indicated closeness of fit for five of the six major goodness of fit indices. According to the convention for the  $\chi^2 / df$  index, neither of the models produced values within the recommended levels for close fit. The conventional range of close fit for the chi-square to degrees of freedom ( $\chi^2 / df$ ) index is between 1 and 2, with values approaching 1 indicative of a better fit (Byrne, 1989). However, large sample sizes have the potential to inflate  $\chi^2$  values and erroneously imply a poor data-to-model fit (Schumacker & Lomax, 2004). To better accommodate data sets with large sample sizes, some researchers have recommended wider ranges between 1 and 3 as an acceptable  $\chi^2 / df$  ratio (Carmines & McIver, 1981).

The normed fit index (NFI) and comparative fit index (CFI) indicated very close fit. Both the NFI and the CFI index are on scales from zero to 1.00, with anything higher than .90 as acceptable and anything higher than .95 as very good (Byrne, 2010; Schumacker & Lomax, 2004). CFI is not affected by sample size, but decreases as the number of variables in the model increase (Gerbing & Anderson, 1993).

The parsimony comparative fit index (PCFI), PCLOSE, and root mean square error of approximation (RMSEA) values all specified acceptable fit. RMSEA is the mean of the covariance residuals, and is the most popular measure of fit (Kenny, Kaniskan, & McCoach, 2014). An RMSEA value below .08 indicates acceptable fit, while an RMSEA value below .05 indicates a good fit (Hu & Bentler, 1999). For data with larger sample sizes, the RMSEA value improves as more variables are added to the model (Kenny, Kaniskan, & McCoach, 2014). Overall, the models produced by the statistical software indicated appropriate fit. Table 5 showcases the goodness of fit indices for the models of interest, all rounded to the hundredths place.

Table 5.

*Goodness of Fit Indices for the Various Models*

Fit Index	Base Model	Race Model	SES Model	Race & SES Model	Recommended Level
$\chi^2 / df$	3.09	2.57	2.47	2.16	1 - 2
NFI	.97	.97	.97	.97	> .90
PCFI	.91	.84	.84	.77	> .80
PCLOSE	.01	.03	.04	.10	$\geq$ .05
RMSEA	.10	.08	.08	.07	$\leq$ .08
CFI	.98	.98	.98	.98	> .90

Note.  $\chi^2/df$  = chi-square/degrees of freedom ratio; NFI = Normed Fit Index; PCFI = Parsimony Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index



### **Relationship between Intercept and Slope**

After the models were created and fit was verified, the LGC analyses were conducted. Loadings for the intercept factor and paths from the slope factor were allowed to freely vary. Changes in the loadings on the slope factor altered the scale of time. This type of rescaling did not affect the correlations between the slope factor and the other predictors in the model. Though a trend analysis was conducted to confirm the shape of the trajectories, factor loadings also provided information about the shape of the growth trends over time. Because the intercept loadings adjusted from 1 to a range between .88 - .96, this indicated a slight bend in the shape of the reading growth trajectories.

The basic model revealed the overall characteristics of the reading comprehension trajectories. The model revealed a significant intercept of 1155.80 ( $p < .01$ ) and a significant slope of 2.92 ( $p < .01$ ). The average person achieved an initial reading score of 1155.80 and experienced an average growth rate of 2.92. The unstandardized covariance between the intercept and slope was not significant at -291.24 ( $p > .05$ ). The non-significant standardized correlation between the intercept and slope was -.33 in the base model.

The negative relationship between the intercept and slope provides evidence that adolescents with a higher reading proficiency score experience lower rates of growth. This also insinuates an overall narrowing of the achievement gap, since the overall performance discrepancy of high achieving and low achieving students is slightly converging over time.

As demonstrated through the base model, there was an estimated variance of .77 for test score one, .80 for test score two, .84 for test score three, .70 for test score four, .80 for test score five, and .83 for test score six. Table 6 features the summary of the basic model, and the diagram for the basic latent growth model is featured in Figure 6.

Table 6.

*Basic Model Summary*

	Estimate	Standard Error	Critical Ratio	P Value
Intercept	1155.80	13.48	85.73	<.0001
Slope	2.92	1.04	2.80	.005
Intercept and Slope Covariance	-291.24	163.70	-1.78	.08
Intercept and Slope Correlation	-.33			

Note. Covariance is unstandardized and correlation is standardized.

### Six-Measurement Model for Adolescent Reading Growth

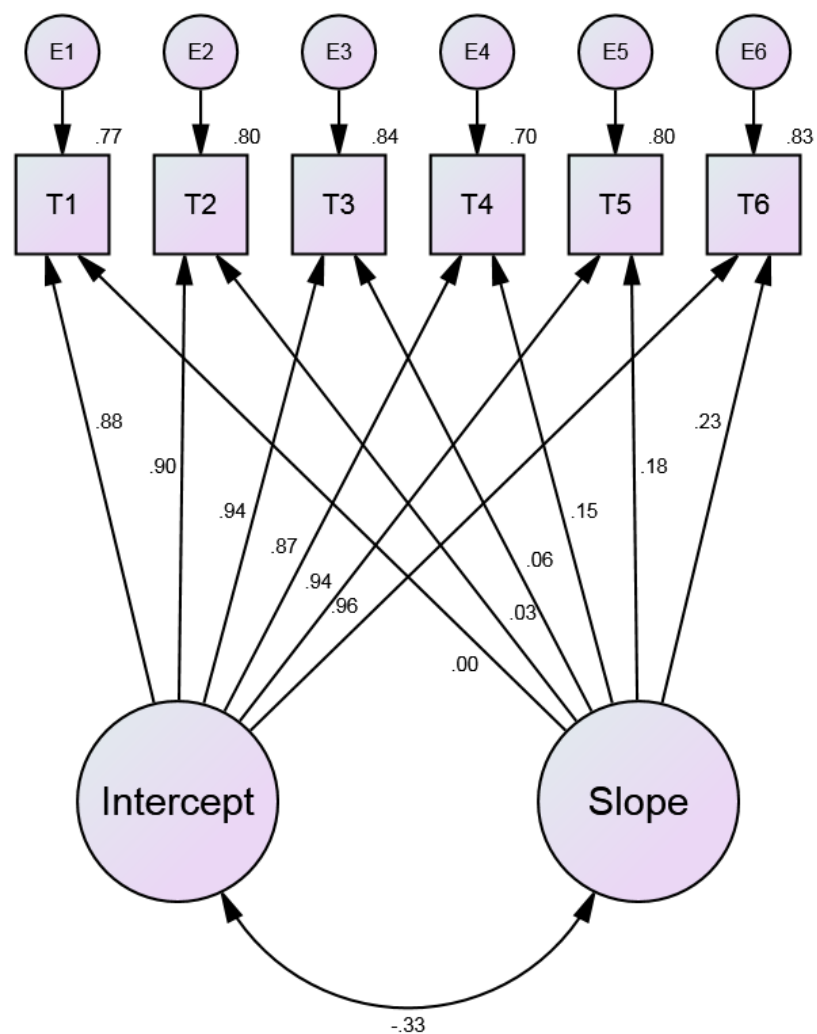


Figure 6. *Diagram for the Basic Latent Growth Model*

### **The Impact of Sociocultural Factors.**

To analyze the differing impact of racial association and socioeconomic status, separate models that accounted for the influence of each were compared. An examination of the variances and correlations among the sociocultural factors in each model reveal information about the impact of these variables over time.

**Race.** The race variables were quantified as follows: Caucasian—1, Multiracial—2, African-American—3, Hispanic—4. The numerical variables were ordered according to each racial group's observed mean performance on the reading comprehension measure. Through this approach, nominal variables functioned as ordinal variables. This transformed the analysis from a race-based comparison, to a racially bound performance-based comparison.

The race predictor variable was significant once added to the model, ( $p < .01$ ). The 1288.67 average intercept of the race model was also significant ( $p < .01$ ). The race predictor variable had a significant impact on the intercept, ( $p < .01$ ), but not on the slope, ( $p > .05$ ). The performance change from a higher to a lower reading comprehension score based on racially bound group means had a significant  $-.36$  impact on the intercept, and a nonsignificant  $.09$  impact on the slope. This negative relationship of the intercept indicated that as the performance decreased throughout each racially bound group, the average initial reading level declined  $.09$  units. Reading comprehension growth did not significantly vary according to racial association. Therefore, Caucasian students started at a higher initial reading level, but did not experience greater reading growth than their non-Caucasian peers.

D1 and D2 are disturbance variables, or latent exogenous variables that are impacted by factors outside of the model's ability to measure (including random or measurement error). The -.32 standardized correlation between the exogenous variables D1 and D2 in the race model were not significant ( $p > .05$ ). Therefore, the latent exogenous variables of the slope (D1) did not significantly covary with the latent exogenous variables of the intercept (D2) in the race model. Table 7 features the model summary of the race model, and the diagram for the race latent growth model is featured in Figure 7.

Table 7.

Race Model Summary

	Estimate	Standard Error	Critical Ratio	P Value
Race	2.22	.07	30.89	<.0001
Intercept	1288.67	27.47	46.91	<.0001
Slope	2.01	1.98	1.01	.311
D1 and D2 Covariance	-263.21	154.37	-1.71	.09
D1 and D2 Correlation	-.32			

Note. D1 = Exogenous variables that impact the intercept; D2 = Exogenous variables that impact the slope;

### Six-Measurement Model for Adolescent Reading Growth (Race)

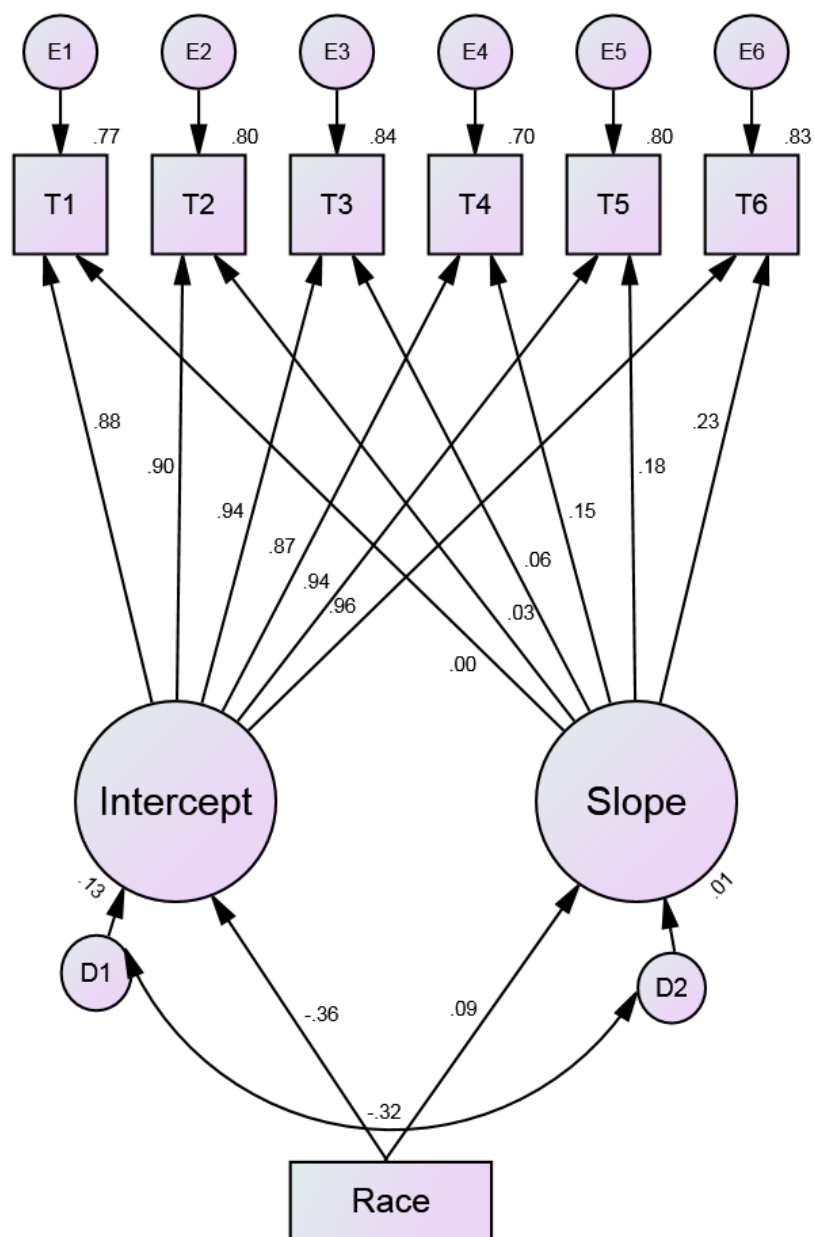


Figure 7. Diagram for the Race Latent Growth Model

**Socioeconomic Status.** The socioeconomic variables were coded as follows: Paid Lunch—1, Free/Reduced Lunch—2. The numerical variables were ordered according to each socioeconomic group's observed mean performance on the reading comprehension measure. In this approach, nominal variables functioned as ordinal variables, which transformed the analysis from a SES-based comparison, to a SES-bound performance-based comparison.

The SES predictor variable was significant once added to the model, ( $p < .01$ ). The 1253.21 average intercept of the SES model was also significant ( $p < .01$ ). The SES predictor variable had a significant impact on the intercept, ( $p < .01$ ), but not on the slope, ( $p > .05$ ). The performance change from a higher to a lower comprehension score based on the SES bound group means had a significant  $-.19$  impact on the intercept, and a non-significant  $.00$  impact on the slope. This negative relationship of the intercept indicated that as performance decreased from the higher to the lower SES group, the average initial reading level declined  $.19$  units. Students who qualify for free-reduced lunch start off at a lower initial reading level than those who qualify for paid lunch, but experienced no difference in growth of reading comprehension than those from a higher socioeconomic level.

The  $-.34$  standardized correlation between the exogenous variables D1 and D2 in the race model were not significant ( $p > .05$ ). Therefore, the latent exogenous variables of the slope (D1) that are impacted by factors outside of the model's ability to measure, such as random or measurement error, did not significantly covary with the latent exogenous variables of the intercept (D2) in the socioeconomic model.

Table 8 features the model summary of the SES model, and the diagram for the SES latent growth model is featured in Figure 8.

Table 8.

Socioeconomic Model Summary

	Estimate	Standard Error	Critical Ratio	<i>p</i> Value
SES	1.29	.03	42.52	<.0001
Intercept	1253.21	37.36	33.55	<.0001
Slope	2.96	2.52	1.18	.240
D1 and D2 Covariance	-291.79	161.28	-1.81	.07
D1 and D2 Correlation	-.34			

Note. D1 = Exogenous variables that impact the intercept; D2 = Exogenous variables that impact the slope



Six-Measurement Model for Adolescent Reading Growth (SES)

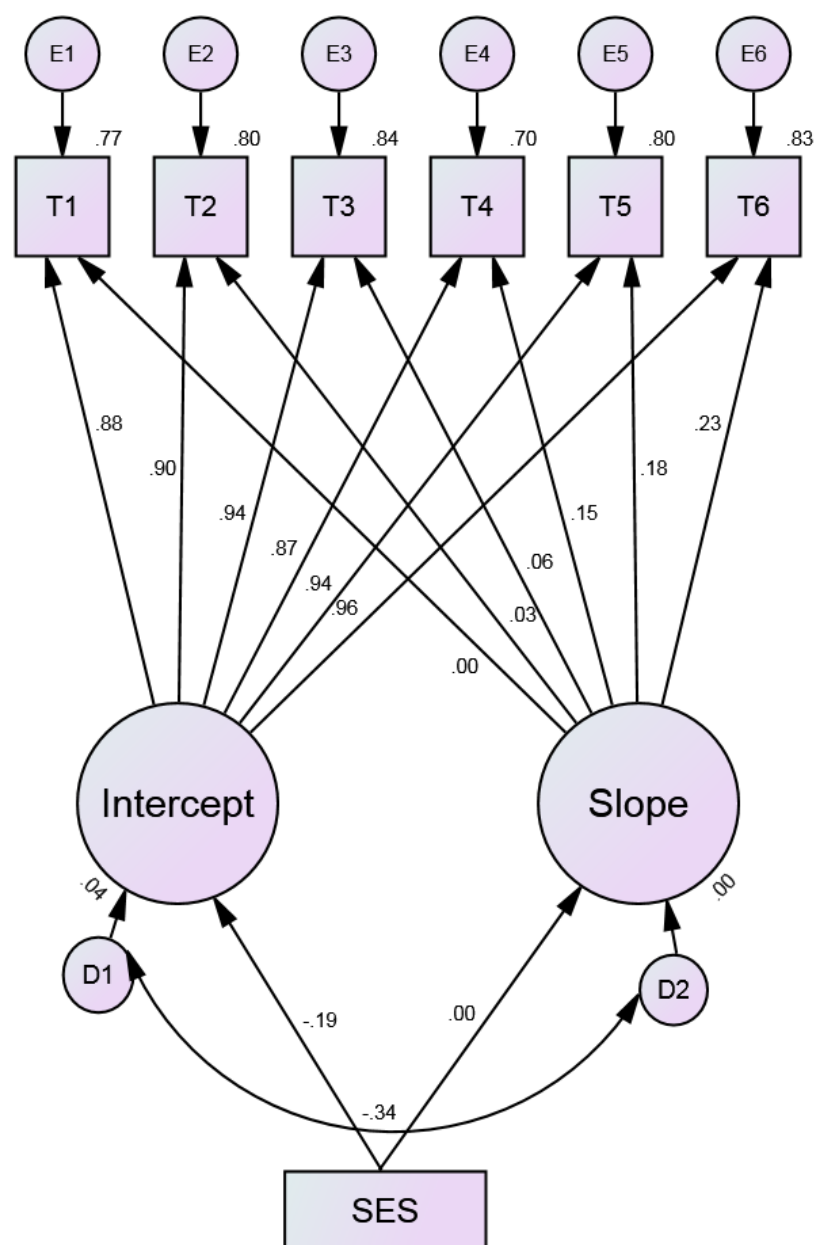


Figure 8. Diagram for the Socioeconomic Latent Growth Model

**Race and Socioeconomic Status.** Both the race and SES predictor variables were individually significant once they were added to the model, ( $p < .01$ ). Though the individual variables were significant to the model, they had no significant correlation with one another ( $p > .05$ ). Therefore, the associated factors of racial background that impact reading comprehension in the model were not mutually connected to the associated factors of SES that impact reading comprehension. This non-significant finding may also be due to the classification of the race and SES variables. Racial association was classified into four different categories, while SES only contained two categories. The inequivalent range of the race and SES variables may somewhat contribute to its lack of correlation in the model.

The 1360.32 average intercept of the race and SES model was significant ( $p < .01$ ). The race and SES variables had a significant impact on the intercept, ( $p < .01$ ), but not on the slope, ( $p > .05$ ). The  $-.33$  standardized correlation between the exogenous variables D1 and D2 in the race and SES model was not significant ( $p > .05$ ). Therefore, the latent exogenous variables of the slope (D1) that are impacted by factors outside of the model's ability to measure, such as random or measurement error, did not significantly covary with the latent exogenous variables of the intercept (D2) in the combined race and socioeconomic model.

Table 9 features the model summary of the SES model, and the diagram for the SES latent growth model is featured in Figure 9.

Table 9.

Race and Socioeconomic Model Summary

	Estimate	Standard Error	Critical Ratio	P Value
Race	2.22	.07	30.89	<.001
SES	1.29	.03	42.52	<.001
Intercept	1360.32	40.80	33.34	<.001
Slope	2.16	2.90	.75	.46
Race and SES Covariance	.06	.03	1.66	.10
D1 and D2 Covariance	-264.81	152.77	-1.73	.08
Race and SES Correlation	.11			
D1 and D2 Correlation	-.33			

Note. D1 = Exogenous variables that impact the intercept; D2 = Exogenous variables that impact the slope

### Six-Measurement Model for Adolescent Reading Growth (Race and SES)

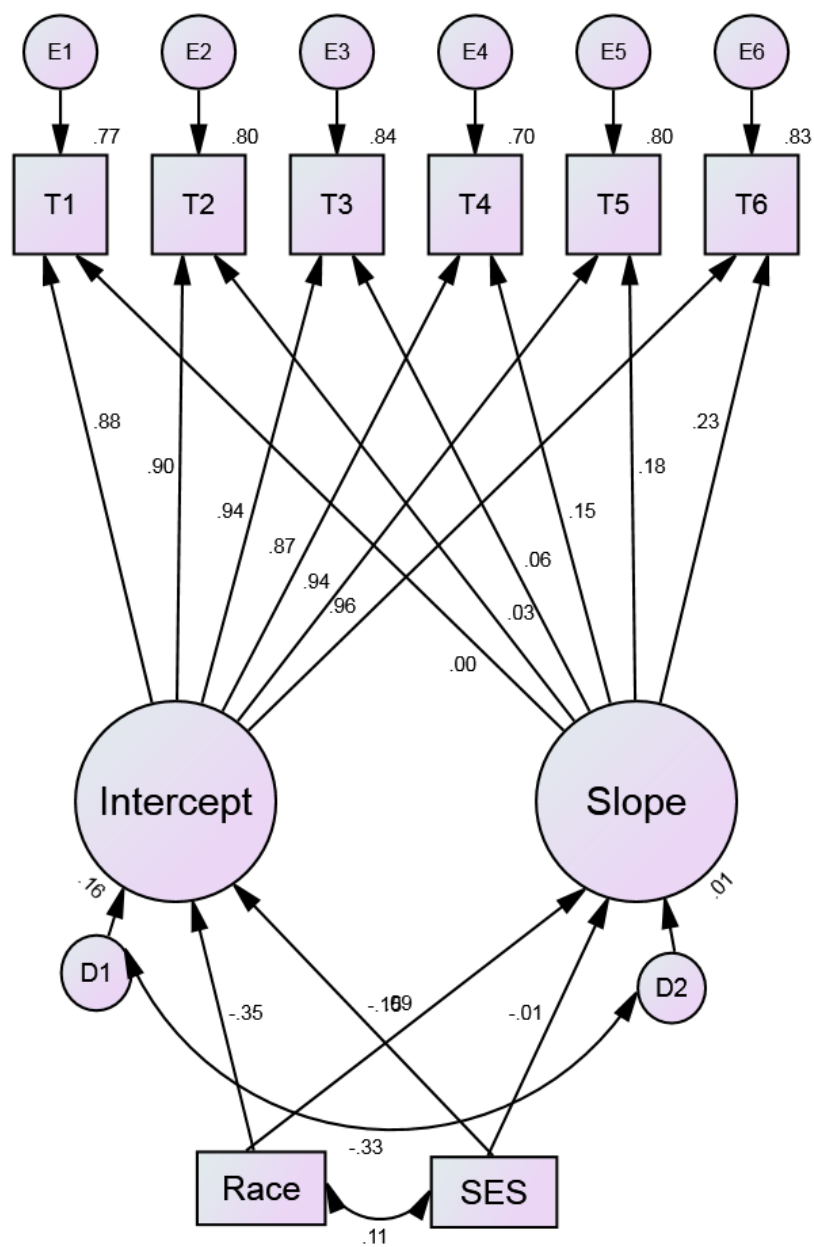


Figure 9. Diagram for the Race and Socioeconomic Latent Growth Model

## CHAPTER V: DISCUSSION

In order to improve the reading comprehension growth of students from ethnic minority backgrounds or low socioeconomic environments, it is critical to identify and gain more insight on the primary factors that are underlying their academic achievement. To quantify the impact of hidden variables that are impacting adolescent reading, a LGC analysis was used to analyze adolescent reading comprehension trajectories. The primary research objective of the current study was to explore the extent to which sociocultural factors, such as racial association and socioeconomic status, impacted initial levels and rates of change in reading comprehension growth. Analyses of intercept and slope variables of adolescent reading trajectories helped to determine whether the reading achievement gap was widening or closing during the high school years. Another research objective was to identify the overall shape of adolescent reading trajectories. This information will help determine if comprehension development is steady and gradual throughout the adolescent period, or if sporadic and abrupt reading growth occurs intermittently during adolescence. This chapter delivers an overview of the results of the study and addresses the implications of the research findings. This chapter also contextualizes the results of the study with the existing body of literature, illuminates the limitations of the research, and provides recommendations for further research.

### **Implications of Findings on Existing Literature**

Existing literature is replete with examinations of tri-annual reading growth characteristics and trends of elementary age students, but scarce among older student populations (Espin, Wallace, Lembke, Campbell & Long, 2010; Graney, Missall, Martinez & Bergstrom, 2009; Nese, et al., 2012). Therefore, the overall components of

adolescent reading that were revealed in the results section will mostly be compared and contextualized with elementary age reading trajectories in the discussion section to showcase the differences in reading growth between younger and older students. The ultimate reasons for the comparative approach is to emphasize that more exclusive research of high school aged students is needed.

### **Reading Trajectory Shape**

A visual assessment of the reading trajectories suggested that comprehension growth during adolescence was not completely linear. But, statistical analysis verified that the trend characteristics more closely resembled linear growth, than quadratic or cubic growth. The assertion of adolescent reading trajectories as linear in the current study does not align with the conclusions of other major studies.

Other researchers who have examined adolescent reading growth have acknowledged the strikingly similar characteristics between quadratic and linear models when determining data fit, but have overall concluded that quadratic models offer a closer fit (Roscorla & Rosenthal, 2004; Beecher, 2011). Roscorla and Rosenthal (2004) examined the reading growth curves of 328 students from 3<sup>rd</sup> to 10<sup>th</sup> grade and concluded a quadratic trajectory shape. Beecher (2011) examined the reading growth curves of 206 students from age seven to nineteen, and also concluded a quadratic trajectory shape. Perhaps in the context of seven or more years that mostly include the early childhood span of development, reading growth may appear to be more curvilinear in shape. But as evident in the current study, a more isolated analysis of the reading development that occurs exclusively during the high school years between ages thirteen to seventeen reveal a more linear shape. To learn more about the reading development that occurs during

adolescence, it is important to exclude the sporadic growth that occurs during the elementary years from the analysis, and solely focus on the development patterns that occur during the high school years. Adopting a conceptual framework of adolescent reading growth as linear, and conducting experiments with exclusively 8<sup>th</sup> – 12<sup>th</sup> grade participants, will lend itself to more relevant and age-appropriate analyses and conclusions of adolescent reading comprehension development.

The overwhelming consensus of reading growth patterns among elementary age students is that of a non-linear shape (Graney, Missall, Martínez, & Bergstrom, 2009; Keller-Margulis, Clemens, Im, Kwok, & Booth, 2012; Nese, et al., 2013; Shin, Davison, Long, Chan, & Heistad, 2013). This is expected since sporadic development occurs when students are learning how to read. Though small in number, a few researchers who have examined the later elementary grades have detected linear-shaped trajectories (Chong, 2009; Low, 2013).

Students perform constrained skills during the early years when decoding and fluency is achieved, and unconstrained skills during the later years when comprehension is achieved (Paris & Stahl, 2005). It appears that when children transition from learning to read in the elementary grades to reading to learn in the middle grades, their development subsides in speed and intensity, and the reading trajectory gradually embodies a new shape (Chong, 2009; Low, 2013). The early years are characterized through curvilinear growth, but more gradual linear reading growth occurs during the adolescent years (Low, 2013). Chong (2009) examined the reading scores of 1206 students from 4<sup>th</sup> to 7<sup>th</sup> grade and concluded reading comprehension growth as linear. Low (2013) examined the reading scores of 955 students from 2<sup>nd</sup> to 7<sup>th</sup> grade, and

concluded that different reading skills exemplify different growth forms. For basic reading skills such as word recognition and spelling, reading growth takes the shape of a quadratic form. For decoding and reading comprehension, reading growth embodies more of a linear shape. Low (2013) decisively declared that reading growth appeared linear until the 7<sup>th</sup> grade, but questioned whether or not reading comprehension continued in a linear fashion through adolescence and adulthood. The current study serves as a connecting piece to the Low study by verifying that reading comprehension grows in a linear fashion from the middle grades to the high school years (Low, 2013).

The reading growth patterns of younger and older students are entirely unique. Therefore, researchers who are interested in the reading growth and development of adolescent-aged students should not build their examinations upon the findings of elementary age students. More research of exclusively high school age populations is needed to build a more dynamic and complex understanding of adolescent reading development.

### **Relationship of Reading Ability and Growth**

There was a negative relationship detected between adolescent reading ability and growth in the current study. This indicated that students who started at a lower reading level grew faster than those who started at a higher reading level. These findings corroborated with several other studies that have highlighted reading comprehension growth of middle aged children (Beecher, 2011; Rescorla & Rosenthal, 2004; Shin, Davison, Long, Chan & Heistad, 2013). This commonly noted phenomenon is known as the law of initial values, which states that higher values of starting levels will demonstrate less growth than lower initial values (Jamieson, 1995). Some students may



experience either accelerated or slowing reading comprehension growth during adolescence because of the various emergent literacy skills that may be impacting their ability to read with ease, such as the development of new vocabulary, motivation, or other reading skills (Pfof, Hattie, Dörfler, & Artelt, 2014). Although reading advancement occurs at marginally diminishing rates during the high school years, this phenomenon still warrants more adequate research. More thorough explorations of the underlying causes and impacts of reading deceleration would shed more light on the adolescent brain and educational experience.

The findings of a negative relationship between the reading comprehension intercept and slope in the current study are contrary to many of those who study reading growth during the early elementary years (Aikens & Barbarin, 2008; McCoach, O'Connell, Reis & Levitt, 2006). McCoach, O'Connell, Reis, and Levitt (2006) reported a positive relationship between the intercept and slope parameters in a sample of students who advanced from kindergarten to first grade. The research team concluded that students with higher abilities experienced greater reading growth. Aikens and Barbarin (2008) also reported a positive relationship between the reading intercept and slope of students as they advanced from kindergarten to first grade. The detection of a positive relationship between the intercept and slope is uniquely characteristic of the early reading stages, in which the child is performing basic decoding and word recognition tasks. Reading that entails more comprehensive comprehension, which begins in the later elementary grades and extends throughout the rest of the formal education process, is signified through a negative relationship between the intercept and the slope.

### **Narrowing Reading Achievement Gap**

The primary focus of the current study was to examine reading comprehension growth, rather than performance differences between students of various demographic groups. For this reason, distinct latent growth curve analyses were not conducted for students of separate racial or socioeconomic groups. However, it would have been possible to do so between the Caucasian and African American sub-groups because of the large and almost equivalent sample sizes of each group. The small sample sizes of the Hispanic and Multiracial sub-groups would have excluded them from this type of analysis. The incongruent sample sizes between the paid and free-reduced lunch students would have also prevented achievement gap comparisons based on SES. Though the achievement gap analysis was secondary, a few conclusions were made pertaining to this phenomenon.

The negative relationship between the intercept and slope parameter alludes to a narrowing achievement gap between Caucasian and non-Caucasian groups. Bassiri and Allen (2012) examined reading comprehension growth patterns from grade 8 to grade 12 and concluded that reading comprehension growth is significant during these years, but small in magnitude. Because the reading growth is small in magnitude during the adolescent stage of development, the associated convergence within the reading achievement gap is also small in magnitude. Although slight, the conclusion of a narrowing achievement gap conveys important information about adolescent reading development.

The classification of the achievement gap as narrowing in the current study differs from the outcome of other major studies that have examined components of adolescent

comprehension growth (Catts, 2008; Hemphill, 2011; Rampey, 2009). The interpretation of narrowing, widening, or sustaining gap trends depends upon the age of the sample and the delineation of the comparative sub-samples. The findings of narrowing achievement gaps in the current study mostly align with national reading assessments that have been collected by the National Center for Education Statistics, likely because the sub sample characteristics were consistent between the two studies. According to the Nation's Report Card, from 2003 to 2007, the Black-White reading achievement gap slightly narrowed among 8<sup>th</sup> graders who qualified for paid lunch, but widened among those who qualified for reduced price lunch (U.S. Department of Education, 2009). From 2003 to 2009, the Hispanic-White reading achievement gap narrowed among 8<sup>th</sup> graders who qualified for paid lunch, as well as reduced prince lunch (U.S. Department of Education, 2009).

The findings of narrowing achievement gaps in the current study negate the outcomes of other major studies that separated students by different characteristics and determined widening gaps (Abedi et al., 2005; Aikens & Barbarin, 2008; Christ, Silbergliitt, Yeo & Cormier, 2010; McCoach, O'Connell, Reis, & Levitt, 2006). Both McCoach, O'Connell, Reis, and Levitt (2006) and Aikens and Barbarin (2008) separated students according to socioeconomic status and determined diverging reading growth among students from the onset of school until the third grade. Christ, Silbergliitt, Yeo and Cormier (2010) examined students from the 2<sup>nd</sup> to the 6<sup>th</sup> grade, separated by special education status, and concluded widening achievement gaps over time. Abedi et al. (2005) analyzed the reading growth of students in the later elementary and middle grades, separated by the language spoken at home, and also concluded that achievement gaps

widened. It appears as if a separation of the sub-sample according to disability status, racial association, or socioeconomic status during the elementary grades may reveal widening trends, along with separation of students by language spoken at home during the middle school years. Most of the researchers who found sustaining or widening gaps did so in the early or later elementary grades from kindergarten to third grade, and separated the sub-sample according to sociocultural factors such as racial association, language spoken at home, or socioeconomic status. Because the reading development process that occurs during the elementary and adolescent stage is fundamentally different, it is important to not transfer the implications of achievement gap research conducted with younger students to the rest of the student population.

The current study highlighted traces of a narrowing achievement gap. When analyzing the achievement gap between adolescents, it is important to collect data from students solely during their adolescent years. Other researchers who have also detected a narrowing reading achievement gap among adolescents delineated the sub-samples according to sociocultural characteristics, such as racial association or primary language spoken at home (Hemphill & Vanneman, 2011; Silverman et al., 2015). The studies performed by Hemphill's and Silverman's research team entail national data composed of thousands of students, and function as the latest studies that have examined the achievement gap.

No clear answer exists in the existing body of literature to explain why progress of closing the achievement gap has considerably declined in recent decades. Additional latent variables, which are either not yet realized or not easily adjustable, likely contribute to the remaining cavity in reading achievement and growth between students

of different cultural backgrounds. In order to further investigate the underlying reasons, opinions, and motivations of adolescents who are impacted by this phenomenon, smaller scale research that includes both quantitative and qualitative components must be conducted on a more localized scale.

### **Impact of Sociocultural Factors on the Starting Reading Level**

The current study indicated a significant impact of race and socioeconomic status on the intercept, or starting reading levels, of adolescents. The distinguishable gaps in reading achievement between students from different racial associations and socioeconomic classes have been long documented in the literature (Allen, 1969; Coleman, 1966). The reasons behind the performance discrepancies date back to the children's earlier stages of academic development. There could have been dynamic forces within the children's early social environments that academically provided some students a head start, and others a late start. Hart and Risley (1995) reported noticeable cleaving between strong and weak readers to emerge as early as three years old. The research team also reported that by the time children start kindergarten, some have heard 32 million fewer words than their classmates. Despite earnest efforts of public schools to equalize opportunity, children from underprivileged environments remain well behind their more economically advantaged peers throughout the duration of the formal schooling process (Hart & Risley, 1995).

### **No Impact of Sociocultural Factors on Reading Growth**

The current study revealed no significant association between racial association or socioeconomic status and reading comprehension growth. This finding marked the

hallmark of the current study. Though it may seem that students from minority backgrounds or low socioeconomic environments are underperforming in comparison to their white counterparts, the equivalent growth trajectories of all adolescents revealed in the current study demonstrate the incremental achievement of underprivileged students that often goes unnoticed (Hemphill & Vanneman, 2011; Rampey, Dion, & Donahue, 2009). In conclusion, all adolescents experience comparable reading comprehension growth capacity and performance.

The major finding of this study contrasts the growth characteristics detected among elementary age students with different reading proficiency levels (Aikens & Barbarin, 2008; McCoach, O'Connell, Reis & Levitt, 2006). Several researchers have detected Matthew effects in younger readers (Stanovich, 1986; Bast & Reitsma, 1997). Matthew effects occur when strong readers learn more words and pull ahead on account of improved reading skills, while weaker readers learn fewer words and lag behind (Stanovich, 1986). Because a child is performing basic decoding and word recognition tasks during the early stages of reading, these skills have the potential to rapidly develop, resulting to the detection of a positive relationship between the intercept and slope (Aikens & Barbarin, 2008; McCoach, O'Connell, Reis & Levitt, 2006). According to this theory, the increasing growth of the strong reader results to an expanding rift between the strong and struggling readers. The naming of the Matthew effects theory was inspired from a verse in the biblical gospel of Matthew. The verse details the parable of the talents and states, "For whoever has, will be given more, and they will have an abundance. Whoever does not have, even what they have will be taken from them" (Matthew 25:29 New International Version). Stanovich (1986) analyzed the

phenomenon of accumulated advantage expressed in the Matthew effect, and contextualized it to the field of literacy.

### **David Effects among Adolescents**

Matthew effects are characterized by a positive intercept-slope correlation that is sometimes detected among younger children when they encounter rapid word development; and on the other hand, a negative intercept-slope correlation is detected among older adolescents when they experience more complex and comprehensive reading comprehension (Beecher, 2011; Rescorla & Rosenthal, 2004; Shin, Davison, Long, Chan & Heistad, 2013). To reflect the relationship between the high and low achievers, Matthew effects are sometimes identified during the formative years, but David effects are detected during adolescence (1 Samuel New International Version). The verse in the first book of Samuel that details the account of the young David who defeated the mighty Goliath warrior reads,

As the Philistine moved closer to attack him, David ran quickly toward the battle line to meet him. Reaching into his bag and taking out a stone, he slung it and struck the Philistine on the forehead. The stone sank into his forehead, and he fell face down on the ground. So David triumphed over the Philistine with a sling and a stone (1 Samuel 17: 48-50 New International Version).

The story of David demonstrates the victory that ensues for struggling readers who refuse to give up. Though the starting position or circumstance may not be favorable, a great reward lies ahead for those who step up to the challenge. Adolescents who start off with a lower reading proficiency grow more rapidly throughout the years than their higher achieving peers. The more hasty growth among low performing readers is noticeable proof that they are fighting, and defeating, their own giants. Though

students started off the year at varying levels of reading proficiency, all the adolescents indiscriminately experienced the rewards of comprehension growth.

Reports of failing schools or low achievement scores obtained by underprivileged students may send a deceptive message of outcome inadequacy. Initial academic levels and growth range should be accounted when evaluating the proficiency of an individual student, or a collective school. Instead of comparing students based on outcome achievement scores, growth range scores should be analyzed and used as the basis of comparison.

### **Need for More Adolescent Research**

In order to provide the appropriate structural support and create a more conducive educational environment for adolescents, more exclusive research must be done targeting the specific age range of students from thirteen to seventeen years old. The components, characteristics, and implications of reading performance are different for students in the elementary grades than those in the high school grades. Stipek and Valentino (2015) confirmed that changes in working memory and attention span facilitated increased academic achievement in the elementary grades, but not the middle school grades. The cognitive processes and executive functions that contribute to reading change in their function and purpose over time, and therefore research findings collected from younger children should not be generalized to older student populations (Claessens & Dowsett, 2014; Stipek & Valentino, 2015). A field of separate, prominent research must be conducted exclusively with older children to learn more about the workings of the adolescent brain and its potential for reading development over time.



## **Limitations of the Research**

The sample and school composition pose a limitation to the study. The sample for the current study included a relatively small percentage of low performing students, with 36% scoring lower than the 60<sup>th</sup> national percentile rank for reading comprehension. Therefore, in the context of this study, the label “low performing” means relative to the other students in the sample, and not relative to nation-wide distribution. Also, the school setting may not be representative of a typical high school in America, and therefore the findings may not be replicable in an academic setting with different characteristics. The students in the current study attended a school that was racially, linguistically, economically, and culturally diverse. Student exposure and interaction with such a diverse and integrated learning environment may have had a latent impact on each student’s achievement. The academic climate in a more homogenous or segregated environment may result to a different impact on the learning potential and achievement of students, than what was detected in the current study (Orfield, Kucsera, & Siegel-Hawley, 2012).

Another limitation of the study is the classification of the participants’ socioeconomic status. School lunch status is a common classifier of family income levels in educational research. However, binary categorizations of SES, such as paid/free lunch status, do not provide precise information concerning the participant’s economic standing and could distort statistical interpretations (Lindo, 2004; Sirin, 2005; Van Ewijk, & Slegers, 2010).

A third limitation of the study relates to the data collection procedures. The duration of the data collection was two years, and the six comprehension benchmark tests

were administered in unequally spaced time intervals. This caused a slight deviation from the theoretical linear model. The testing procedures were also a concern. The testing environment was not centrally controlled, but rather regulated at the discretion of the classroom teacher. Because there were no standard operating procedures, classroom distractions or irregularities could have impacted student performance on the benchmark assessments.

### **Recommendations for Further Research**

The research findings warrant further and more comprehensive investigations regarding the sociocultural influences of adolescent readers. Because of the growing concern with school re-segregation, the National Center for Education Statistics recently revealed that more information is needed regarding the relationship between a school's demographic composition and achievement gaps (Orfield, Kucsera, & Siegel-Hawley, 2012). The emerging body of research in this area reveals a significant correlation between a school's minority population density and its school-wide student achievement (Madyun & Lee, 2010). This phenomenon should be further explored with various student samples from different geographical regions.

Additional recommendations for further research include examining reading trajectories of students from different schools who come from different communities to serve as the basis of comparison, rather than drawing the entire sample from one school community. This approach will enable the researcher to get a more robust representation of varying socioeconomic factors and better evaluate the impact of the environment of large. There may be a difference in reading growth between students who have been integrated and socialized in diverse educational environments with greater financial

resources for their whole lives, compared to those who have attended segregated schools with fewer financial resources for extended periods of time. This information will shed more light on the sustained impact of different social environments on reading growth and achievement. It may also inspire structural changes to the current education system through the desegregating of America's high schools zoning patterns.

Another recommendation is to deconstruct the reading process, and isolate one or two component skills that contribute to reading comprehension at the adolescent stage. This type of analysis will provide additional insight of the associated growth characteristics of adolescent comprehension. For instance, vocabulary accounts for about 25% of the variance in the reading comprehension of students in the middle grades, and about 50% of the variance in reading comprehension of students in the secondary grades (Tighe & Schatschneider, 2014). Because vocabulary appears to grow in importance as students grow older and read more complex texts, a study that parallels the growth in vocabulary to the growth in comprehension during the adolescent years would reveal the developmental strength of the underlying factors that support adolescent comprehension.

This type of study may also provide stepping stones of exploration to more research concerning adult reading comprehension, which impact postsecondary educational attainment and college retention and graduation rates (Livingston & Wirt, 2004). In a current culture that heavily promotes the importance of college, reading related struggles pose substantial hardships to individuals who pursue college, but lack the foundational skill set to accomplish advanced academic tasks. About 44% of the total high school population demonstrated grade-level reading proficiency, with only 17% of African Americans and 29% of Hispanic Americans meeting the appropriate reading

benchmark standards (National Center for Education Statistics, 2013). In 2004, 42% of community college freshman and 20% of freshmen at four-year institutions took remedial courses in reading, writing, or math their first year of college (Livingston & Wirt, 2004). Because the 21<sup>st</sup> century society demands a more skilled and academically proficient workforce, the establishment and sustainment of strong literacy skills is imperative. More research is needed to fully understand the isolated components of adolescent reading comprehension, along with the adequate educational support that is needed to facilitate proper literacy development into adulthood.

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## APPENDICES

## APPENDIX A: IRB APPROVAL

**IRB****INSTITUTIONAL REVIEW BOARD**

Office of Research Compliance,  
010A Sam Ingram Building,  
2269 Middle Tennessee Blvd  
Murfreesboro, TN 37129

**EXEMPT APPROVAL NOTICE**

2/23/2015

Investigator(s): Tyra W. Pickens and Dr. Jwa Kim  
Department: Literacy Studies  
Investigator(s) Email: twp2s@mtsu.edu; jwa.kim@mtsu.edu  
Protocol Title: "The Psychometric Properties and Predictive Validity of Three High School English Language Arts Benchmark Tests "  
Protocol ID: 15-033

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above and this study has been designated to be EXEMPT. The exemption is pursuant to 45 CFR 46.101(b) (2) **Educational Tests, Surveys, Interviews, or Observations**

The following changes to this protocol must be reported prior to implementation:

- Addition of new subject population or exclusion of currently approved demographics
- Addition/removal of investigators
- Addition of new procedures
- Other changes that may make this study to be no longer be considered exempt

The following changes do not have to be reported:

- Editorial/administrative revisions to the consent of other study documents
- Changes to the number of subjects from the original proposal

All research materials must be retained by the PI or the faculty advisor (if the PI is a student) for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board  
Middle Tennessee State University

NOTE: All necessary forms can be obtained from [www.mtsu.edu/irb](http://www.mtsu.edu/irb).

## APPENDIX B: IRB ADDENDUM APPROVAL



2/5/2016

Investigator(s): Tyra Pickens  
Department: Literacy Studies  
Protocol Title: The Psychometric Properties and Predictive Validity of Three High School English Language Arts Tests  
Protocol Number: #15-033

Dear Investigator(s):

I have reviewed your research proposal identified above and your requested changes. I approve of the following change:

1. Analyze an additional 3 benchmark test scores.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615)494-8918 or [compliance@mtsu.edu](mailto:compliance@mtsu.edu). Any change to the protocol must be submitted to the IRB before implementing this change.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to complete the online training. If you add researchers to an approved project, please forward an updated list of researchers to the Office of Compliance **before** they begin to work on the project.

Sincerely,

Office of Compliance  
Middle Tennessee State University

Template Revised March 2014

MTSU Compliance Office  
010A Sam Ingram Bldg.  
1301 E. Main St.  
Murfreesboro, TN 37129