The Children Left Behind: The Performance of Young Special Education Students in Mathematics, Reading, Writing, and Science

by

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ABSTRACT

The objective of this study was to examine the representation of demographic groups in special education, as well as to investigate the performance of special education students on the 2009 Connecticut Mastery Test, a standardized assessment used to determine student and school district achievement as part of the No Child Left Behind Act. The test was administered to all Connecticut students in grades 3 through 8, and assessed mastery in mathematics, writing, reading, and science. Black and Hispanic students, males, and students of lower socioeconomic status were found to be over-represented in special education. Special education students performed significantly lower than their non-special education peers across all subjects and measures of curriculum mastery. Interactions were found between ethnicity and special education status as a predictor of reading and writing performance. A significantly higher percentage of Hispanic children enrolled in special education were found to meet mastery in reading and writing than white and black students in special education. No difference was found between the percentage of white and black students in special education meeting mastery in reading and writing. Of students not enrolled in special education, however, a significantly lower percentage of black and Hispanic students met mastery in reading and writing than white students. The over-enrollment of black and Hispanic students in special education for language-based learning disabilities is cited as a possible explanation, as are biases against speakers of Ebonics and students with foreign accents.

INTRODUCTION

No Child Left Behind Act and Special Education

This school year, roughly 3,000,000 Connecticut students will take part in standardized testing as a result of the No Child Left behind Act ("No Child Left Behind: What is NCLB?," 2009). President George W. Bush reauthorized the Elementary and Secondary Education Act (ESEA) of 1965 on January of 2002, under the new title, No Child Left Behind (NCLB). Signing the Bill, President Bush stated that the Act's founding principle "is that every child can learn, we expect every child to learn, and [states] must show us whether or not every child is learning" ("Issue brief: No Child Left Behind," 2006). Even in its earliest conception, NCLB was aimed at eliminating the achievement gaps among classically disadvantaged groups of students: the economically disadvantaged, ethnic minorities, special education students, and those learning English as a second language (Leach-Esposito, 2008). From its inception, the Bill was met with bipartisan support. Unanimously praised by conservatives and democrats, both George W. Bush as well as Senator Ted Kennedy were equally instrumental in the Bill's conception and its instatement into law ("No Child Left Behind: What is NCLB?," 2009).

The primary function of No Child Left Behind was originally to provide funding to schools with disadvantaged groups. Title I of NCLB grants a set sum of financial support to public schools to cover the cost of tutoring programs, special education departments and services, English language learner (ELL) courses, after school programs, technology, and free or reduced-cost school meals ("Improving basic programs operated by local education agencies (Title I, Part A)," 2010). The

amount of funding a school receives is based on the number of disadvantaged students and the demonstrated need of the school. As a result, the Act intended to provide the most aid to schools that had high numbers of disadvantaged students and low budgets ("Improving basic programs operated by local education agencies (Title I, Part A)," 2010).

No Child Left Behind has evolved from targeting individual schools with high numbers of classically disadvantaged groups to targeting entire school districts with low-achieving student populations. This revised Act now takes the performance of all students into consideration when allocating school funds ("Issue brief: No Child Left Behind," 2006). In order to assess the entire student population of a district, all states are now required to establish levels of curriculum mastery, develop standardized testing to evaluate such mastery, and administer the assessment yearly to all students enrolled in both public and private schools. The state of Connecticut uses two standardized tests, the Connecticut Mastery Test (CMT) and the Connecticut Academic Performance Test (CAPT), for younger and older students, respectively. Failure to administer such tests results in a loss of funding under Title I ("No Child Left Behind: What is NCLB?," 2009).

The overall performance of a school and district is based on adequate yearly progress (AYP) ("No Child Left Behind reports," 2009). Standards of AYP are set and maintained by the state. Each state is expected to set and work towards reaching an AYP goal. Connecticut, for example, aims to have 100% of its students, including the classically disadvantaged, achieve scores of at least “Proficient” on the

mathematics and reading portion of the CMT by 2014. Connecticut defines adequate yearly progress for children in grades 3 through 8 as:

(1) ninety-five percent participation for both the mathematics and reading portion of the Connecticut Mastery Test;

(2) a target percentage of students achieving scores at or above "Proficient" on the mathematics and reading portion of the Connecticut Mastery Test; and

(3) a target percentage of students achieving scores at or above "Proficient" for an additional test portion, or at least 70% of students receiving a score of at least above "Basic" on the writing portion of the Connecticut Mastery Test, or a marked general improvement in test scores from the previous year ("No Child Left Behind reports," 2009).

The target percentage of students expected to meet at least "Proficient" for a specific subject is not fixed and will vary by year. If a school does not meet the criteria for adequate yearly progress for two consecutive years, the state will flag the school and district as "in need of improvement" ("No Child Left Behind: A parent's guide," 2003). The state of Connecticut had 406 public schools listed as "in need of improvement" under the No Child Left Behind Act for the 2009/2010 school year. 116 of those schools were flagged because their classically disadvantaged students failed to make adequate yearly progress, despite the adequate gains made by their non-disadvantaged peers ("No Child Left Behind school report: 2008-09 school year," 2009). Schools that meet adequate yearly progress are designated as "safe harbor" schools ("No Child Left Behind: A parent's guide," 2003). In many states,

such as Connecticut, parents of students attending schools "in need of improvement" can elect to send their child to a local "safe harbor" school instead (Sprague, 2009).

Under the No Child Left Behind Act, the majority of the United States' 5,000,000 children enrolled in special education are required by law to participate in standardized testing. Only 1% of all special needs children are allowed to take an alternative assessment, usually reserved for those severely impaired. Prior to NCLB, students with individualized education plans (IEP) were exempt from all state testing (Gardner, 2008). Since 1995, special education children in Connecticut were allowed to take state-mandated standardized testing "out-of-level" (OOL) (Sergi, 2002). Under this provision, students were able to take tests designed for a lower grade level in place of their own. By providing special education students with a test better suited to their performance level, OOL testing was also used to prevent children from becoming frustrated and defeated by assessments that were too difficult (Thurlow, Elliott, & Ysseldyke, 1999).

Since the signing of No Child Left Behind in 2002, however, special education students are no longer able to take standardized tests out-of-level and are required to take the examination developed for their grade level (Sergi, 2002). Because state and federal aid is delegated to school districts based upon the percentage of students mastering classroom curriculum, OOL testing prevents states from receiving an accurate depiction of students who are meeting grade level standards. Supporters of NCLB have criticized OOL testing, claiming that it lowers performance expectations for special education students and, therefore, prevents students from reaching their potential (Thurlow, et al., 1999).

Many educators and special education instructors have argued that standardized testing as part of NCLB puts special education students at a particular disadvantage. They believe that since the tests are created for specific grade levels, they are not appropriate measures of mastery for children who perform below grade level (Jewell, 2009). For this reason, the majority of special education students in the United States did not take part in state-wide testing before the signing of No Child Left Behind (Johnson, Kimball, Brown, & Anderson, 2001). Many educators believe that these assessments fail to display what special education children are mastering. Instead these standardized tests, developed for non-special education students, only solidify what most educators already know: that the majority of special education students perform significantly below their peers and significantly below what is expected of them for their grade level (Ollendick & Hersen, 1998).

Although the No Child Left Behind Act serves to identify and allot more funding for classically disadvantaged subgroups, such as those students enrolled in special education, lawmakers and educators believe that flaws in NCLB's stipulations hinder the progress of disadvantaged students (Meier, Kohn, Darling-Hammond, Sizer, & Wood, 2004). Under NCLB, disadvantaged groups must make adequate yearly progress. If at least one disadvantaged group fails to make sufficient progress, the entire school will be labeled as "in need of improvement," and will be forced to make costly changes to the curriculum and staff ("No Child Left Behind: A parent's guide," 2003). It is estimated that the special education subgroup has the greatest influence in the AYP of schools and districts ("No Child Left Behind and students with specific learning disabilities," 2003). During the 2003/2004 school year, for

example, 60% of schools failing to make adequate yearly progress in Connecticut did so as a result of their special education population (Sternberg, 2004).

However, if a disadvantaged group contains less than a specified number of students, it is no longer considered a "significant" group and is not bound by the AYP requirements. The majority of states stipulate that 50 students from a given school must have an IEP for special education students to be a significant disadvantaged group within the student population (Meier, et al., 2004). Special education advocates have claimed that this required number of students provides schools with a loophole to avoid an "in need of improvement" designation. This minimum number of students required can also reward those schools that do not refer students to special education and do not provide services ("No Child Left Behind and students with specific learning disabilities," 2003).

A recent study surveyed several small, public schools in Ohio and found that the number of referrals to special education had dropped significantly since the instatement of NCLB (Meier, et al., 2004). The study also cites anecdotal evidence of school administrators pressuring teachers to make less special education referrals in order to keep their number of students with IEP's below the 50-student minimum. Additionally, this stipulation can act as an incentive to drop current students from their special education designation, thus eliminating services prematurely and disadvantaging needy students even further ("No Child Left Behind and students with specific learning disabilities," 2003).

Student Representation within Special Education

The majority of research concerning special education students has concentrated on the representation of various student populations within special education. The first studies to examine over-representation have looked primarily at gender, with findings showing male students to be historically overrepresented in special education classrooms (Heller, Holtzman, & Messick, 1982). Some researchers attribute this phenomenon to the increased prevalence of Attention-Deficit Disorder (ADD), Attention-Deficit Hyperactivity Disorder (ADHD), and Dyslexia in young male children relative to their female peers (Ollendick & Hersen, 1998). Studies have found that males are at a greater risk for developing a learning disability (Flannery, Liederman, Daly, & Schultz, 2000). More recent studies have found that of special education children, males tend to have more severe disabilities than females as a result of genetic and environmental factors (Derks, Dolan, Hudziak, Neale, & Boomsma, 2007).

Others argue, however, that the over-representation of young male children in special education is more likely due to an incorrect over-diagnosis of boys, resulting from their delayed social and intellectual maturation relative to girls (Adelman, Lauber, Nelson, & Smith, 1989). More controversial studies have found that teacher and physician biases against hyperactive and disruptive young boys account for the majority of incorrect referrals to special education and diagnoses of ADD and ADHD (Brier, 1989; Derks, et al., 2007). Conversely, a 2006 study found a positive instructor bias for male elementary and middle school students that proved to increase the academic performance of young boys (Beaman, Wheldall, & Kemp, 2006). Few

studies, though, have focused on the under-representation of young female students in special education (Arms, Bickett, & Graf, 2008).

Studies concerning over-representation in special education have also focused on the disproportion of referrals to and enrollment in special education by ethnicity. The majority of research has compared the proportion of white students to that of minorities, collapsing minority ethnicities into one group (Oswald, Coutinho, Best, & Singh, 1999). One of the first to study the over-representation of several ethnicities, Alfredo J. Artiles and Stanley C. Trent found that black and Hispanic students significantly outweigh their white and Asian peers in special education, with black students being the most represented (1994). Many studies attribute these disproportions not to differences between the performance of white and black students, but to teacher biases against the academic performance of black students (Ferguson, 2003). In addition, studies have linked the disproportionate number of black students in special education to instructors' desires to remove black children from their classrooms, specifically black males (Haller, 1985).

The widespread use of Ebonics, a dialect of American English used among black populations, is also cited as a possible explanation for the over-representation of black students in special education (Grant, Oka, & Baker, 2009). Though Ebonics has complex rules of grammar and syntax, educators often believe that students who speak Ebonics have language deficiencies because their speech does not follow the conventions of Standard English (Kretzschmar, 2008). As a result, these children are more likely to be referred to special education and diagnosed with a language-based learning disability (Hicks, 2009).

Similarly, studies have found that students with thick Spanish accents are more likely to be referred to special education, regardless of their English proficiency and classroom performance (Elhoweris, Mutua, Alsheikh, & Holloway, 2005). Researchers have found that instructors tend to have biases against students with non-native accents (Chin, 2010), often rating these students as low-performers, regardless of actual academic achievement (Millar, 1997). These biases, in turn, are thought to result in a higher proportion of Hispanic children in special education (Elhoweris, et al., 2005).

These implicit instructor biases also help explain the over-representation of English language learner students (ELL) in special education (Ollendick & Hersen, 1998). Emergent research, however, has found that the over-representation of ELL students is not widespread across the United States, but prevalent only in isolated school districts (Gabel, Curcic, Powell, Khader, & Albee, 2009). Instructors with significant experience teaching immigrant and Hispanic populations are less likely to over-represent ELL students in their special education referrals (Donovan & Cross, 2002). Researchers have suggested that because these educators are more familiar with foreign-born and Hispanic students, they may be more skilled at distinguishing between a child who has language difficulties as a result of a learning disability and a child who is underperforming in verbal tasks as a result of learning English as a second language (Artiles & Trent, 1994).

Current research has found that the over-representation of minority students in special education is better explained by differences in socioeconomic status (Artiles & Trent, 1994). It has been well-established that students of lower socioeconomic

status are overrepresented in special education. Many researchers attribute this finding to environmental factors, rather than a product of instructor biases (Donovan & Cross, 2002). Several studies have established a link between the development of learning disabilities and poverty-related factors, such as: lack of health insurance, poor prenatal care, low birth weight, childhood illness, exposure to lead-based paints, and maternal substance abuse (Meier, et al., 2004). A study by David Podell and Leslie Soodak found that children from low socioeconomic backgrounds are more likely to be referred to special education if their classroom instructor views his or her teaching as ineffectual (1993). More confident instructors, however, do not present any socioeconomic bias in their special education referrals.

Academic Performance of Special Education Students

Few studies have measured and analyzed the academic performance of special education students using standardized testing. Instead, the majority of studies concerning children with learning disabilities have relied on psychological evaluations and IQ scores as methods of assessment (Ollendick & Hersen, 1998). These methods, although more precise than standardized testing, do not evaluate the mastery of classroom curriculum or academic performance by subject. Rather, they examine the discrepancy, if any, between the child's intellect and achievement ("Protecting students with disabilities," 2009). Grades and other teacher assessments are also commonly used in studies investigating the performance of special education students relative to their non-special education peers, but these methods do not provide an unbiased and consistent method of comparison between students (McKown & Weinstein, 2008).

Those studies that do use standardized tests as a means of assessment typically study older students enrolled in high school and college. This is most likely a result of sample convenience since the majority of students taking standardized tests prior to 2002 were older students applying for colleges, graduate programs, and military positions (Kaplan & Saccuzzo, 2009).

Even fewer achievement studies have compared the classroom performance and achievement of special education students by different demographic groups. The vast majority of studies have, instead, compared the classroom performance of special education students to those not enrolled in special education. It is a generally held understanding among educators and researchers that special education students, as a whole, perform significantly below non-special education students in most measures of student achievement and mastery of curriculum material (Heller, et al., 1982). This finding is regarded as stable across a variety of ethnicity backgrounds and socioeconomic statuses, barring that the two groups compared are of the same demographic group (Donovan & Cross, 2002).

Most studies that compare the classroom performance of special education students are longitudinal, measuring a student's progress over the course of a year or several years. Multi-year longitudinal studies are often used to study the effectiveness of various special education services and programs, as well as the effects of delayed referral (Wagner, 1992). Longitudinal studies are also used to trace the effect of environmental conditions, such as low birth weight, on the development of learning disabilities and the classroom performance of these children later in life (Chyi, Lee, Hintz, & Sutcliffe, 2008).

Present Study

The present study will examine the under and over-representation of demographic groups within the special education program of a school district located in central Connecticut. Using scores obtained from a statewide standardized test assessing academic mastery as part of the No Child Left Behind Act, comparisons will be made between the performance of special education and non-special education students in mathematics, reading, writing, and science. Unlike previous studies measuring academic achievement through standardized testing, this study will examine the performance of younger students, with a primary focus on those in grades 4 through 8.

Student performance will be largely assessed by mastery level scores and the percentage of students mastering a specific subject. A primary goal of this study is to address how demographics such as ELL status, gender, grade level, socioeconomic status, and ethnicity affect the performance of students in special education relative to those students not enrolled in special education. Unlike previous studies, the performance of special education students will be examined using different demographic groups as a means of comparison. It is predicted that a higher proportion of male, black, Hispanic, and English language learner students, as well as those of lower socioeconomic backgrounds will be enrolled in special education. Special education students are also expected to perform lower in all measures of mathematics, reading, writing, and science competency compared to those students not enrolled in special education.

METHODS

Sample

The sample included students enrolled in grades 4 through 8 during the 2008/2009 school year, from a school district located in a central Connecticut city of 48,000 residents (2000 Census estimate). The majority of residents were of middle and lower-middle class socioeconomic status, with an average per capita income of $25,720, slightly below the state average ("United States 2000 census: Demographic profiles," 2000).

Within the sample, 13.2% (n=260) of students were enrolled in special education. A special education designation was given to students who had been identified by the school as having a documented disability, particularly a learning disability, and were protected under Section 504 of the Rehabilitation Act of 1973. These students had an IEP and received special education services through the school district or privately, and often used testing accommodations ("Protecting students with disabilities," 2009).

Of the total sample, 38.8% (n=762) qualified for free/reduced school meals, a program for students of low income families. A family of 4, for example, must have earned less than $39,220, $18,020 above the poverty line, to qualify for free/reduced meals in 2008 ("Child nutrition programs: Income eligibility guildelines," 2008). Gender was self-reported by the student or family, with 46.8% (n=919) of all students sampled identifying as female. Ethnicity was also self-reported, with 54.9% (n=1079) classifying themselves as white, 25.4% (n=499) as black, 14.8% (n=291) as Hispanic, 4.5% (n=88) as Asian, and 0.4% (n=8) of students as American Indian.

Students identified as English language learners were learning English as a second language and made up 3.2% (n=8) of the entire sample. All ELL students were currently receiving school-provided or private English language instruction.

Assessment

Student data were obtained using the Connecticut Mastery Test, a compulsory standardized test used to assess students' mastery of state mandated classroom curricula. Developed in 1985 to evaluate the performance of public school students in grades 4, 6, and 8, the CMT is now taken by all students in grades 3 through 8, regardless of school type ("Connecticut Mastery Test: Parent guide," 2010). Tests for each grade vary by level of understanding, difficulty, subjects tested, and mastery objectives.

All students, despite grade level, took tests containing mathematics, reading, and writing subject sections. Students in grades 5 and 8 were administered an additional science section ("Connecticut Mastery Test: 2009 interpretive guide," 2009). Students were given 7 hours to complete the CMT, with some special education students receiving extra-time on the assessment in accordance with their testing accommodations set by the school district. Other approved testing accommodations for students with documented learning disabilities included changes in test presentation as well as the use of an aid to fill in answers ("Connecticut Mastery Test: 2009 interpretive guide," 2009). Students were administered the CMT in March, 2009 and student scores were released to the school district in July, 2009. The present study was approved by the Institutional Review Board at Wesleyan

University. CMT data for students in grades 4 through 8 were provided by the school district.

Mathematics competency was assessed using a total of 25 subtest strands. Questions typically concerned fractions, measurement, geometry, and word problems and were in multiple-choice and open-ended formats. Students' performance in reading was evaluated using 4 comprehension subtest strands and the Degrees of Reading Power (DRP) assessment. The reading subtest strands contained both multiple-choice and open-ended questions. The DRP contained several fiction prose passages and required students to answer multiple-choice questions pertaining to plot and general understanding. Students' writing competency was measured by 2 subtest strands assessing the editing and revision of written work, as well as a timed piece of writing in which students responded to a prompt in essay form. Mastery in science was assessed using multiple-choice and open-ended questions that tested students' knowledge of the life, physical, and earth sciences. Science mastery was determined by performance on 5 subtest strands ("Connecticut Mastery Test: 2009 interpretive guide," 2009).

The Connecticut State Department of Education developed specific criteria, in accordance with the No Child Left Behind Act, to determine standards of mastery. Students first received a raw score based on the number of questions correctly answered for each subject subtest strand. These raw scores were combined to yield a composite raw subject score. This raw score was then converted into a scaled score, ranging from 100 to 400. Students' scaled scores were evaluated against a 5-point

rubric assessing levels of subject mastery: Advanced (5), Mastery (4), Proficient (3), Basic (2), and Below Basic (1).

"Mastery" for a particular subject on the CMT was defined by the state, in compliance with NCLB, as achieving a subject mastery level of 4 or 5. As a result, mastery levels were grouped into two categories, those meeting mastery in a particular subject (4 or 5) and those performing below mastery (1, 2, and 3). In order to obtain overall mastery, students must have received a subject mastery level of 4 or 5 in all subjects. The state and federal government currently use both subject and overall mastery to determine the level of funding for school districts. Consequently, primary concern does not fall on subtest strand, raw, or scaled scores, but on the mastery level scores of students ("Connecticut Mastery Test: 2009 interpretive guide," 2009).

Scaled scores and mastery levels were provided by the school district. A dichotomous variable assessing mastery status for each subject test was created by designating mastery levels of 1 through 3 as not reaching mastery in a given subject, and levels of 4 and 5 as obtaining mastery. A dichotomous variable, overall mastery, was created to distinguish those students who met mastery on every subject test for their grade level from those students who did not.

Statistical Analysis

Analyses were conducted using SAS version 9.2. First, the associations between special education status and the following demographics: gender, grade level, ethnicity, ELL status, and free/reduced meals qualification, were tested using chi-square analyses. The tests were used to determine if these demographic groups

were over or under-represented in special education. Additional post hoc paired comparison chi-square tests were necessary to determine the representation of specific ethnicities within special education.

The performance of special education and non-special education students in mathematics, reading, writing, and science were then compared using mastery levels, subtest strand scores, and measures of subject and overall mastery (using ANOVA and chi-square tests for continuous and categorical variables, respectively). All ANOVAs were followed with a Duncan post hoc test.

Next, ethnicity and ELL status were controlled for in a multivariate logistic regression model testing the association between special education status and the qualification for free/reduced meals. Likewise, free/reduced meals and ELL status were controlled for in a logistic regression model when evaluating the association between special education status and ethnicity. Logistic regression models were also used to control for gender, grade level, ELL status, ethnicity and free/reduced meals qualification, when comparing the overall mastery and subject mastery of special education and non-special education students in mathematics, reading, writing, and science.

Logistic regression models were also used to test two-way interactions as predictors of subject and overall mastery. These models included interactions between special education status and each of the following demographic variables: gender, the qualification for free/reduced meals, and ethnicity. Interactions found significant were then tested in logistic regression models, controlling for ELL status,

free/reduced meals qualification, and ethnicity, depending on the nature of the interaction.

Chi-square analyses were then used to view and locate the remaining significant interactions, examining the proportion of specific ethnic groups mastering reading and writing, with tests performed separately for those enrolled in special education and those not enrolled. These analyses were necessary to compare the performance of specific ethnic groups, by special education status. Ethnic groups were limited to white, black, and Hispanic students, due to the low number of Asian and American Indian students in the sample. Associations were then evaluated in logistic regression models, controlling for ELL and free/reduced meals status.

RESULTS

Univariate Analyses

Approximately 13% (n=260) of students in grades 4 through 8 were enrolled in special education during the 2008/2009 school year. Black and Hispanic students were the most represented ethnicities in special education, with 15.6% (n=78) and 18.9% (n=55) of students from these groups enrolled in special education, respectively. Twelve percent (n=1) of American Indian students and 11.6% (n=125) of white students received special education services, with Asian students being the least represented in special education (1.1%, n=1; see Figure 1). Males made up 73% (n=189) of special education students, and 54% (n=139) of special education students qualified for free/reduced meals. Three percent (n=8) of students receiving special education services were English language learners (see Table 1). Just under 9%

(n=22) of students enrolled in special education mastered the mathematics subject test, while 13% (n=34) obtained mastery in reading, 11% (n=28) mastered the writing subject test, and 13% (n=15) of students in special education met mastery in science (see Table 5).

Bivariate Analyses

Demographics.

Chi-square analyses revealed that those students enrolled in special education were more likely to qualify for free/reduced meals (53.5%) and to be male (72.7%), than those students who were not in special education (36.5% and 50.3%, respectively; $p<.001$, both associations). No significant association was found between enrollment in special education and learning English as a second language ($p=.477$) and student's grade level ($p=.347$). There was, however, a significant association between ethnicity and special education status ($p<.001$; see Table 2). Post hoc paired comparisons revealed that black ($p=.026$) and Hispanic students ($p<.001$) were more likely to be enrolled in special education than their white peers. Additionally Asian students were significantly less likely to receive special education services than the white ($p=.002$), black ($p<.001$), Hispanic ($p<.001$), and American Indian students ($p=.031$). Black and Hispanic students were equally represented among special education students ($p=.237$; see Table 3).

Test Performance.

Significant associations were found between special education status and subject mastery level using one-way ANOVAs, with children in special education

scoring lower than their classmates not enrolled in special education in mathematics (2.20 vs. 3.68), reading (2.15 vs. 3.52), writing (2.25 vs. 3.68), and science (2.15 vs. 3.39) ($p<.001$, all scores; see Tables 4). Students in special education scored significantly lower on all 25 mathematics subtest strands (see Table 7), the Degrees of Reading Power assessment, all 4 reading subtest strands (see Table 8), both editing and revision subtest strands (see Table 9), and all 5 science subtest strands (see Table 10) compared to those students not receiving special education services ($p<.001$, all subtest strands and assessments).

Chi-square analyses showed that a significantly smaller percentage of special education students reached mastery in mathematics (8.5% vs. 61.3%), reading (13.1% vs. 65.7%), writing (10.8% vs. 67.9%), and science (13.2% vs. 53.7%), than those not enrolled in special education. As a result, a significantly lower number of children in special education obtained overall mastery on all 3 core subjects (3.5% vs. 48.6%) than their peers not enrolled in special education ($p<.001$, all subjects and overall mastery; see Tables 5 and 6). Chi-square analyses also found that a significantly lower number of special education students in the 5th and 8th grades met mastery on all 4 subject tests (1.8%), compared to students not in special education (40.3%) ($p<.001$; see Tables 5 and 6).

Multivariate Analyses

ELL status and ethnicity were controlled for in the association between special education enrollment and free/reduced meals qualification in a logistic regression model. After controlling for the above variables, the association remained significant ($p<.001$), indicating that a greater proportion of special education students

qualified for free/reduced meals compared to those students not enrolled in special education regardless of ELL status and ethnicity (see table 12). ELL and free/reduced meals status were then controlled for using a logistic regression model to test the association between special education enrollment and ethnicity. After controlling for ELL and free/reduced meals status, the over and under-representation of specific ethnicities in special education was no longer significant (p=.492; see Table 11).

Multivariate logistic regression models were also used to control for gender, grade level, ELL status, ethnicity, and free/reduced meals qualification in the associations between special education status and mastery in the mathematics, reading, writing, and science, as well as overall mastery. After controlling for the above variables, all associations proved significant, with a smaller percentage of special education students reaching mastery in all subjects than students not enrolled in special education (p<.001, all associations; see Table 13).

Interaction Models

Interactions between special education identification and the following demographic variables: gender, free/reduced meals qualification, and ethnicity were tested as predictors of subject test and overall mastery in logistic regression models. Significant interactions were found between special education status and ethnicity as predictors of reading (p=.029) and writing mastery (p=.011), and between special education enrollment and the qualification for free/reduced meals as a predictor of reading mastery (p=.022). All other interactions were not significant as predictors of subject mastery (see Tables 14, 15, and 16).

When ethnicity and ELL status were controlled for in a logistic regression model, the interaction between special education enrollment and the qualification for free/reduced meals was no longer found to be a significant predictor of reading mastery (p=.563; see Table 17). The interaction between special education status and ethnicity, however, remained a significant predictor of reading (p=.020) and writing (p=.009) mastery, even after controlling for the qualification of free/reduced meals and ELL status (see Table 18).

Bivariate Analyses: Non-Special Education Students.

Post hoc paired comparison analyses revealed that of non-special education students, a significantly higher percentage of white students met mastery in reading and writing compared to black and Hispanic students (p<.001, all). No significant difference was found between the percentage of black and Hispanic students mastering reading (p=.686) and writing (p=.312; see Tables 21 and 22).

Bivariate Analyses: Special Education.

Within students enrolled in special education, however, there was no difference between the proportion of white and Hispanic students obtaining mastery in reading (p=.347) and writing (p=.105). A significantly larger percentage of Hispanic special education students mastered reading (p=.018) and writing (p=.067; approaching significant at a .05 level) compared to their black counterparts. The difference in the proportion of white and black students mastering reading approached significant at a .05 level (p=.082), with a higher percentage of white students obtaining mastery. There was no significant difference between the

percentage of white and black special education students meeting mastery in writing. (p=.639; see Tables 21 and 22).

Multivariate Analyses: Non-Special Education.

The associations between specific ethnic groups and reading and writing mastery in non-special education students were then tested in logistic regression models, controlling for ELL status and the qualification for free/reduced meals. Analyses found that of students not enrolled in special education, the higher percentage of white students reaching mastery in reading and writing, compared to black (p<.001, both subjects) and Hispanic students, was still significant after controlling for the above demographic variables (p<.001, both subjects). Analyses also showed no difference in the proportion of black and Hispanic students not enrolled in special education mastering reading (p=.653) and writing (p=.763; see Tables 23 and 24).

Multivariate Analyses: Special Education.

After, the associations between specific ethnic groups and reading and writing mastery in special education students were tested in logistic regression models, controlling for ELL and free/reduced meals status. Of students enrolled in special education, the higher percentage of white students reaching mastery compared to black students no longer approached significance at a .05 level in reading, after controlling for ELL and free/reduced meals status (p=.206). No difference was found between the proportion of white and black special education students mastering writing (p=.822). The percentage of Hispanic special education students reaching

mastery in reading (p=.013) compared to that of black students remained significant. Controlling for the above demographic variables strengthened the significance of the higher proportion of Hispanic special education students reaching mastery compared to that of white students in reading (p=.073, approaching significance at a .05 level) and writing (p=.008, reaching a .01 level), and compared to that of black students in writing (p=.041, reaching a .05 level; see Tables 23 and 24).

DISCUSSION

Study Findings

This study sought to examine the 2009 Connecticut Mastery Test results of special education students in grades 4 through 8 from a school district located in central Connecticut. A primary goal of the study was to analyze the under and over-representation of specific demographics within special education. These demographics included gender, ethnicity, socioeconomic, and ELL status. An additional goal of the study was to compare the performance of special education students and those not enrolled in special education in the subjects of mathematics, reading, writing, and science. This study used a standardized test to assess student performance, rather than psychological testing and teacher assessment, a staple of previous studies (Arms, et al., 2008). The present study was also one of the first to examine the standardized test scores of young children. The findings of this study also contribute to the large body of special education literature by providing a unique within-subject comparison of academic performance across different demographics.

Consistent with previous findings, special education students in the present study were more likely to be male (Flannery, et al., 2000) and of a lower socioeconomic status (Heller, et al., 1982). Students in special education were also more likely to be of black and Hispanic ethnicities (Oswald, et al., 1999). This over-representation of black and Hispanic children in special education, however, no longer proved significant when ELL and socioeconomic status were controlled for, confirming the findings of Artiles and Trent (1994). Contrary to other studies, however, no under or over-representation of English language learners was found among special education students (Donovan & Cross, 2002). This current finding may be due to the low number of students in the sample identifying as ELL, thereby reducing the power of analyses. It may also be that educators from the school district sampled are more familiar with and skilled at distinguishing between language-based learning disabilities and difficultly mastering English as a second language. This may be due to the substantial number of Hispanic students in the school district, thus replicating the findings of Gabel et al. (2009).

Both special education and non-special education students had mean mathematics, reading, writing, and science mastery level scores below the desired mastery level (score of at least 4) set by the state and federal government. The mean subject mastery level for students not enrolled in special education was 3, obtaining a mastery level of "Proficient" in all subjects. Special education students earned scores significantly below those of non-special education students, receiving a mean mastery level of 2, performing at "Basic" in all subjects. These current findings support the established claim that those students not enrolled in special education outperform

students in special education in most classroom subjects and measures of achievement and mastery (Ollendick & Hersen, 1998; Donovan & Cross, 2002).

Non-special education students earned their highest mean mastery level score in mathematics (M=3.68), while students enrolled in special education received their highest mean score in writing (M=2.25). Both groups obtained their lowest mean mastery level score in science (M=3.39 vs. M=2.15). Additionally, special education students also obtained their lowest mean score in reading (M=2.15). It is understandable that the reading subject test would pose the most difficult for special education students since the majority of learning disabilities are language-based (Ollendick & Hersen, 1998). These types of disabilities affect how young children sight-read, process written words, and comprehend the meaning of written statements. Language-based learning disabilities also hinder the speed at which students read, making reading arduous and intellectually taxing (Wong, Graham, Hoskyn, & Berman, 2008). Such language-based disabilities almost exclusively affect reading, leaving the child's writing skills relatively intact (Gerber & Bryen, 1981).

Despite these generally low mean mastery level scores, over 60% of non-special education students met mastery in mathematics, reading, and writing, individually, and over 50% obtained mastery in science. Almost 50% of these students mastered all 3 core subjects (mathematics, reading, and writing). Roughly 40% of students who were administered the additional science test mastered all 4 subjects. However, less than 15% of students enrolled in special education met mastery on the mathematics, reading, writing, and science subject tests, individually. Less than 4% of special education students obtained mastery in all 3 core subjects,

and 2% of those who were administered the science subject test earned mastery in all 4 subjects. These findings also support the long-held understanding that non-special education students have a stronger mastery of classroom curriculum than special education students (Ollendick & Hersen, 1998; Wong, et al., 2008).

It is possible that the discrepancy between the low mastery level scores and the relatively high percentage of non-special education students meeting mastery is due to several low-performing students bringing the mean mastery level scores below the median. As a result, the percentage of students meeting mastery is a more accurate depiction of student performance, rather than mean mastery level scores, which are skewed by outliers in the sample.

According to the 2008/2009 standards of mastery set by the No Child Left Behind Act, 82% of special education students must perform at or above "Proficient" in mathematics, 79% of students must meet at least "Proficient" in reading, and 70% of special education students must score at or above "Basic" in writing (McQuillan, 2009). Of those sampled, however, less than 50% of special education students were "Proficient" in mathematics and reading. Despite over 70% of students enrolled in special education meeting at least "Basic" in writing, this demographic group did not make adequate yearly progress due to their performance in reading and writing. As a result, these schools were flagged as "in need of improvement" for the 2009/2010 school year.

The current study also found that of special education students, Hispanic students performed significantly higher in reading and writing compared to black and white students. In addition black students preformed equally to white students in

reading and writing. These findings, however, do not extend to students not enrolled in special education. Of those not in special education, white students scored significantly higher than black and Hispanic students in reading and writing, while the performance of black and Hispanic students were similar to each other. This occurrence is most likely due to the over-referral of black and Hispanic students to special education. As stated previously, classroom teachers have been found to hold biases against black and Hispanic students, often viewing them as under-achieving even when their performance is independently rated as at least adequate (Heller, et al., 1982).

However, because these findings only occur on language-based assessments, it appears that not only are these students over-referred, but they are also over-diagnosed with a language-based learning disability. If children who do not have a learning disability receive additional support in a particular subject area, such as reading or writing, it is logical that those students will perform better in that area than had they not received those additional services (Tomlinson, 1982). This finding may be due to instructor biases against speakers of Ebonics (Kretzschmar, 2008) and students with foreign accents (Chin, 2010), primarily black and Hispanic students, respectively. Instructors are often unable to differentiate between variations of Standard English and language-based learning disabilities, and so black and Hispanic children who speak Ebonics or have a foreign accent are more likely to be wrongly referred and diagnosed than their white peers (Millar, 1997).

It has also been hypothesized that bilingualism has some positive effects on verbal skills, but only in children who have inhibited language skills, such as those

with learning disabilities (Tomlinson, 1982). Since Hispanic children are more likely to speak more than one language (Millar, 1997), the presence of bilingualism might help explain why Hispanic special education students perform better on language tasks than black and white students.

Study Limitations and Future Directions

The nature of this study lends itself to limitations. Specifically, the scope of the findings is limited by the student demographic information gathered by the test assessment. The standardized test used for this study was developed by the state and federal government, and as a result, the researchers were unable to design and implement a detailed demographic assessment. Since previous research has found that children living in unstable homes are more likely to be enrolled in special education and perform lower than other students in special education (Tomlinson, 1982), such information concerning students' home and family life would have enhanced the findings and implications of this study. Such demographic questions could have ascertained with which parent, if any, the child lives, the marital status of the child's parents, and the highest level of education attained by the parents.

Also missing from the demographics assessed by the Connecticut Mastery Test is the presence of multiethnic students. Because an interaction of ethnicity and special education status exists as a predictor of reading and writing performance, it is important to examine the performance of those students who are of more than one ethnic background. Since the CMT used definitive ethnic categories, the results of this study must be viewed in light of the fact that all multiethnic students in the sample were forced to identify with just one ethnic background.

The results of this study may also be compromised by the poor design of the variable ELL status. ELL students are defined by the assessment as students currently learning English. It does not take into consideration students who learned English as a second language and have since been labeled "proficient" by the school district, and thus no longer require English language programs. This measure may also be too exclusive as it also does not take into consideration students who speak fluent English, but speak a different language at home. Future studies should examine the possible effects of bilingualism on the reading and writing abilities of young students with learning disabilities. A study concerning only Hispanic students, for example, could examine a possible interaction between special education status and bilingualism as predictors of reading and writing performance.

Although the scores of almost 2000 students were analyzed, the relatively low number of special education, Asian, American Indian, and English language learning students greatly reduced the power of many analyses. Future studies should address this issue by replicating this study in communities with large Asian, American Indian, and English learner populations. This small sample size among specific demographics can also be remedied by using a larger sample. A follow up study, for example, can analyze the CMT scores of randomly selected Connecticut school districts, or examine multiple school districts of communities with similar ethnic and socioeconomic demographics.

Conclusions and Implications

The current study supports established findings that male, Hispanic, black, and low-socioeconomic students are over-represented in special education. As a

result, more effort needs to be made on the part of the school district to reduce the number of incorrect referrals to special education. This can be done by educating instructors on common implicit biases against male, black, and Hispanic children, in particular. Instructors also need to be aware of language differences among black and Hispanic students, such as the use of Ebonics and foreign accents. They also need to be trained on how to differentiate these language differences from actual language-based learning disabilities. By reducing the number of children enrolled in special education by error, more money and instructor support can be delegated to children who actually need special education services.

In addition, changes must be made to the No Child Left Behind Act. Standardized tests should not be used to assess the curriculum mastery of special education students, because it is well established that these students do not perform as well as those not enrolled in special education. Instead, alternative and out-of-level testing needs to be made widely available and tailored to special education students. The adequate yearly progress of these students cannot be measured against non-special education students or even against other students enrolled in special education. Yearly progress should, instead, be evaluated by comparing the individual gains of special education students. AYP can still be quantified for the purposes of NCLB, but progress should not be measured by the percent of students reaching a benchmark performance. It should be measured by the percent of students making a specified amount of personal progress.

Loopholes concerning the definition of a significant subgroup need to be remedied so that school districts do not purposely deny children their right to special

education services as a means of staying in good standing with NCLB. Schools whose special education students do not make adequate yearly progress should not be penalized by being required to make costly staff and curriculum changes. Instead increased funds should be allotted to these schools so that they can afford more special education teachers as well as fund remedial comprehensive programs. If schools are not able to fund and provide such programs, educators are merely putting a bandage on the problem through accommodations. Rather, school districts need to provide services that give special education students the skills they need to overcome their learning disabilities. If educators and lawmakers do not make these necessary improvements and changes, children in special education will never get the opportunity to succeed and will remain perpetually left behind.

TABLES AND FIGURES

Table 1: Student Demographics by Special Education Status

	Special Education n (%)	Non-Special Education n (%)
F/R Meals [a]	139 (53.5%)	623 (36.5%)
ELL [b]	8 (3.1%)	40 (2.4%)
Gender		
Male	189 (72.7%)	857 (50.3%)
Female	71 (27.3%)	848 (49.7%)
Ethnicity		
White	125 (48.1%)	954 (56.0%)
Black	78 (30.0%)	421 (24.7%)
Hispanic	55 (21.2%)	236 (13.8%)
Asian	1 (0.4%)	87 (5.1%)
American Indian	1 (0.4%)	7 (0.4%)
Grade Level		
4th	46 (17.7%)	386 (22.6%)
5th	58 (22.3%)	359 (21.1%)
6th	53 (20.4%)	324 (19.0%)
7th	47 (18.1%)	327 (19.2%)
8th	56 (21.5%)	309 (18.1%)

[a] Qualified to receive free/reduced meals.

[b] English language learner.

Table 2: Association between Special Education Status and Student Demographics

Characteristics	χ^2	df	p – value
Gender	45.58	1	< .001*
F/R Meals [a]	27.21	1	< .001*
ELL [b]	0.51	1	.477
Ethnicity	24.41	4	< .001*
Grade Level	4.463	3	.347

[a] Qualified to receive free/reduced meals.

[b] English language learner.

* Values are statistically significant at a .01 level.

Table 3: Association between Special Education Status and Specific Ethnic Groups

Ethnicity Pairs	χ^2	df	*p* – value
White & Black	4.98	1	.026*
White & Hispanic	10.75	1	.001**
White & Asian	9.22	1	.002**
White & American Indian	0.01	1	.920
Black & Hispanic	1.40	1	.237
Black & Asian	13.49	1	< .001**
Black & American Indian	0.06	1	.807
Hispanic & Asian	16.93	1	< .001**
Hispanic & American Indian	0.21	1	.647
Asian & American Indian	4.64	1	.031*

* Values are statistically significant at a .05 level.
** Values are statistically significant at a .01 level.
Note: The above associations are post hoc paired comparison analyses for the association between special education status and ethnicity (Table 2).

Table 4: Association between Special Education Status and Mastery Level

					Special Ed.		Non-Sp. Ed.	
Subject Score	Model df	Error df	F – value	*p* – value	Mean	SD	Mean	SD
Math	1	1851	255.94	< .001*	2.20	0.05	3.68	0.07
Reading	1	1841	157.77	< .001*	2.15	0.10	3.52	0.03
Writing	1	1923	519.09	< .001*	2.25	0.07	3.68	0.02
Science [a]	1	761	110.46	< .001*	2.15	0.11	3.39	0.04

[a] Subject test taken only by students in grades 5 and 8.
*Values are statistically significant at a .01 level.

Table 5: Subject Test Mastery by Special Education Status

	Special Education n (%)	Non-Special Education n (%)
Subject Test		
Mathematics	22 (8.5%)	1045 (61.3%)
Reading	34 (13.1%)	1120 (65.7%)
Writing	28 (10.8%)	1159 (67.9%)
Science [a]	15 (13.2%)	359 (53.7%)

[a] Subject test taken only by students in grades 5 and 8.

Table 6: Association between Special Education and Subject Mastery

Subject	χ^2	df	p – value
Mathematics	253.72	1	< .001*
Reading	307.93	1	< .001*
Writing	257.64	1	< .001*
Science [a]	64.28	1	< .001*
Overall (4, 6, 7) [b]	190.71	1	< .001*
Overall (5 and 8) [c]	63.79	1	< .001*

[a] Subject test taken only by students in grades 5 and 8.

[b] Mastery on all subject tests for grades 4, 6, and 7.

[c] Mastery on all subject tests for grades 5 and 8.

* Values are statistically significant at a .01 level.

Table 7: Association between Special Education Status and Math Subtest Scores

					Special Ed.		Non-Sp. Ed.	
Subtest Score	Model df	Error df	F – value	p – value	Mean	SD	Mean	SD
Strand 1	1	1862	46.28	< .001*	3.81	.15	4.65	.04
Strand 2	1	1527	118.71	< .001*	3.54	.13	4.96	.04
Strand 3	1	1862	119.39	< .001*	1.72	.11	3.99	.03
Strand 4	1	1860	110.97	< .001*	4.07	.16	5.63	.04
Strand 5	1	1862	142.17	< .001*	3.45	.18	5.49	.05
Strand 6	1	1169	104.86	< .001*	3.48	.18	4.92	.04
Strand 7	1	1862	131.78	< .001*	2.47	.15	4.30	.05
Strand 8	1	1862	102.68	< .001*	2.80	.12	4.11	.04
Strand 9	1	1856	95.67	< .001*	3.20	.16	4.87	.05
Strand 10	1	1133	83.76	< .001*	2.60	.13	3.51	.03
Strand 11	1	1468	65.56	< .001*	2.28	.20	4.37	.08
Strand 12	1	805	32.34	< .001*	1.97	.17	2.90	.05
Strand 13	1	1858	88.09	< .001*	2.70	.12	3.87	.04
Strand 14	1	1861	62.70	< .001*	3.25	.15	4.62	.05
Strand 15	1	1861	174.27	< .001*	3.64	.14	5.42	.04
Strand 16	1	1861	88.26	< .001*	3.66	.15	4.79	.03
Strand 17	1	1856	83.35	< .001*	2.72	.12	3.81	.04
Strand 18	1	1856	105.78	< .001*	2.81	.13	4.09	.04
Strand 19	1	1856	107.03	< .001*	3.13	.13	4.43	.04
Strand 20	1	1856	111.49	< .001*	2.90	.13	4.60	.05
Strand 21	1	1861	74.27	< .001*	2.20	.15	3.59	.05
Strand 22	1	1448	40.84	< .001*	4.46	.19	5.90	.07
Strand 23	1	1446	90.46	< .001*	2.17	.13	3.73	.05
Strand 24	1	1051	68.51	< .001*	1.92	.15	3.67	.07
Strand 25	1	687	44.60	< .001*	1.55	.19	3.22	.07

* Values are statistically significant at a .01 level.

Table 8: Association between Special Education Status and Reading Subtest Scores

					Special Ed.		Non-Sp. Ed.	
Subtest Score	Model df	Error df	F – value	*p* – Value	Mean	SD	Mean	SD
Strand 1	1	1843	137.72	< .001*	5.97	.20	8.27	.06
Strand 2	1	1843	139.23	< .001*	5.67	.17	7.57	.05
Strand 3	1	1843	81.55	< .001*	4.42	.15	5.71	.04
Strand 4	1	1843	119.41	< .001*	5.24	.20	8.32	.05
DRP [a]	1	1850	126.91	< .001*	52.11	.83	63.93	.30

[a] Degrees of Reading Power assessment.
* Values are statistically significant at a .01 level.

Table 9: Association between Special Education Status and Writing Subtest Scores

					Special Ed.		Non-Sp. Ed.	
Subtest Test	Model df	Error df	F – value	*p* – value	Mean	SD	Mean	SD
Strand 1	1	1928	482.68	< .001*	8.36	.23	13.54	.08
Strand 2	1	1928	481.79	< .001*	9.67	.21	14.26	.07

* Values are statistically significant at a .01 level.

Table 10: Association between Special Education Status and Science Subtest Scores

					Special Ed.		Non-Sp. Ed.	
Subtest Score	Model df	Error df	F – value	*p* – value	Mean	SD	Mean	SD
Strand 1	1	761	80.62	< .001*	6.93	.27	9.75	.12
Strand 2	1	761	85.08	< .001*	6.63	.25	9.59	.12
Strand 3	1	761	109.22	< .001*	6.85	.29	10.35	.12
Strand 4	1	761	89.16	< .001*	12.21	.44	17.32	.20
Strand 5	1	761	100.12	< .001*	8.21	.36	12.38	.15

* Values are statistically significant at a .01 level.

Table 11: Association between Special Education Status and Ethnicity, Controlling for F/R Meals [a] and ELL Status [b]

	Odds Ratio	Confidence Limit	*p* – value
Ethnicity	.946	.808 – 1.108	.492

[a] Qualified to receive free/reduced meals.
[b] English language learner.

Table 12: Association between Special Education Status and F/R Meals [a], Controlling for Ethnicity and ELL Status [b]

	Odds Ratio	Confidence Limit	*p* – value
F/M Meals	2.049	1.553 – 2.703	< .001*

[a] Qualified to receive free/reduced meals.

[b] English language learner.

* Value is statistically significant at a .01 level.

Table 13: Association between Special Education Status and Subject Mastery, Controlling for Ethnicity, F/R Meals [a], ELL Status [b], Gender, and Grade Level

Subject	Odds Ratio	Confidence Limit	*p* – value
Mathematics	.054	.034 – .086	< .001*
Reading	.078	.053 – .116	< .001*
Writing	.062	.041 – .094	< .001*
Science [c]	.109	.060 – .198	< .001*
Overall (4, 6, 7) [d]	.039	.020 – .078	< .001*
Overall (5 and 8) [e]	.023	.005 – .094	< .001*

[a] Qualified to receive free/reduced meals.

[b] English language learner.

[c] Subject test taken only by students in grades 5 and 8.

[d] Mastery on all subject tests for grades 4, 6, and 7.

[e] Mastery on all subject tests for grades 5 and 8.

* Values are statistically significant at a .01 level.

Table 14: Special Education Status and Gender as a Predictor of Subject Mastery

Subject	Odds Ratio	Confidence Limit	*p* – value
Mathematics	.972	.338 – 2.790	.957
Reading	.771	.346 – 1.720	.526
Writing	1.156	.493 – 2.710	.728
Science [a]	3.685	.451 – 30.121	.224
Overall (4, 6, 7) [b]	.799	.192 – 3.326	.758
Overall (5 and 8) [c]	< .001	< .001 – >999.999	.968

[a] Subject test taken only by students in grades 5 and 8.

[b] Mastery on all subject tests for grades 4, 6, and 7.

[c] Mastery on all subject tests for grades 5 and 8.

Table 15: Special Education Status and F/R Meals [a] as a Predictor of Subject Mastery

Subject	Odds Ratio	Confidence Limit	*p* – value
Mathematics	1.156	.428 – 3.125	.775
Reading	2.434	1.136 – 5.214	.022*
Writing	1.329	.573 – 3.086	.508
Science [b]	.607	.125 – 0.937	.535
Overall (4, 6, 7) [c]	1.864	.449 – 7.743	.391
Overall (5 and 8) [d]	< .001	< .001 – >999.999	.971

[a] Qualified to receive free/reduced meals.

[b] Subject test taken only by students in grades 5 and 8.

[c] Mastery on all subject tests for grades 4, 6, and 7.

[d] Mastery on all subject tests for grades 5 and 8.

* Value is statistically significant at a .05 level.

Table 16: Special Education Status and Ethnicity as a Predictor of Subject Mastery

Subject	Odds Ratio	Confidence Limit	*p* – value
Mathematics	.616	.304 – 1.246	.178
Reading	1.639	1.051 – 2.556	.029*
Writing	1.835	1.151 – 2.924	.011*
Science [a]	. 643	.247 – 1.677	.367
Overall (4, 6, 7) [b]	1.282	.551 – 2.984	.564
Overall (5 and 8) [c]	< .001	< .001 – >999.99	.942

[a] Subject test taken only by students in grades 5 and 8.

[b] Mastery on all subject tests for grades 4, 6, and 7.

[c] Mastery on all subject tests for grades 5 and 8.

* Values are statistically significant at a .05 level.

Table 17: Special Education Status and F/R Meals [a] as a Predictor of Reading Mastery, Controlling for Ethnicity and ELL Status [b]

Subject	Odds Ratio	Confidence Limit	*p* – value
Reading	1.283	.552 – 2.982	.563

[a] Qualified to receive free/reduced meals.

[b] English language learner.

Table 18: Special Education Status and Ethnicity as a Predictor of Reading and Writing Mastery, and Controlling for F/R Meals [a] and ELL Status [b]

Subject	Odds Ratio	Confidence Limit	*p* – value
Reading	1.843	1.088 – 2.622	.020*
Writing	1.689	1.162 – 2.922	.009**

[a] Qualified to receive free/reduced meals.

[b] English language learner.

* Value is statistically significant at a .05 level.

** Value is statistically significant at a .01 level.

Table 19: Reading Mastery by Ethnicity and Special Education Status

	Special Education n (%)	Non-Special Education n (%)
Ethnicity		
White	18 (52.94%)	774 (71.93%)
Black	5 (14.71%)	196 (18.22%)
Hispanic	11 (32.35%)	106 (9.85%)

Table 20: Writing Mastery, by Ethnicity and Special Education Status

	Special Education n (%)	Non-Special Education n (%)
Ethnicity		
White	12 (42.86%)	738 (68.27%)
Black	6 (21.43%)	226 (20.91%)
Hispanic	10 (37.71%)	117 (10.82%)

Table 21: Association between Ethnic Groups and Reading Mastery, by Special Education Status

Ethnicity Pairs	χ^2	df	*p* – value
Special Education			
White & Black	3.05	1	.082***
White & Hispanic	.87	1	.347
Black & Hispanic	5.63	1	.018*
Non-Special Education			
White & Black	133.43	1	< .001**
White & Hispanic	101.40	1	< .001**
Black & Hispanic	.16	1	.686

* Value is statistically significant at a .05 level.
** Values are statistically significant at a .01 level.
*** Value approaches significant at a .05 level.
Note: The above associations are post hoc paired comparison analyses for the interaction between special education status and ethnicity as a predictor of reading mastery (see Table 19).

Table 22: Association between Writing Mastery and Ethnic Groups, by Special Education Status

Ethnicity Pairs	χ^2	df	*p* – value
Special Education			
White & Black	.22	1	.639
White & Hispanic	2.62	1	.105
Black & Hispanic	3.35	1	.067**
Non-Special Education			
White & Black	78.14	1	< .001*
White & Hispanic	72.30	1	< .001*
Black & Hispanic	1.02	1	.312

* Values are statistically significant at a .01 level.

** Value approaches significant at a .05 level.

Note: The above associations are post hoc paired comparison analyses for the interaction between special education status and ethnicity as a predictor of writing mastery (see Table 20).

Table 23: Association between Reading Mastery and Ethnic Groups, by Special Education Status, Controlling for F/R Meals [a] and ELL Status [b]

Subject	Odds Ratio	Confidence Limit	*p* – value
Special Education			
White & Black	.437	.147 – 1.297	.206
White & Hispanic	1.515	.962 – 2.387	.073***
Black & Hispanic	4.329	1.389 – 13.487	.012*
Non-Special Education			
White & Black	.360	.270 – .471	< .001**
White & Hispanic	.621	.526 – .733	< .001**
Black & Hispanic	1.081	.771 – 1.515	.653

[a] Qualified to receive free/reduced meals.

[b] English language learner.

* Value is statistically significant at a .05 level.

** Values are statistically significant at a .01 level.

*** Value approaches significant at a .05 level.

Table 24: Association between Writing Mastery and Ethnic Groups, by Special Education Status, Controlling for F/R Meals [a] and ELL Status [b]

Subject	Odds Ratio	Confidence Limit	*p* – value
Special Education			
White & Black	1.135	.377 – 3.412	.822
White & Hispanic	2.003	1.198 – 9.357	.008**
Black & Hispanic	3.135	1.051 – 9.357	.041*
Non-Special Education			
White & Black	.437	.334 – .572	< .001**
White & Hispanic	.682	.577 – .805	< .001**
Black & Hispanic	.950	.6884 – 1.328	.763

[a] Qualified to receive free/reduced meals.

[b] English language learner.

* Value is statistically significant at a .05 level.

** Values are statistically significant at a .01 level.

Figure 1: Percent of Students Enrolled in Special Education (%) by Ethnicity

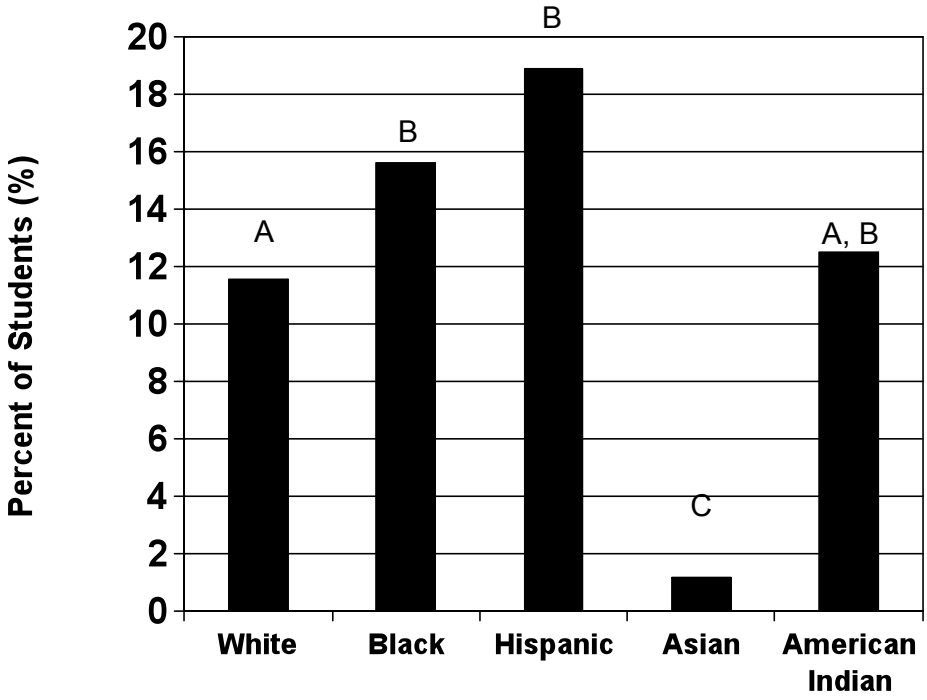


Figure 2: Mean Mastery Level Score by Subject and Special Education Status

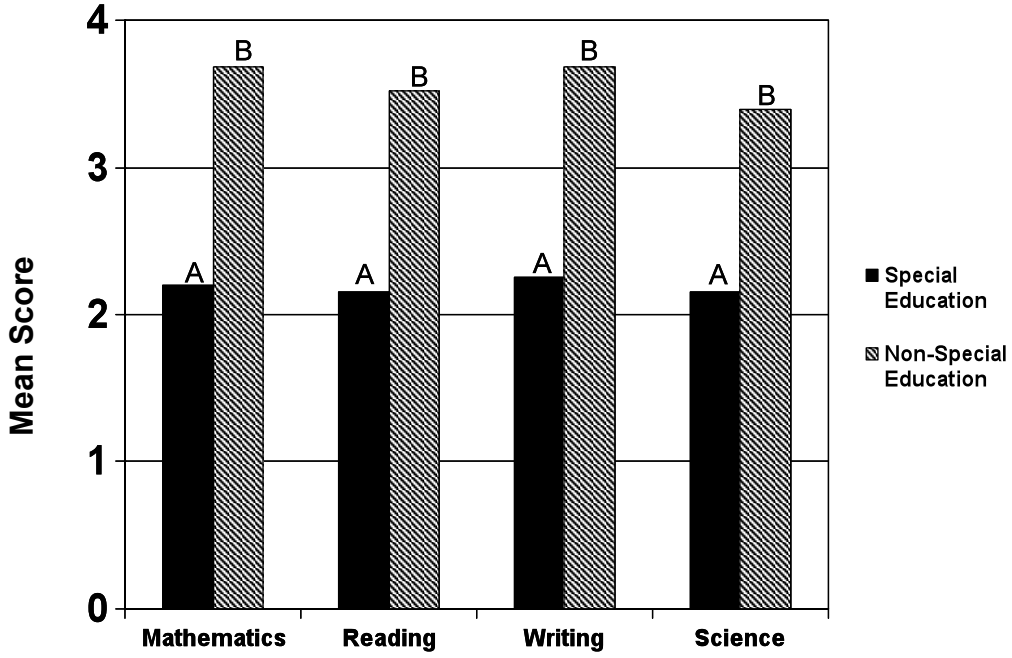


Figure 3: Percent Reaching Mastery (%) by Subject and Special Education Status

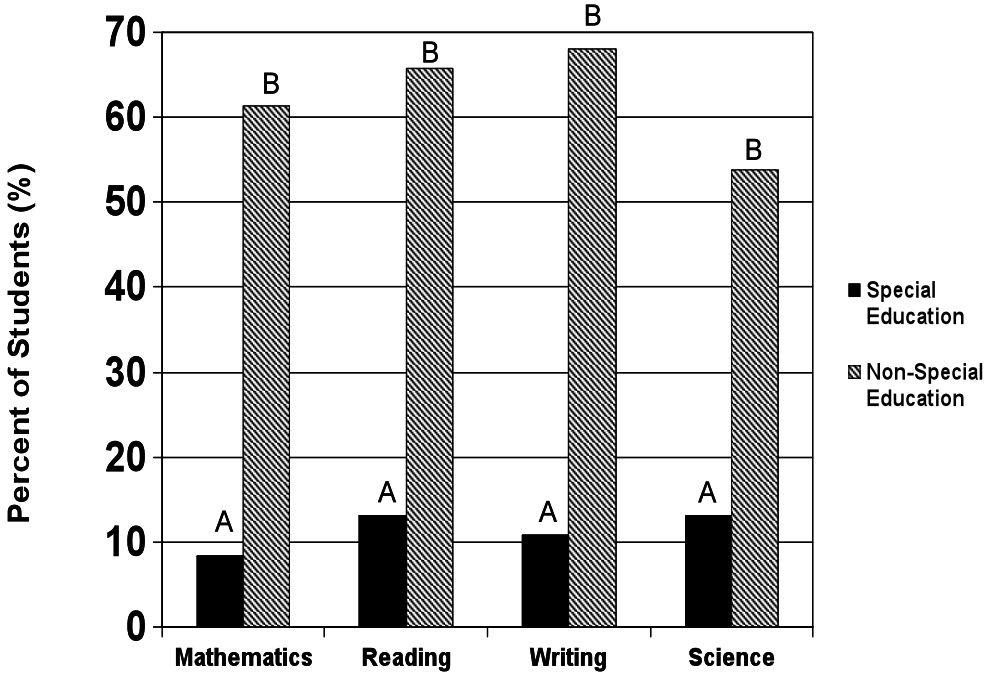
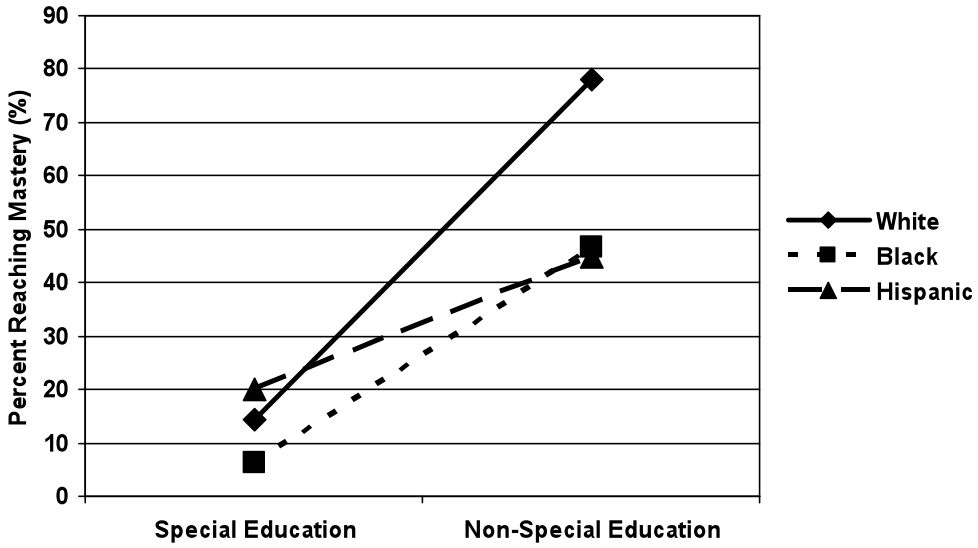
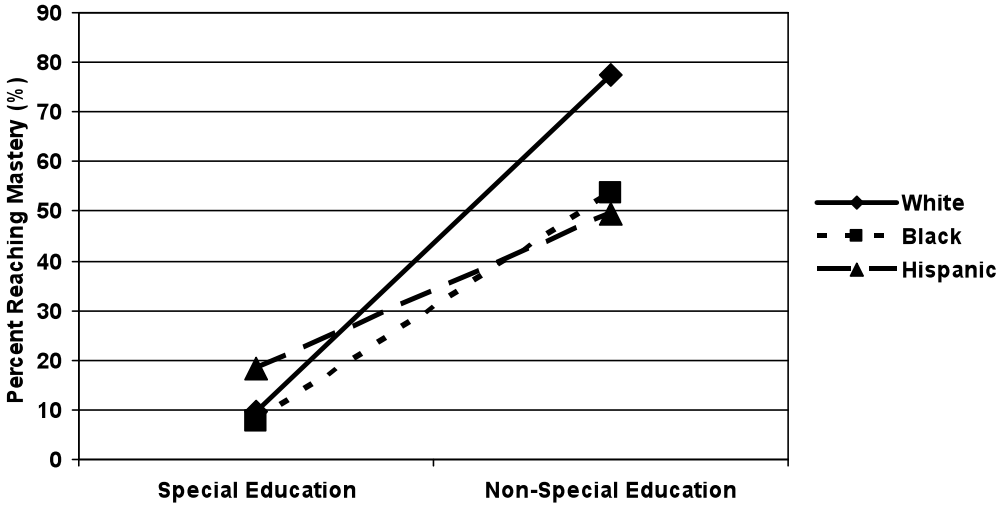


Figure 4: Percent Reaching Mastery on Reading Subject Test (%) by Special Education Status and Ethnicity



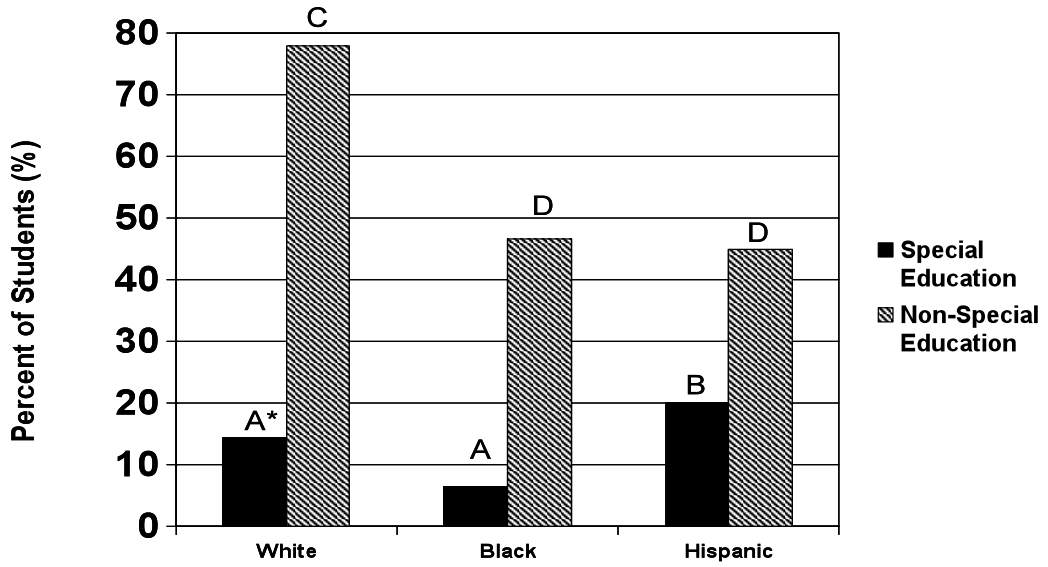
Note: Asian and American Indian students were removed from this graph, but not from analyses, due to low n (%) among both special education and non-special education students.

Figure 5: Percent Reaching Mastery on Writing Subject Test (%) by Special Education Status and Ethnicity



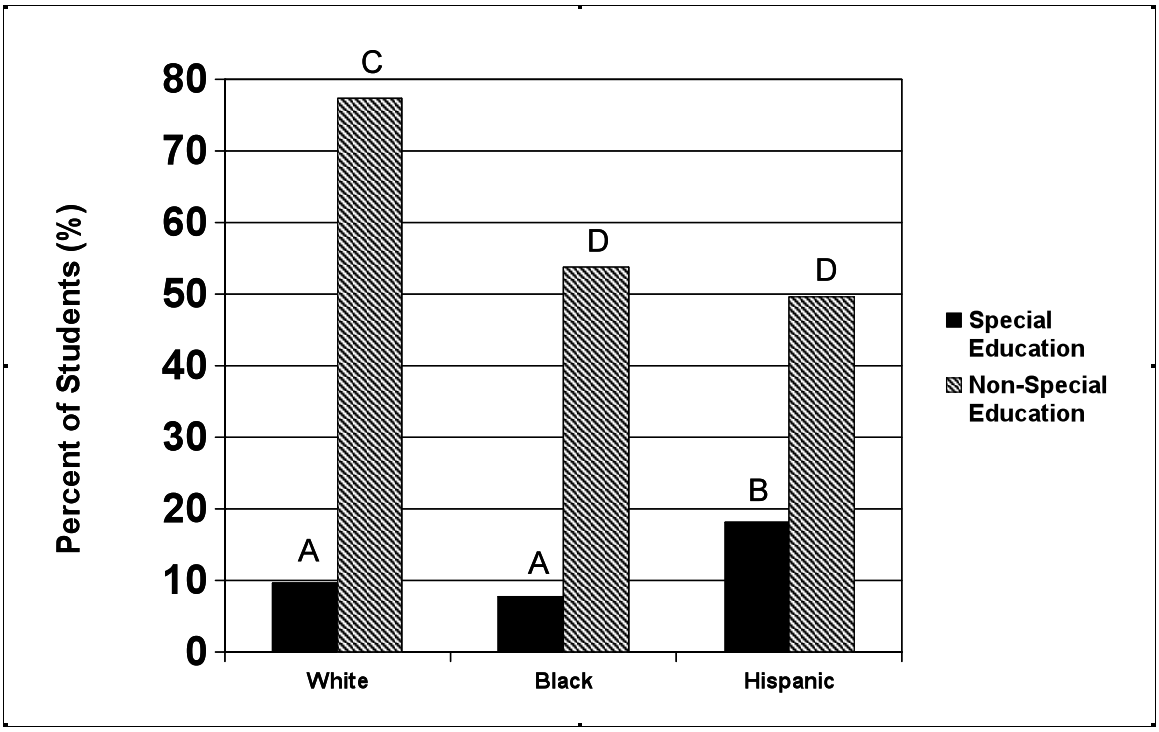
Note: Asian and American Indian students were removed from this graph, but not from analyses, due to low n (%) among both special education and non-special education students.

Figure 6: Percent of Special Education Students Reaching Mastery on Reading Subject Test (%) by Ethnicity



*Difference between white and Hispanic students' performance approached significant at a .05 level.

Figure 7: Percent of Special Education Students Reaching Mastery on Writing Subject Test (%) by Ethnicity



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