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The Relationship between Gifted Selection Criteria and Student Performance on Fifth-Grade Science Achievement

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THE RELATIONSHIP BETWEEN GIFTED SELECTION CRITERIA AND STUDENT PERFORMANCE ON FIFTH-GRADE SCIENCE ACHIEVEMENT

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To: Dean Michael Heithaus
College of Arts, Sciences & Education

This dissertation, written by Teresa Vega Cereijo, and entitled The Relationship Between Gifted Selection Criteria and Student Performance on Fifth-Grade Science Achievement, having been approved in respect to style and intellectual content, is referred to you for judgement.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2022

DEDICATION

To my husband, Manny, whose patience knows no boundaries. To my sister Mercy, who’s most likely teaching the angels in the heavens how to read.

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ABSTRACT OF THE DISSERTATION

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Education policymakers have struggled for decades to provide equal opportunities for all students. Persistent disparities exist between subgroups of students, based on factors such as race, disability, ethnicity, and socio-economic status (SES), which leads to over-representation of minority students in special education and their under-representation in gifted education. Efforts to ensure equity in school districts in identification and support of minority and low SES students have been lagging. Failing to reach students' potential and educating them with appropriately challenging curriculum is a disservice not only to them, but also to our nation. Although gifted programs were developed with the intent to improve educational opportunities for all students, inequities exist in identification of gifted students, leading to inequitable learning outcomes.

The purpose of this study was to determine the relationship between gifted selection criteria and performance on fifth-grade science achievement. The researcher applied a non-experimental ex post facto research design to investigate the differences in gifted enrollment eligibility criterion and factors within the model to better understand these differences, including SES of gifted students; gender; ethnicity; and standardized scores in science, English Language Arts (ELA), and math. Using an archived 2018–2019 dataset obtained from 42 Miami-Dade County Public Schools, data were analyzed from 1,072 fifth-grade students who completed science, ELA, and mathematics standardized tests of achievement.

Results from *t*-tests revealed differences between gifted enrollment pathways and performance in science assessments. A linear regression analysis revealed that math and ELA scores predicted achievement in science, and the different eligibility criterion also positively predicted science performance. SES uniquely contributed to the relationship of the gifted eligibility criterion in predicting science performance.

Additionally, implications from this research for educational policymakers are to focus on exerting efforts to ensure that based on these findings, as well as other existing studies, selection criteria for gifted programs will meet the needs of the diverse population of students.

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INTRODUCTION

Education policymakers have struggled for decades to provide equitable opportunities for all students. With the growing population of the United States and ethnic diversity ever present in the classrooms, the educational system should be responsible for maximizing achievement and talent among all students to be globally competitive for the future (Ecker-Lyster & Niileksela, 2017). Persistent achievement disparities exist between subgroups of students in English Language Arts (ELA), math, and science, based on factors such as race, disability, ethnicity, socio-economic status (SES); these disparities have led to over-representation of minority students in special education but under-representation in gifted education (McClain & Pfeiffer, 2012). In 2012, fewer than 5% of Hispanics and fewer than 2% of English Language Learners (ELL) were enrolled in gifted and talented programs, compared to almost 8% of White K-12 students (Card & Giuliano, 2016). Educational institutions have been slow to implement equity in identification and support of minority and low socio-economic status (SES) students. When educational policies do not educate all students with the appropriate curriculum, this disservice leads to inequitable outcomes in college, employment, and the future of our nation (Benjamin, 2012). Although gifted programs were developed with the intent to improve opportunities for gifted and talented students, inequities exist in identification of gifted students, leading to disparity in learning outcomes, including science achievement.

Background of the Problem

Current assessments and identification of gifted eligibility have led to disparities, particularly among diverse ethnic and SES groups (Ecker-Lyster & Niileksela, 2017). This inconsistent practice begins with the various definitions of giftedness and continues with instruments that focus on a narrow view of intelligence (McClain & Pfeiffer, 2012). As a result, ethnic minority and low SES students are underrepresented in gifted program enrollment (McBee et al., 2012; McClain & Pfeiffer, 2012; Van Tassel-Baska, 2007).

Definition of Giftedness

Gifted evaluations and services are provided in almost all of the 50 states in the United States, but there are large variations between the states regarding the definition and policy for gifted education (McClain & Pfeiffer, 2012). There is currently no federal mandate to identify or serve gifted students; therefore, state and local education agencies determine what programs and services are provided for students who fall under their definition of gifted. The National Association for Gifted Children (NAGC, 2019b) defines gifted children as individuals who demonstrate outstanding levels of aptitude or competence in one or more academic domains. As such, some would add that gifted students are uniquely valuable human resources, who exhibit outstanding intellectual ability and are capable of extraordinary accomplishments and performance (Callahan, 2005; Gallagher, 1994; McClain & Pfeiffer, 2012). According to the *State of the States in Gifted Education Report* (NAGC, 2019a), each state might have its own definition of "gifted," yet some similarities exist. For example, most states include advanced IQ, creativity, talent, and academic ability as part of their definition. Gifted individuals are highly creative, innovative, and motivated thinkers who represent great intellectual capital (Grissom et al., 2019). To meet the needs of these gifted students, public schools throughout the country offer educational and enrichment programs that include meaningful content and learning opportunities at higher levels of cognition that are not typically offered in general education classrooms (Zumeta & Raveling, 2003). Gifted program goals and objectives include critical thinking skills and problem-solving.

The disparity of the gifted definition and its identification criteria for services across and within states creates concern for minority students, identified broadly as the underrepresented population, in these gifted education programs (Ecker-Lyster & Niileksela, 2017). In 2011, there were 36% fewer Hispanic students in gifted programs throughout the nation, compared to those in the general education classes (Ford, 2014). The 2017-2018 Civil Rights Data Collection reported the United States having over 3 million students enrolled in gifted programs, with only 2% ELL and 18% Hispanics. These programs could benefit underrepresented students, in particular low SES and ELL students (Card & Giuliano, 2014). The benefits of equal access to gifted programs recognizes the potential of all students with high levels of aptitude and talent who are capable of extraordinary performance.

Gifted Education and Inequitable Assessment Practices

The *State of States in Gifted Education* (NAGC, 2019a) reported that one third of the states that provide gifted services also require the use of IQ tests for screening students for gifted identification. Assessment practices to determine eligibility for gifted programs typically rely on norm-referenced, standardized intelligence tests that measure English verbal skills. Despite growing percentages of Black/African Americans, American Indian/Alaska Native, and Latin/Hispanic American students enrolled in schools, there is a significant underrepresentation of racially and linguistically diverse students in gifted education (Ford et al., 2008). This disproportionality has led to widespread debate about the utility of cognitive ability tests, or IQ tests, when assessing racial minority students because of concerns that these types of tests do not provide accurate information about their abilities. As a result, when entry screening into those programs relies primarily on standardized IQ testing, there is reason to believe enrollment inequities exist based on test biases, particularly if used in isolation without additional assessment data (Grissom et al., 2019). Standardized intelligence tests, which compare same-age peer performance on the range of cognitive abilities, have been the focus of bias. Test bias also leads to a lack of consensus on the definition of gifted students, particularly as the student population grows increasingly diverse (Card & Giuliano, 2014).

Studies exploring variance in IQ test scores across racial or ethnic groups indicate that SES is associated with performance on IQ tests (Weiss & Saklofske, 2020). García and Weiss (2017) found that performance on standardized tests was linked to SES and parental background starting at an early age. Parental education is a key dimension of SES that shapes children's academic skill development while influencing their knowledge base, practices, beliefs, and aspirations related to learning (Betancur et al., 2018). Betancur et al. (2018) found parent education and family income were moderately associated with science achievement gaps; however, these gaps were reduced when ELA and math achievement were included in their model. Grissom et al. (2019) pointed out that multiple criteria for gifted eligibility are recommended to avoid potential biases in standardized testing, particularly for educational decision-making.

Although states throughout the nation have different eligibility criteria for gifted identification, districts develop alternative eligibility criteria to address the growing population of the underrepresented population in these gifted programs. Florida, with almost 6 million Hispanic students enrolled in its public schools, is ranked third in the nation for Hispanics. Over 80% of the ELL students in the state are Hispanic. To give equal access for gifted services, an alternative eligibility criterion, known as Plan B (FL Rule 6A-A.03019, Section b, 1991), has increased gifted program enrollment in Florida for the previously underrepresented ELL and low SES student populations.

Alternative Pathways to Gifted Education in Florida

There are two different pathways for eligibility for gifted enrollment in Florida: Plan A and Plan B. The traditional pathway for gifted enrollment, known as Plan A, begins with a referral (usually by a teacher or parent) and screening using various cognitive assessment tools. Once referred, the student is administered a standardized test of intelligence (IQ test); if the student scores 130 (two standard deviations above the mean of 100) or higher on this test, the student meets the Plan A criteria for gifted services. The alternative pathway, known as Plan B (FL Rule 6A-A.03019, Section b, 1991), recognizes that the sole use of IQ tests for gifted eligibility does not capture all students equitably in screening and leads to underrepresentation of English language learner students (McClain & Pfeiffer, 2012). Racial and ethnic discrepancies in test scores between groups can occur alongside differences based on family SES (Weiss & Saklofske, 2020). Although an IQ one to two standard deviations above 100 is a common gifted selection criterion, additional criteria are also used. These vary locally by school district but mostly include the state's recommended creativity tests, scores on standardized assessments, and gifted characteristics checklist (NAGC, 2008).

Using Plan B to increase the representation of ELL and low SES learners in gifted classrooms has gained momentum throughout the districts in Florida. Using the alternative plan for gifted enrollment, Miami-Dade County Public Schools (M-DCPS) has seen an enrollment increase of almost 10% in gifted classrooms since 2010. However, performance on standardized assessments, specifically in science, has not shown a parallel increase. In 2010, 50% of the students in the state performed at a satisfactory level on the science assessment. In 2019, when more students were enrolled in gifted classrooms, this increased to only 52%. Almost half of the total number of fifth graders scored below satisfactory on the science standardized assessment (Florida Department of Education [FLDOE], 2019).

Gifted Students' Performance on Standardized Tests

The focus of education since the 2001 No Child Left Behind Act (NCLB) has been for education policy to narrow K-12 achievement gaps. Most of this effort has been on narrowing the achievement gap from underperforming groups (defined primarily by race, SES, or disability status) and bringing it to a satisfactory level of achievement. Consequently, these achievement gaps are described by researchers as excellence gaps, which are differences in the proportion of lower income students achieving the highest levels of academic performance (Plucker et al., 2010) on math, ELA, and science assessments (NAGC, 2019c). Plucker et al. (2010) provided research on excellence gaps between high income and low-income students who reach advanced levels of academic performance. This research indicated that 2% of students eligible for Free and Reduced-

Price Lunch (FRPL) scored above satisfactory in the 2013 Grade 4 National Assessment of Educational Progress (NAEP), compared to 13% of students not eligible for FRPL. It is also important to note that empirical research has shown that Hispanic students from homes where English is not spoken show the greatest gains in science performance in the first several years of schooling (Curran & Kellogg, 2016; Reardon & Galindo, 2009).

Science Performance in Florida Gifted Classrooms

Many researchers have reported the importance of SES on student achievement, including reading (Benson & Borman, 2010) and mathematics (Galindo & Sonnenschein, 2015), but comparatively few have studied this relationship to science achievement of elementary school students (Saçkes et al., 2011). Science achievement gaps are longstanding and require policies to reduce economic inequality in the United States (Reardon, 2013). If left unaddressed, and given the nation's increasing economic disparities, low science achievement could persist in growing segments of the United States' population, particularly among Hispanic, ELL, and low-SES groups. Curran and Kellogg (2016) point to science achievement gaps between low SES and high SES students as a potential foundation for disparities seen in later educational settings and science related careers. That is, Hispanic, ELL, and low-SES populations are also underrepresented in postsecondary science degree programs and science-related career fields. Educators who teach gifted students in science classes begin with programing standards used as part of the educational plan for gifted student and focus on differentiating the instruction to meet each student's needs and abilities, which most likely will affect subsequent career choices (M.-T. Wang & Degol, 2017). Key cognitive skills, such as relational reasoning, problem solving, planning, and basic calculation skills have been found to predict academic achievement in later years (Blums et al., 2017; Curran & Kellogg, 2016; Quinn & Cooc, 2015). Gifted programs often include enrichment activities, which refer to the presentation of curriculum content with more depth, complexity of subject matter, and abstract thinking in the science topics—characteristics gifted students are likely to demonstrate (Robinson et al., 2014).

Because national gaps in science achievement between low-SES and high-SES students persist, improving science achievement must remain an important initiative for educators and policymakers (Betancur et al., 2018; Blums et al., 2017; Jackson & Ash, 2012; Reardon, 2013). For example, national estimates reveal that the 50th percentile science score of both Hispanic students and those participating in FRPL were lower than the 25th percentile of non-Hispanic students who did not qualify for FRPL (Plucker et al., 2010). Elementary teachers must follow a science curriculum that addresses the science standards of each state. Gifted science classes differ from the general education classes in that they embed the curriculum for the gifted programs. However, disparities could continue to exist as a result of students attending schools or enrolling in educational programs where science (along with mathematics and ELA) instruction is of lower quality and frequency.

School districts throughout the state use Florida's adopted alternative plan for gifted enrollment of underrepresented populations. The multiple criteria within this plan attempt to remedy underrepresentation among the state's large population of low-SES and ELL students, many of whom are Hispanic. Still, there is limited research on whether the identification of gifted students is related to science achievement or whether there are differences in science test performance (Curran & Kellogg, 2016).

Purpose of the Study

Although substantial research has been done to identify underrepresented populations among those enrolled in gifted programs, a body of literature that addresses academic performance of students from diverse ethnic and SES backgrounds enrolled in gifted classrooms is lacking (Callahan, 2005; Card & Giuliano, 2014; McClain & Pfeiffer, 2012; Plucker et al., 2013). Existing research fails to fully investigate the relationship between gifted enrollment pathways and performance in gifted classrooms in science achievement. In turn, most of the existing research focuses on increasing the representation of Hispanic and low-SES students in gifted classrooms without also looking at the effects of performance, such as standardized test score results, from these underrepresented populations in gifted classrooms (Artiles et al., 2005; Callahan, 2005; Card & Giuliano, 2016).

Every child should have the opportunity to optimally learn and succeed in his or her education. The purpose of this study was to determine the relationship between gifted selection criteria and performance on fifth-grade science achievement. This study focused on the Florida definition of gifted education, which is students who have superior intellectual development and are capable of high performance, aligned with gifted eligibility criteria and alternative pathways for enrollment, to identify the relationship between equity of gifted student enrollment and standardized science test performance. That is, how are the students enrolled through Plan A or Plan B performing on science standardized exams? Specifically, FLDOE (2019) defines Plan B gifted students in Florida as students of an underrepresented group who meet the criteria specified in an approved school district plan in 1 of 2 ways:

1. ELL students who have limited English proficiency
2. Students who have low SES (FAC, Rule 6A-6.6.03019), as determined by the FRPL subsidy

Hispanic students in Miami-Dade County make up 89% of the total ELL population. This study sought to determine whether other predictors (e.g., eligibility plan, gender, ELA, and math achievement scores) influence science achievement in fifth grade, because that is when students are first tested on science in the state of Florida.

Research Questions

The following research questions were developed after careful investigation of the gifted eligibility process and enrollment:

Research Question 1: Is there a significant difference in the 2018–2019 fifth-grade science standardized test scores between students enrolled in the gifted program who qualified under Plan A and Plan B?

Research Question 2: Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between enrolled gifted students who qualified for the FRPL subsidy and enrolled gifted students who did not qualify for FRPL?

Research Question 3: Is there a significant difference in the 2018–2019 science standardized test scores across gender of gifted fifth-grade students?

Research Question 4a: Do gifted students' ELA and mathematics standardized scores predict science scores of gifted fifth-grade students in the 2018–2019 assessments?

Research Question 4b: Do ELA and mathematics standardized test scores predict gifted students' performance on a science standardized assessment while controlling for gender differences?

Research Question 5: Does Plan A or Plan B eligibility predict science scores for gifted students?

Significance of the Study

Comparing performance on standardized assessments of students who are eligible under Plan A or Plan B could increase diversity and reduce referral bias for low-SES students during the gifted eligibility process. Plan B gifted eligibility identifies low-SES and ELL students for enrollment in the gifted program. In the 2007–2008 school year, almost 60% of students in Florida qualified for FRPL. Ten years later, this increased to almost 70% (McFarland, et al., 2019). In this study, I explored data related to students who were enrolled in the gifted program under Plan B gifted eligibility criterion for the underrepresented population, analyzing their fifth-grade science, ELA, and math scores. Comparing the two eligibility categories (Plan A and Plan B) for the gifted program to identify whether there was a significant difference in achievement is relevant to educators, administrators, and policymakers. Studying data from gifted selection criteria for the FRPL subsidy, ethnicity, gender, and achievement in fifth-grade science, math, and ELA provides a better understanding of students enrolling in gifted programs and revealed several areas for further investigation.

Assumptions and Limitations

There were numerous assumptions related to this research. I assumed the information and data provided were reported accurately. Further, I assumed that the criteria for gifted eligibility by different pathways was completed with sincerity, providing clear evidence of student performance and achievement in general education classes.

I also assumed participants' science classes followed Florida's Next Generation Sunshine State Standards (NGSSS). The sample population for this study was limited to Florida's M-DCPS district—specifically, gifted fifth-grade classes. This was done to limit the differences in science curriculum across schools, demographics, and instruction.

The study was limited to the data provided by one school district in Florida. I did not gather data from the complete gifted eligibility checklist for Plan B because it was not de-identifiable information available by the district. For example, although the Williams Creativity checklist is embedded in Plan B, data from this checklist were not included.

Definitions and Operational Terms

English Language Arts (ELA): Content related to the English language, including literature, grammar, and essay writing (FLDOE, 2019).

English Language Learners (ELL): Refers to students whose primary language is not English and whose English proficiency is below the average proficiency of peers whose primary language is English (FLDOE, 2019).

Excellence Gap: The performance on standardized ELA, math, and science assessments at the higher advanced levels of achievement between high income and low-income students (NAGC, 2019c).

Florida Standards Assessments (FSA): Created by FLDOE (2018) and administered to all students in Grades 3–10 in ELA and Grades 3–8 in math. This assessment was designed for accountability purposes to ensure that all students were meeting state standards, which are a set of competencies that each student is expected to know at each grade level.

Florida's Next Generation Sunshine State Standards (NGSSS): Are K-12 science content standards that measure achievement of the expectations for what students should know in science. Students in Grades 5 and 8 participate in a statewide science assessment (FLDOE, 2018).

Gifted Characteristics Checklist: A rating scale used to determine students' gifted eligibility (Advanced Academic Programs for MDCPS, 2019)

Free and Reduced-Price Lunch (FRPL) Subsidy: A federal program that provides funding for schools to support students who are eligible for the free and reduced-price lunch program; often used as a proxy measure for SES. (M-DCPS, 2018)

Hispanic Students: Spanish speaking students, mostly Cuban and Puerto Rican in the state of Florida, which make up more than 5 million students in the state (National Center for Education Statistics [NCES], 2015).

Minority Students: Those students who do not belong to a region's or nation's majority racial or ethnic group (Cambridge Dictionary, n.d.-a).

Plan B Matrix Score: Based on FL rule 6A-A.03019, Section b, 1991, scores students receive on the Matrix for Gifted Identification used in M-DCPS to qualify for gifted program services. The Plan B Matrix uses four indicators of giftedness to determine eligibility for students in underrepresented groups: the Gifted Characteristics Checklist, a variety of standardized academic achievement test data, an individualized test of intelligence (IQ test), and the Williams Creativity Scale (Advanced Academic Programs for MDCPS, 2019).

Underrepresented Students: Describes a lack of representation of a subset of a population that holds a smaller percentage within a significant subgroup than the subset holds in the general population (Cambridge Dictionary, n.d.-b).

Wechsler Intelligence Scale for Children Full Scale IQ: An individually administered test that can be completed without any reading or writing and takes about 65–80 minutes to complete. The test is divided into 15 subtests, and the full-scale portion of the test is administered for gifted program qualification (Wechsler, 2014).

Wechsler Intelligence Scale for Children-V (WISC-V): An intelligence test that measures a child’s intellectual ability and 5 cognitive domains that impact performance: verbal comprehension index, visual spatial index, fluid reasoning index, working memory index, and processing speed index (Wechsler, 2014).

William’s Creativity Scale: Checklist rating eight common behavioral characteristics of creative children. This scale pinpoints both cognitive-thinking and affective-feeling traits conducive to creative performance. It is used in M-DCPS and takes fewer than 30 minutes for the teacher to complete (M-DCPS, 2018).

CHAPTER II

REVIEW OF THE LITERATURE

When school districts attempt to identify gifted students, this process becomes complicated for learners from various linguistic, ethnic, SES, and cultural backgrounds. Policymakers recognize the importance of providing gifted education for students with unique cognitive potential, but there are no specific national requirements to identify or serve these children. Federal mandates and laws do not currently exist to identify this population of students (NAGC, 2019b). School districts from each state are therefore charged with developing local policies regarding identification procedures while ensuring equitable access, which can lead to disproportionate gifted enrollment rates in each district.

There has been limited understanding on the relationship between gifted identification and science achievement, particularly among minority students in elementary school. Blums et al. (2017) associated SES with several cognitive outcomes, including the quality of a student's early family environment. Other researchers have noted a negative association between poverty and children's cognitive and academic abilities, including verbal skills, IQ, and problem-solving abilities (Capella et al., 2008; McGlonn-Nelson, 2005).

Science achievement gaps within subgroups begin in the primary grades and grow larger as the student transitions from elementary to middle and high school (Curran & Kellogg, 2016; Morgan et al., 2016). Educational policymakers face complex challenges in identifying gifted students. To develop a better perception of their ability in the sciences, environmental and linguistic factors must be included in the identification process for students to reach their full potential in gifted programs (Capella, 2008; Morgan et al., 2016).

The relationship between gifted eligibility and science achievement was explored in this study. I included a review of the literature, including the history of gifted education, issues with gifted screening and identification, the theoretical framework supporting the proposed study, and a conceptualization of gifted learners and underrepresentation in gifted programs. Additionally, "excellence gaps" related to performance on standardized tests between low SES students and students from affluent families, specifically in science, are discussed along with implications for education policy.

Historical Background of Gifted Education

The history of gifted education in the United States dates to the 1600s, with the establishment of the Boston Grammar School, when it was believed that accelerated education produced citizens who would help the nation's economy (Gold, 1965). Giftedness evolved at the turn of the 20th century across several fields of research: on mental inheritance, on children not considered normal, on measurements for normal or supernormal intelligence, and on the realization that grade school would not meet the needs of gifted children (Tannenbaum, 2000).

The first research studies about gifted learners were widely published by gifted education researcher Paul Witty (1977). He demonstrated that giftedness had various dimensions in art, music, intellect, and other areas and dispelled then-popular myths that bright people were unhealthy, unattractive, or asocial (Witty, 1977). Gifted characteristics in children included creativity, artistic talent, high achievement, leadership, and motivation (McClain & Pfeiffer, 2012). The *State of States in Gifted Education* (NAGC, 2019a) reports almost 90% of states' definitions of giftedness include intelligence as an area or category of giftedness. As such, although each state varies in its definition of giftedness, almost 50% of states mandate intelligence tests be used as one of the criteria for identifying gifted students (McBee et al., 2012).

Controversies in IQ Testing in Educational Decision-Making

Another pioneer in gifted education was Dr. Lewis Terman, considered the "father" of the gifted education movement (Warne, 2019). In 1916, Terman conducted longitudinal studies of 1500 high-IQ children and performed extensive field studies using one of the first standardized intelligence measures for children, the Stanford-Binet test. Through his research, Terman provided the earliest definitions of giftedness, focusing on a specified performance of 140 (or above) standard score on this intelligence test (Castellanos & Diaz, 2001). However, Terman's approach to identifying giftedness became controversial when using intelligence testing to highlight differences in ability among racial groups (Graves & Blake, 2016). For example, in the 1979 court case, *Larry P. v. Riles*, the use of intelligence tests was deemed racially biased and discriminating for African American students who were wrongly placed in special education. The use of intelligence tests for determining ability can be problematic since culture and language are known to influence test performance, particularly for children from diverse cultural, linguistic, socioeconomic, and immigrant backgrounds (Ford, 2005). Cultural bias, a tendency to interpret actions or words according to culturally derived meaning (Haddad et al., 2018, Chapter 5), can affect the validity and interpretation of test results when such tests have been primarily developed and standardized from more mainstream, American-English-speaking backgrounds (Ford, 2014).

Differences in performance on IQ tests between subgroups have persisted for decades. For example, on the most recent version of the Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V; Wechsler, 2014), White children had a mean IQ standard score of 103.5, which is higher than that of Latin/Hispanic children (*M* = 94.4), and Black/African American children (*M* = 91.9). Asian Americans outperformed the other three groups with a mean standard score of 108.9 (Weiss & Saklofske, 2020). These observed differences in test performance do not necessarily indicate differences in cognitive ability. However, some still believe that the difference is evidence of heredity or genetic inferiority (Graves & Blake, 2016). This simplistic and dangerous explanation ignores the role of environment, including education and opportunity to learn, on students' test performance. Studies have purported about 50% of the variance in individual intelligence can be attributed to environmental or contextual influences including parent education, acculturation, SES, and academic expectations for students (Weiss & Saklofske, 2020).

Researchers have noted inequities were inherent in the assessment process, particularly when IQ tests were the primary assessment tool used in eligibility or classification (Castellanos & Diaz, 2001; Garcia, 2015; Resing et al., 2002; Warne, 2019). As such, this method of identification leads to disproportionate rates of minority students in special education programs and under enrollment in advanced academic programs, namely gifted education (Weiss & Saklofske, 2020).

Purpose of Gifted Education

For decades, the concept of giftedness has been associated with high intelligence and exceptional performance (McClain & Pfeiffer, 2012). In the 1950s, largely in response to the acceleration of the space race, gifted education continued to evolve. The launch of the Sputnik satellite put gifted education in the forefront of schooling by addressing the need for highly capable children to be well-educated in order to secure the future for the United States' global dominance (Benjamin, 2012). Policymakers then looked at gifted education to prepare students to discover, and they nurtured talents with the approval of the National Defense Education Act of 1958 (Castellanos & Diaz, 2001). This Act reinforced the connection between federal involvement in education and national defense and provided funds to strengthen instruction in science, math, and foreign languages. A large-scale effort to federally fund services for the gifted programs, including testing of students with special intellectual abilities, was provided to ensure the survival of a free nation where there was motivation to progress in various career fields. The focus of this movement was to re-examine the United States' human capital and quality of schooling in the sciences and mathematics (Witty, 1977).

The pendulum of educational reform was again jolted with the 1983 report, *A Nation at Risk: The Imperative for Educational Reform*, declaring that public education in the United States was a failure. The report stated that there were over 23 million functionally illiterate American adults and about 40% functionally illiterate minority youth (National Commission on Excellence in Education, 1983). The report further contended that the United States was being overtaken in commerce, industry, science, and technology, and that education had lost sight of its goals, high expectations, and the disciplined efforts needed to redirect harm to the American economy and standards of living (Farkas & Duffett, 2008). As a result of this report, public education achieved top priority on the national agenda (Heim, 2016). In 2002, gifted education was once again sidelined, and modifications were made to the definition of gifted and talented students with the passing of Title I (part of NCLB) requirements to meet the educational needs of low-achieving children in our nation's highest poverty schools (United States Department of Education, 2004).

This policy, renamed Every Student Succeeds Act (ESSA) in 2015, is well crafted but led to an increased focus on testing and accountability to have all children reading by third grade. As a result of this policy, students who excelled academically and were considered high-achieving in school were pushed aside to focus more attention on the lowest performers. Ensuring that all students received a similar education affected gifted students negatively, ignoring their cognitive and academic needs. Consequently, students who would greatly benefit most from an accelerated curriculum were neglected. In this era of NCLB and ESSA, the concern for equity of instruction and achievement superseded the concern for raising the academic bar (Farkas & Duffett, 2008).

Today, education is once again being reshaped with the intent of improving learning opportunities for all students. However, problems persist with meeting the needs of gifted students, and eligibility criteria based on standardized testing are blamed for the underrepresentation of low-SES and ELL students (Card & Guiliano, 2016; Ford et al., 2008; Garcia, 2015; Lakin & Lohman, 2011). The NAGC (2019b) advocates for equitable identification of gifted and talented students via policies and procedures to allow for the appropriate identification, referral, and placement of gifted children, focusing on high standards, fairness, and inclusion.

There remains a lack of consensus among educators, researchers, and policymakers on how best to approach identification of gifted learners across the nation (McClain & Pfeiffer, 2012). Most experts in the field of gifted education conceptualize gifted identification as a long-term process, where assessments should be ongoing to promote students' abilities and talents (Callahan, 2005; McBee et al., 2012; NAGC, 2019a). Over the past four decades, standardized intelligence tests have been used for identifying gifted students, yet these standardized IQ tests have fallen under much criticism as their cultural biases have been exposed (Card & Giuliano, 2016; McClain & Pfeiffer, 2012).

Identification and Screening of Gifted Learners

School-based assessment of intelligence used for gifted eligibility is typically conducted via standardized IQ tests (or cognitive ability tests), which often originate from European or English-speaking cultures. These tests involve measuring particular cognitive abilities (e.g., verbal ability, visual-spatial ability, working memory, and processing speed) using novel and direct tasks. Intelligence has been shown to be a strong predictor of academic achievement (Roth et al., 2015). Roth et al. (2015) showed that intelligence can be regarded as one of the most influential variables in the context of achievement. Specifically, verbal ability tests are more strongly related to academic achievement than nonverbal ability tests (Lakin & Lohman, 2011). In their research on the predictive accuracy of verbal, quantitative, and nonverbal reasoning tests, Lakin and Lohman (2011) found that non-verbal tests led to classification errors and failed to identify ELL and minority students in talent identification. These nationally normed tests are designed to compare performance of one student to other students nationally. However, overreliance on national norms can also lead to decreased academic expectations among minority, ELL, migrant, and low-SES students. Students evaluated as less able than their peers are less likely to be recommended for gifted education, contributing to a self-fulfilling prophecy of underachievement (Card & Giuliano, 2016).

These types of criteria create barriers for minority students. Erwin and Worrell (2012) indicated that IQ tests were considered some of the best measures of intellectual potential available; however, the researchers noted that an IQ test should not be used in isolation, but as part of a multi-method approach of identification for gifted students. Performance on IQ tests is most likely affected by assumptions based on: school, resources, ecological environment, settings, abundance of professional staff, and other extraneous independent variables (Bronfenbrenner, 2005; Garcia, 2015). Additionally, Ford (2005) addressed the problem in her research with these assumptions, specifically English Language Learners, that affect the performance on tests. Ford (2014) described gifted education programs as the most segregated educational programs in the nation and pointed out the grave consequences of using a single test to place students in gifted programs. Many researchers agree that IQ tests should be used cautiously and as part of a multi-method assessment, especially when identifying minorities, non-native English speakers, and low-SES children for gifted education. Card and Giuliano's (2016) called for revising gifted eligibility criteria, specifically in Florida where their research was conducted, and including more students from underrepresented populations. They concluded that many students from low-SES households were “under-referred” to the gifted program.

Based on the responses provided by each state’s gifted education department, researchers McClain and Pfeiffer (2012) identified 16 states from the 50 surveyed, that mandated schools use IQ tests as the threshold for gifted identification, and in some cases allow different thresholds for disadvantaged students. For example, to qualify for gifted services, students generally must attain a standard score of at least 130 (98th percentile; two standard deviations above average) on the IQ test (McClain & Pfeiffer, 2012). However, to offset economic and linguistic disadvantages, some states offer alternative eligibility plans, which specify lower minimum IQ scores (e.g., 112, which is ~75th percentile and less than one standard deviation above average) for ELL students or those who qualify for FRPL (Card & Giuliano, 2016). Studies on gifted identification have found that ecological environmental factors of higher SES are positively associated with cognitive attainment (Capella et al., 2008; Hur & Bates, 2019). Researchers point out that efforts have been made to address equitable inclusion of underrepresented populations, including low-SES students, who have been overlooked in gifted education programs (Card & Giuliano, 2016; McBee et al., 2012; McClain & Pfeiffer, 2012), yet they also purport that eliminating the use of IQ tests entirely might not resolve these inequities.

The ELL and Low-SES Populations

ELL refers to the culturally and linguistically diverse students who have not yet developed the English language to the point where they can proficiently learn in English-only instruction (Castellanos & Diaz, 2001), but who might be academically proficient in their native languages. Since ESSA was signed into law in 2015, state and local educational agencies have been required to implement provisions of that law. These provisions include programs specifically addressing students identified as ELL to ensure that they attain English proficiency and meet academic content and the achievement of state standards that all students are expected to meet (Shneyderman, 2019). School districts throughout the nation are required to abide by a set of assurances when creating and implementing programs for students who are classified as ELL.

According to the NCES (2015), in 2018, the total enrollment of public-school students in the United States who were ELL was 5 million; in 2010 there were 4.5 million students. Spanish was the home language of almost 4 million ELL students, which represents 75% of the ELL student population in 2018. California, Texas, and Florida had the highest population of ELL students.

Low-SES students are identified through their participation in federal lunch subsidy programs offered in the public schools. According to the NCES, in the 2015-2016 school year, there were almost 26 million students enrolled in the public schools who were eligible for the FRPL subsidy. In short, 52% of the public school students in the United States were identified as low-SES. In California, Texas, and Florida, almost 8.5 million students were eligible for the FRPL subsidy (NCES, 2015).

In states like Florida, ELL students (with over 70% Spanish speakers) and low-SES students who qualify for the FRPL subsidy are underrepresented in gifted programs. The underlying cause for this underrepresentation in gifted classrooms starts with identification processes and procedures and continues with issues of grouping, curriculum, and instruction in gifted programs (Callahan, 2005). Of those students enrolled in gifted programs nationally, only about 20% were considered low-SES

(McFarland, et al., 2019). Ethnic minority students (e.g., Asians, Muslims, Haitians), as well as Hispanics constitute almost 25% of the country's population, yet they are underrepresented in science related careers (Artiles et al., 2005).

Historically, students from lower SES backgrounds have performed lower academically compared to students from higher SES backgrounds (Caro & Cortés, 2012). Erwin and Worrell (2012) found that achievement gaps continued to play an important role in whether students qualified for gifted and talented education programs. Despite the efforts made by several states to recruit students from underrepresented populations, disparities persist where achievement test scores, for example, are lower across multiple SES indicators (Erwin & Worrell, 2012).

Large gaps have been found in science achievement between White and Hispanic children, with income inequalities and racial segregation in schools perpetuating disparities in learning opportunities (Caro & Cortés, 2012). García and Weiss (2017) noted performance gaps and found extensive unmet needs and untapped talents among low-SES children. By comparing the relationship between children's SES and their cognitive and noncognitive skills over a 10-year span, the researchers found that the gaps had not narrowed, despite low-SES parents becoming more involved in their children's education (García & Weiss, 2017). However, research continues to show many students from low-SES backgrounds are high ability students who are persistently overlooked and underrepresented in advanced classes and gifted programs (Callahan, 2005).

FRPL Subsidy

Students from low SES background, as determined by income-based eligibility for the FRPL subsidy, are underrepresented in the gifted program enrollment. Under the

National School Lunch Program, federal funds are provided for nutritionally balanced, low-cost or no-cost meals to low-SES children each school day. In educational research, the percentage of students receiving FRPL under the National School Lunch Program Act is often used as a proxy indicator of the percentage of students living in poverty (i.e., low SES students; NCES, 2015). To qualify for a FRPL subsidy, students must have an annual household income (before taxes) that is less than or equal to $23,107 for a one-adult household and $80,346 for a household size of eight (NCES, 2015).

Performance gaps between subgroups of low-SES children reflect extensive unmet needs and thus unmet needs, indicating students who would benefit from gifted instruction (García & Weiss, 2017). Success in education begins with the development of strong cognitive and noncognitive skills (Callahan, 2005; Erwin & Worrell, 2012; García & Weiss, 2017). Reardon (2013) found that income disparities among families attributed to academic achievement gaps among students, as measured by standardized assessments. Studies on the identification of gifted students indicate that to close the representation gap in low-SES gifted enrollment, standardized assessments should not be used as the sole criterion (Card & Guiliano, 2016; Lakin, 2016; McClain & Pfeiffer, 2012). Schools play a key role in the effort to reduce these gaps and inequalities with educational policies promoting cognitive and social development (Reardon, 2013).

Ford et al. (2008) indicated that the path to increasing the underrepresented population in gifted education is adopting culturally sensitive instruments and multicultural practices that accurately recognize students' cognitive strengths, leading to increased gifted program enrollment for low-SES students. Research on assessment practices and the underrepresentation of minority students in gifted and talented education found the narrow definition of giftedness, IQ testing used as a gifted criterion, and differences in cultural learning styles contributed to the disproportionate under-identification of ELL and low-SES students in gifted and talented education programs (Erwin & Worrell, 2012; Ford et al., 2008). A link also exists between science achievement, SES, and the availability of educational resources, such as gifted programs (Chiu, 2007).

Many states have attempted to increase identification of gifted children (NAGC, 2019a). Florida, specifically M-DCPS, is considered a frontrunner in this effort of finding overlooked gifted students and developing their talents (Rowe, 2017). The state's use of an alternative plan for eligibility, known as Plan B (FL Code Rule 6A-A.03019, Section b, 1991), has increased gifted enrollment in the state to include a higher representation of low-SES and ELL students.

With almost a quarter of the students living in the United States from low-SES families and 5 million being ELL (NCES, 2015), the need for an equitable participation from these diverse underrepresented populations in gifted programs is critical. Disparities will persist unless policies and practices continue to move toward equitable gifted enrollment and address the systems that influence gifted identification (Bronfenbrenner, 2005; Coetzee et al., 2020; Crawford et al., 2020; Paat, 2013; Rouse et al., 2011).

Bio-Ecological Systems Model and Underrepresented Gifted Students

Various aspects of child development emphasize the importance of understanding children in their proximal contexts (Bronfenbrenner, 2005). A population-based study on the challenges children face indicated that children in large urban areas enter public school with needs that go beyond those associated with traditional academic instruction

(Rouse et al., 2011). Poverty and children's ethnic and racial demographics have been associated with all academic and behavioral outcomes; the complex problems faced by children and families today require much consideration on how to build capacity in schools to support students and their families (Capella et al., 2008). Many high-ability students continue to be left behind by school districts throughout the nation in identification for gifted or advanced courses. Data from the Office of Civil Rights (2016) reveal wide disparities in the percentage of Hispanic and low-SES students enrolled in advanced courses compared to other students. Bronfenbrenner (1979) proposed a framework to explain system level issues that are relevant to educational policymakers. This framework is useful in understanding the effects of low-SES and ELL status on enrollment in gifted programs and advanced courses.

Bronfenbrenner (1979) distinguished between environmental influences, structures, and systems. He believed every person was influenced by different environmental systems, which helps explain why people behave differently in different circumstances or environments. Specifically, his bio-ecological model considers individuals and their affiliation to people, organizations, and the community at large. Policymakers might benefit from incorporating this framework to acknowledge how systemic and ecological factors influence child development and improve assessment practices that use an ecological approach (e.g., incorporating parent/teacher feedback, adjusting for SES, developmental history). Crawford et al. (2020) raised awareness of issues associated with the characteristics of the gifted underrepresented population by using proximal processes to gain insight about gifted students from low-SES backgrounds related to their interactions at home, in the classroom, and in their community. These interactions had been overlooked within the different systems, yet by using Bronfenbrenner's bioecological systems theory, issues in gifted identification of underrepresented minority students may be more equitably addressed (Crawford et al., 2020).

Bronfenbrenner's Bio-ecological Systems Model (Table 1) helps explain how the systems affecting gifted students' individual, interpersonal, organizational, community, and public policy contexts are influenced by ecological or systemic factors (Bronfenbrenner, 2005).

Table 1

Bronfenbrenner's Bio-Ecological Systems Model

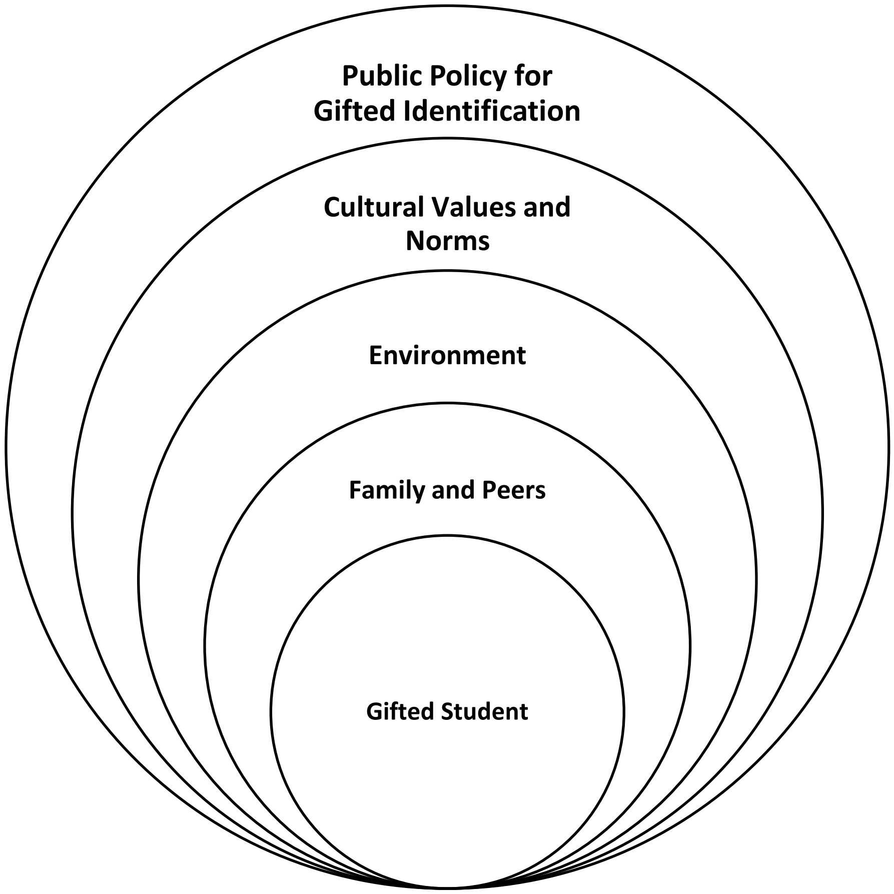
Context	Description
1. Individual	cognition, talent, aptitude
2. Interpersonal	social network, teacher referral, parent
3. Organizational	environment, school, opportunities
4. Community	cultural values, training teachers and parents
5. Public Policy	policies used for the identification of gifted students at the national, state, and local levels

Note. Adapted from *Making Human Beings Human: Bio-Ecological Perspectives on Human Development*, by U. Bronfenbrenner. Copyright 2005 by Sage Publications.

A graphic representation of the relationships of the Bio-Ecological Model between the variables is presented in Figure 1. This model builds on the theoretical discussion of this chapter, starting with the gifted child, and how the child is influenced by each of the five contexts.

Figure 1

Bronfenbrenner's Bio-Ecological Systems Model for Gifted Learners



Note. Adapted from *Making Human Beings Human: Bio-Ecological Perspectives on Human Development,* by U. Bronfenbrenner. Copyright 2005 by Sage Publications.

Ecology, as used in this model, is the study of the relationships between people and their physical environment (Capella et al., 2008). States such as Florida have increased gifted program enrollment using alternative plans for enrollment, which help identify students who demonstrate outstanding levels of aptitude or competence in one or more academic domains, and provide them with opportunities to learn at advanced levels. The bio-ecological model identifies systems and policies that sometimes act as barriers for students to attain success. Bronfenbrenner (1979) examined the social interactions between numerous individuals across multiple settings or environments. In contrast, when examining the underrepresented population of gifted students, researchers often focus on a single setting where students interact, such as home, community, or school (Crawford et al., 2020). This model shows that environmental and systemic factors contribute to students' performance in class and on tests (Capella et al., 2008). Students identified as gifted are not always dependent on their test performance or student skills, but rather on how these systems promote or develop these skills early on (Capella et al., 2008). The following section discusses education gaps in high-achieving students.

Excellence Gaps in Test Performance

The gap between students from low SES and affluent families has increased in the past several decades, with a 30–40% difference in achievement since 2001 (NCES, 2019). Beginning when economically disadvantaged students enter kindergarten, the gap in their achievement differs from their more affluent peers as they progress through elementary, middle, and high school years (Reardon, 2013). Students in the lowest 20% economically often score more than one standard deviation below the top 20% in reading and math (Caro & Cortés, 2012; Reardon, 2013).

Since the implementation of NCLB, progress has been made in having a larger proportion of students reach basic grade-level proficiency across different demographic groups (Plucker et al., 2010). Although much attention has been given to educational reform and closing achievement gaps, Plucker and Peters (2016) highlighted the gaps that exist even within high-achieving groups. Their findings show that there is a growing gap in achievement scores between low-SES students and their more affluent peers on math, ELA, and science assessments (Plucker & Peters, 2016).

These excellence gaps are quite striking, especially when looking at science performance compared to other countries. In one study, only 15% of fourth-grade students tested in science scored at the advanced level (Plucker et al., 2013). Also noted in Plucker and Peters' (2016) research was the difference in achievement between students who were eligible for FRPL and those who were not. Only 2% of students eligible for FRPL scored above satisfactory in the 2013 fourth-grade NAEP, compared to 13% of students not eligible for FRPL. When policymakers look at results of standardized exams to analyze the closing of achievement gaps between low-SES and affluent families, attention should also be placed on the results of students in advanced classes (specifically those in gifted classes) and the size of those excellence gaps (Plucker et al., 2010). The principal focus of the study on excellence gaps is to bring national attention to the gap in the data related to standardized exam scores for high achieving students and putting more effort on change for advanced intellectual skills in our world's information-based society.

Outcomes and Disparities in Science Achievement

During the past 2 decades, achievement gaps in science between minority and majority groups have not significantly narrowed (Banerjee & Lamb, 20016; Crawford et al., 2020). Research on the effects of poverty on academic performance has been used to identify individual, family, regional, and school-level factors associated with excellence gaps in science (Banerjee & Lamb, 2016). The researchers reported deprivation of basic living resources as factors in standardized national science and math tests. They also linked underachievement in scores as a result of a lack of a positive environment and support. Some of the best evidence on early science achievement gaps comes from the NAEP. The results from this nationally representative study demonstrated that science achievement gaps between ethnic subgroups and between male and female students exist in fourth and eighth grade. Additionally, the 2015 results from the Program for International Student Assessment (PISA) of 15-year-old students indicated the United States ranked 28 out of 72 countries competing in science and ranked 38 for college graduating science majors (Harrington, 2016).

Studies of low-SES students have indicated that circumstances in their environment, such as home, community, or school, affect their science achievement (Banerjee & Lamb, 2016; Betancur et al., 2018). Reardon (2013) found income achievement gaps have grown significantly in the last several decades and the gap in standardized test scores was 40% larger than decades earlier. He asserted that high-income students have historically performed better than low-SES students on measures of academic success: grades, standardized test scores, high school completion rates, and college enrollment (Reardon, 2013). Similarly, Curran and Kellogg (2016) found significant science achievement gaps between ethnic subgroups in the first 2 years of schooling.

Gaps in science achievement persist between the total population of students and economically disadvantaged students in all subjects and are more persistent in the sciences with only small yearly increases in scores (Snyder & Musu-Gillette, 2015). Banerjee and Lamb (2016) found this to be true about science achievement among students from families living in high poverty and more likely to be unemployed and/or less educated than students from more affluent families.

Continuing Disparities in Science Achievement

Longitudinal research has found that fifth-grade ELL and low-SES students historically underperform in science achievement compared to other fifth graders (Jackson & Ash, 2012). According to the 2019 NAEP Report Card, the 50th percentile science scores of ELL students were lower than the 25th percentile science scores of non-ELL students, while the 50th percentile science scores of students eligible for FRPL were just above the 25th percentile for those not eligible for FRPL. In 2019, average science scores for the nation were lower by 2 points at the fourth-grade level compared to 2015 scores (NAEP, 2019). Fourth-grade students identified as non-ELL outperformed ELL students in science (Table 2). The NAEP achievement levels (Table 3) use a cut score for the advanced, proficient, and basic levels of performance.

Table 2

Average Scores in NAEP Science for Fourth-Grade ELL and Non-ELL Students

	M Scale Score	
Year	ELL	Non-ELL
2009	114*	154*
2015	121	158*
2019	122	155

Note. ELL = English Language Learner. Retrieved from National Assessment of Educational Progress (NAEP), 2019.
https://www.nationsreportcard.gov/science/nation/groups/?grade=4
*Significantly different from 2019 ($p < .05$)

Table 3

NAEP Fourth-Grade Achievement Level Cut Score

NAEP Achievement Level	Cut Score
Advanced	224
Proficient	167
Basic	131

Note. Retrieved from National Assessment of Educational Progress (NAEP) 2019. https://www.nationsreportcard.gov/science/nation/groups/?grade=4

Science achievement gaps occur as early as kindergarten, with large gaps occurring between the lowest SES group and other groups in third grade, which further widens through eighth grade (Morgan et al., 2016). These disparities might be the result of students attending schools or enrolled in educational programs where science (along with mathematics and ELA) instruction is of lower quality and frequency (Quinn & Cooc, 2015). Similarly, parent education and family income have been associated with science achievement gaps; however, these gaps are reduced when ELA and math achievement were included in the research model (Betancur et al., 2018).

Influence of ELA and Math Skills on Science Achievement

ELA and math are intertwined with science assessment and might even explain science performance. As an example, based on the FLDOE (2018) Science Item Specifications, a fifth-grade physical science assessment question may include comprehension skills, domain-specific vocabulary, measurement of grams and time, and computation skills.

Reardon and Galindo (2009) compared achievement gaps of Hispanics in ELA and math and found that students from homes where English was not spoken had lower ELA and math skills levels when entering kindergarten compared to students from homes where English is spoken. Moreover, there is a strong correlation between ELA and mathematics scores and science scores where high complexity items are written in the assessment to elicit analysis and abstract reasoning (Banerjee & Lamb, 2016; Betancur et al., 2018). Olszewski-Kubilius and Corwith (2017) identified one cause for achievement gaps between higher income families is that higher SES students had more words in their vocabulary by the age of 4 years than the underrepresented children in the study whose families qualified for welfare benefits. Bell et al. (2019) found that as early as third grade, math scores helped predict future successes in life. Their study indicated that as students aged, the gap in science between low-SES and high-SES students grew wider. Bell et al. (2019) suggested that low-SES students start out at the same achievement level as their high-income peers yet fall behind as they continue through their schooling, due most likely to differences in their childhood environment. The effects of poverty and child demographics are associated with all academic and behavioral outcomes and influence how to build capacity in the gifted classroom (Bronfenbrenner, 2005; Capella et al., 2008). When ELA and mathematics gaps occur in the elementary grades, it becomes more difficult for students to then acquire scientific knowledge and skills concurrently over time (Curran & Kellogg, 2016).

Science and Gender

There also exist gaps in science performance between males and females in minority groups (Curran & Kellogg, 2016; Robinson et al., 2014; M.-T. Wang & Degol, 2017). The gender gap between males and females favors girls in science achievement up until they reach high school, although many efforts have been made to determine why and how this can be remedied (Hill & Rogers, 2012). As students progress through school, the gaps in science achievement between girls and boys widens, specifically during the teen years. Hill and Rogers (2012) found that creativity factors, values, and motivation influenced gender gaps in science performance. Although it is difficult to specify at which age girls and boys differ in cognitive abilities, the gap does seem to widen over time (M.-T. Wang & Degol, 2017). Motivation factors could be crucial to the development of the interest of students and curiosity in science, providing and sustaining positive classroom experiences for girls from elementary through secondary school (M.-T. Wang & Degol, 2017). Motivation, specifically in females, has drawn increasing attention for gifted and talented students (Hill & Rogers, 2012; Robinson et al., 2014; Saçkes et al., 2011).

Gifted Students and Science Achievement

Gifted students have highly developed comprehension skills, especially when compared to other students in their age group (McClain & Pfeiffer, 2012; Tannenbaum, 2000). Robinson et al. (2014) reported on the effects of a science-focused science, technology, engineering, and mathematics (STEM) intervention on gifted elementary students’ science knowledge and skills. The purpose of this study was to measure the effects of STEM intervention on gifted students’ science learning, including science process skills, content knowledge, and concept knowledge. With the rigor and acceleration of STEM intervention in gifted classrooms, the results of this study supported the implementation of a rigorous differentiated science curriculum focused on improving science concepts, content knowledge, and process skills. Gifted students in self-contained science classrooms were better able to design science experiments for real world problems and make scientific connections using overarching concepts,; they also benefitted from being allowed to fully explore investigatory concepts appropriate for their age group (Robinson et al., 2014). Student achievement in gifted science classes creates opportunities for students to maximize their potential in the sciences (Callahan, 2005).

Improving science achievement in the United States has been a central focus for policymakers and researchers (Betancur et al., 2018; Blums et al., 2017; Curran & Kellogg, 2016; Morgan et al., 2016). Many variables seem to influence science achievement, including SES, ethnicity, parental education, and income (Banerjee & Lamb, 2016). Findings from previous studies suggest that science education that includes ELA and mathematics instruction can also improve science outcomes (Betancur et al., 2018). Research investigating the effects of ELA and mathematics on science achievement, especially when new state standards call for more complex forms of reasoning and integration of ELA and mathematics in science, could be predictive about the persistence of science achievement gaps (Betancur et al., 2018; Morgan et al., 2016). Early intervention that includes inquiry instruction, critical thinking, and multisensory vocabulary activities can close achievement gaps in science topics for low-SES and ELL students (Jackson & Ash, 2012). However, there is still limited research on how gifted eligibility plays a role in science achievement while controlling for these factors (e.g., gender, SES, ELA, and math achievement).

Summary

This chapter provided a review of pertinent literature related to the key concepts guiding this study. The chapter began with the history of gifted education, national education policy and reform, and the issues related to the identification and screening of gifted students. Next, the underrepresented populations of ELL and low-SES students and the use of an alternative plan to remedy the disproportionality of diverse student enrollment in gifted programs was discussed. A discussion of the alternative plan to increase the population of the diverse gifted learners was included and the “excellence gap” in performance on standardized tests, specifically in science, are expounded upon from students enrolled in advanced or gifted classes.

The intent of gifted programs is to improve opportunities for gifted and talented students, yet inequities exist in identification of gifted students, leading to disparity in learning outcomes including science achievement. As suggested by Card and Giuliano (2016), there is a need to address the disproportionate under enrollment of ELL and low-SES students in gifted programs. The findings in this literature review invite further examination of the relationship between gifted eligibility criteria and science achievement.

CHAPTER III

METHODOLOGY

If educational policymakers do not find ways to reduce the growing inequalities in educational outcomes, schools will never be the great equalizers we expect them to be (Reardon, 2013). The definition of what constitutes gifted and talented students, along with policy and procedures in the identification of students who demonstrate advanced intellectual ability, creativity, talent, and academic ability, plays a critical role in determining which students actually enroll in gifted programs (McClain & Pfeiffer, 2012). Considering the complex task of identifying gifted and talented students, it is imperative that educational policymakers consider the underlying causes of underrepresentation of particular groups of students in gifted programs and achievement, specifically in science, to prepare students to compete in a global society (Castellanos & Diaz, 2001; Curran & Kellogg, 2016). Consequently, this study investigated the relationship between gifted criteria and science achievement.

This chapter discusses the methods used in this study. It begins by stating the purpose of the study and research questions. This is followed by the research design, population, study sample size, variables and instrumentation, procedures, and data analysis.

Purpose of the Study

The purpose of this study was to determine the relationship between gifted selection pathways (Plan A and Plan B) and performance on fifth-grade science achievement assessments. I used a non-experimental ex post facto research design to investigate the differences in gifted enrollment pathways and factors within the model to better understand these differences: SES; gender; ethnicity; and science, ELA, and math standardized test scores. This research contributes to the literature by exploring the achievement in science of low-SES and ELL students enrolled in gifted programs through Plan B and those enrolled in gifted programs through Plan A. This study uniquely contributes to the literature by determining the relationship between gifted enrollment pathways and performance in gifted classrooms on science assessments. The implications of this study will help to generate ideas about how to address existing research (e.g., Card & Guiliano, 2016; Ford et al., 2008; Lakin, 2016; McClain & Pfeiffer 2012; Van Tassel-Baska et al., 2007), with a focus on increasing representation of ELL and low-SES students in gifted classrooms.

Research Questions and Hypotheses

This study focused on the following question: What is the relationship between gifted selection criteria and fifth-grade students' performance on standardized science assessments? Several sub-questions and hypotheses further directed the investigation:

Research Question 1: Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between students enrolled in the gifted program who qualified under Plan A and Plan B?

H_1 There is a significant difference in the 2018-2019 science standardized test scores between students enrolled in the gifted program who qualified under Plan A or Plan B.

Research Question 2: Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between enrolled gifted students who qualified for the FRPL subsidy and enrolled gifted students who did not qualify for FRPL?

H_1 There is a significant difference in science standardized test scores between enrolled gifted students who qualify for FRPL and enrolled gifted students who do not qualify for FRPL.

Research Question 3: Is there a significant difference in the 2018-2019 science standardized test scores across gender of gifted fifth-grade students?

H_1 There is a significant difference in the science test scores between males and females.

Research Question 4a: Do gifted students' ELA and mathematics standardized scores predict science scores of gifted fifth-grade students in the 2018–2019 assessments?

H_1 ELA and mathematics scores do predict science scores.

Research Question 4b: Do ELA and mathematics standardized test scores predict gifted students' performance on a science standardized assessment while controlling for gender differences?

H_1 Gender does contribute to ELA and mathematics scores, predicting standardized test performance in science.

Research Question 5: Does Plan A or Plan B eligibility predict science scores for gifted students?

H_1 Gifted students' enrollment pathway (Plan A or Plan B) does predict science scores.

Population and Sample Size

The study was actualized using a sizeable urban school district in southeast Florida and explored the relationship between gifted eligibility criterion, Plan A and Plan B gifted enrollment pathways, and science achievement as measured by state standardized test scores. The school district, M-DCPS, is the largest school district in the state of Florida and the fourth largest in the nation. M-DCPS has a majority-minority population of Hispanics, with an enrollment of over 350,000 students; over 60,000 are ELL and, of those, almost 55,000 are Hispanic. Over 70% of the students are eligible for FRPL, of which almost 20% are ELL (Statistical Highlights, 2018-2019). The Grades K-12 demographics (Table 4) breaks down the ELL population of the total M-DCPS student enrollment.

Table 4

2018-2019 Student Demographic Characteristics by ELL Status

Category	ELL	Enrollment Grades K-12
Ethnicity	Asian	508 (0.8%)
	Hispanic	56,699 (89%)
FRPL Status	FRPL	48,130 (82%)
	Not-FRPL	11,235 (18%)
Language	Spanish	55,766 (88%)
	Haitian Creole	4,291 (7%)
	Other	3,627 (5%)
Placement	Gifted	502 (1%)

Note. Miami-Dade County Public Schools' (M-DCPS) demographic data combine race/ethnicity. Totals for White and Black are omitted in this table. Retrieved from M-DCPS 2018-2019 English Language Learners (ELL) and Their Academic and English Language Acquisition Progress: 2018-2019 (Shneyderman, 2019)

Data from this study were collected for fifth-grade gifted students enrolled in M-DCPS elementary schools or K-8 centers that housed gifted programs. There are 392 schools in the county and almost 40,000 students enrolled in gifted programs throughout the district, although not all schools have a gifted program. Elementary schools in the district include primary grades (Pre-K, kindergarten, and first grade) up to the fifth grade. The K-8 centers used in this study include the middle school grades (sixth, seventh, and eighth grades) within the same campus as primary and elementary grades.

The sample population for this study was obtained from different regions throughout the county (north, central, or south). The North Region of M-DCPS is comprised of 104 schools in Miami-Dade County, the Central Region is comprised of 112 schools, and the South Region contains 116 schools.

An adequate sample size is a necessary component for making valid study conclusions (Cook & Cook, 2008). Green (2010) suggested that a sample size of 5–50 participants per variable is adequate for a regression analysis. Hence, a sample size of 385 is considered sufficient for an alpha of .05. The sample population of 1,072 students used for this study exceeded the required sample size, yielding a 95% confidence level with a 5% confidence interval.

Research Design

I used a non-experimental, ex-post facto research design. Ex-post facto research was the most suitable design to investigate the research questions posed since it relies on variables that are not controlled by the investigator, as they have already transpired (Cook & Cook, 2008). To determine if there was a correlation between science performance and student eligibility for FRPL, a correlational analysis was used to examine the degree to which two or more variables were associated or related (Chiang et al., 2015). From this analysis, a correlation coefficient for this research was the science standardized test scores of fifth-grade gifted students compared to the ELA and mathematics standardized scores of students enrolled in the gifted program. A regression analysis was also completed to establish the predictive strength of the relationship. Regression analysis shows how one variable predicts another (Pedhazur & Pedhazur Schmelkin, 1991). These statistical analyses were appropriate for this study because they indicated the relationships between variables in terms of direction and strength (Cook & Cook, 2008), while controlling for other related predictor variables, such as gender.

I analyzed data from standardized assessments previously administered to students for fifth-grade science NGSSS from the 2018–2019 school year. Data for each student included performance results using a scale score and science level (Table 5) for this assessment. Archived data from ELA FSA and Mathematics FSA scale scores and level were also obtained for each student for the 2018–2019 school year. Each subject has a different scale score for each level of performance (Table 5). Table 6 shows the research variables used to test the research hypotheses.

Table 5

Scale Score Ranges for 2018-2019 Science Assessment and FSA

	Performance Level				
Subject	Inadequate (Level 1)	Below Satisfactory (Level 2)	Satisfactory (Level 3)	Above Satisfactory (Level 4)	Mastery (Level 5)
ELA	257-303	304-320	321-335	336-351	352-385
Mathematics	256-305	306-319	320-333	334-349	350-388
Science	140-184	185-199	200-214	215-224	225-260

Note. ELA = English Language Arts. Score ranges are different for each subject area.

Table 6

Data Collection Variables

Data Collected	**Description**	**Research Variable**
Gender	Male or Female	Predictor
Gifted Eligibility	Plan A or Plan B	Independent
FRPL Eligibility	Eligible or not eligible for FRPL	Independent
FSA Scale Score	ELA	Predictor
FSA Scale Score	Mathematics	Predictor
NGSSS Scale Score	Science	Dependent

Note. FRPL = free and reduced-price lunch; FSA = Florida Standards Assessment; ELA = English Language Arts; NGSSS = Next Generation Sunshine State Standards.

According to the FSA *Evidence of Reliability and Validity Report* (FLDOE, 2020), the FSA are standards-based, summative tests that measure achievement of the educational standards. Various measures of reliability met acceptable industry standards and the content of these assessments was consistent with the test specifications for ELA, mathematics, and science (FLDOE, 2020). As such, these assessments support instruction and student learning, helping educational leaders and policymakers determine whether the state's educational goals are being met. The 2018–2019 administration of the ELA, mathematics, and science standardized assessments was paper based.

The schools used for this study were "A" graded schools in 2019. In 1999, Florida implemented a major reform called A+ Accountability (Florida Rule 6A-1.09981) where schools are graded for performance on standardized tests. Each school's annual performance generates a grade. A grade of "A" or "B" is considered a high achieving school, while a grade of "D" or "F" is considered a low achieving school. Grades in elementary schools and K-8 Centers (Table 7) are based on the results of the ELA, math, science, civics (seventh grade), and middle school end of course accelerated percentage. The total value is 100 points.

Table 7

Florida's School Grading Scale

School Grade	Percentage
A	62% or above
B	54%-61%
C	41%-53%
D	32%-40%
F	31% or less

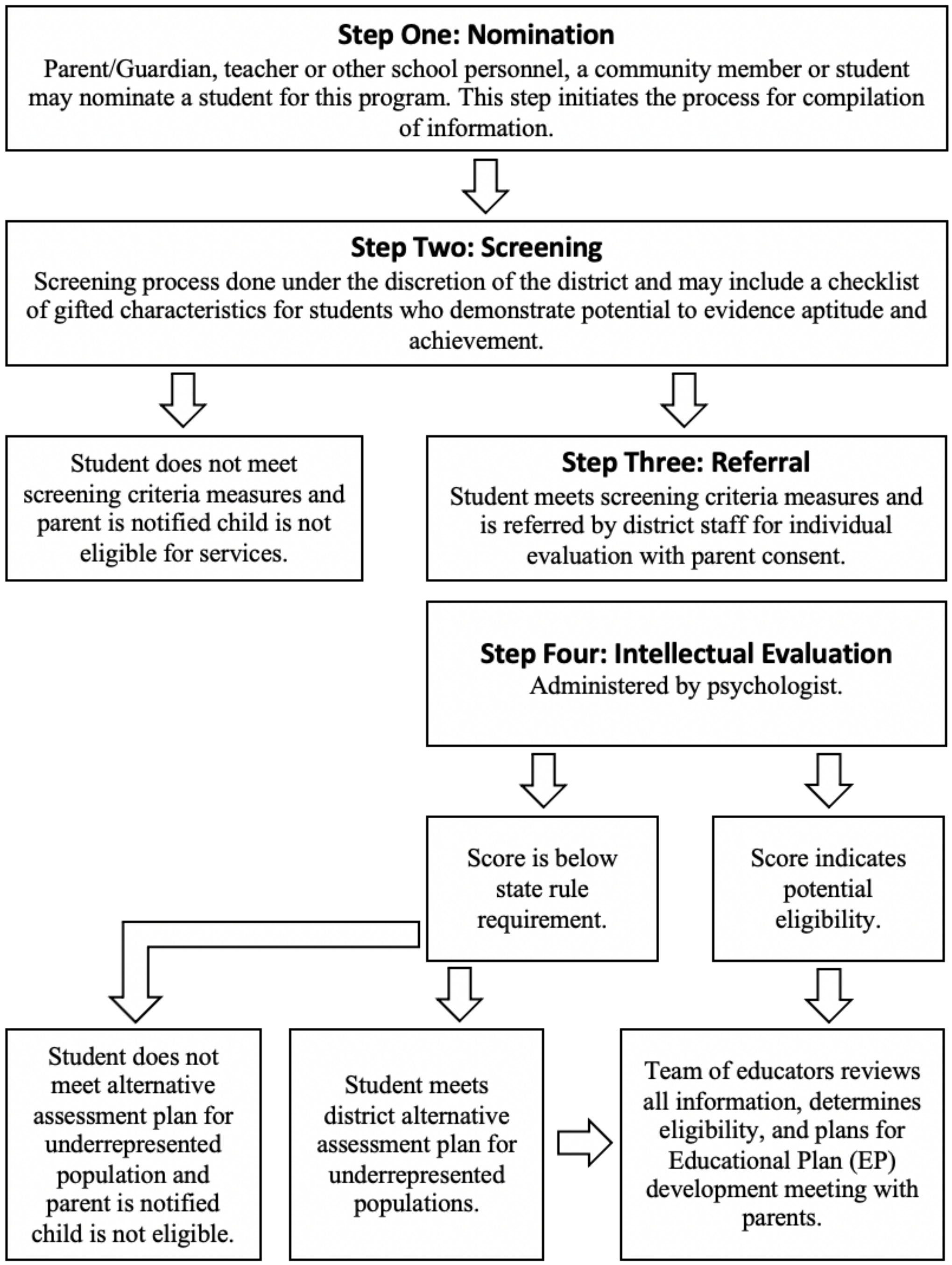
Note. Retrieved from 2019 Florida's School Grade Overview. https://www.fldoe.org/core/fileparse.php/18534/urlt/SchoolGradesOverview19.pdf

M-DCPS's Alternative Gifted Plan B

Plan B (FL Code Rule 6A-A.03019, Section b, 1991) gifted eligibility was established in an effort to encourage each Florida district to increase the population of underrepresented students (students with limited English proficiency, or who are from a low- SES family) in the gifted program (Advanced Academic Programs for MDCPS, 2019). With the use of the alternative plan for gifted enrollment, the district has seen an increase of almost 10% enrollment in gifted classrooms since 2010. Figure 2 shows a guideline for determining gifted eligibility (Plan A or Plan B) in the state of Florida (FLDOE, 2017). Students who qualify for gifted enrollment through Plan B have completed all the steps to meet gifted eligibility but have scored below the state rule requirement for Plan A (Figure 2).

Figure 2

Eligibility Flow Chart for Gifted Services in Florida



Note. Retrieved from Florida Department of Education's *Resource Guide for the Education of Gifted Students in Florida*, 2019 (https://www.fldoe.org/core/fileparse.php/5660/urlt/RGEGSF.pdf).

Research Variables

Two independent variables guided the study: student eligibility for gifted programs through Plan A or Plan B. Plan A gifted eligibility uses IQ as the eligibility criteria while Plan B uses ELL and SES (determined by students' eligibility for the FRPL subsidy) as the threshold for eligibility. Students who are enrolled in gifted programs through Plan B using ELL as the threshold for eligibility also receive ELL services, although no students needing ELL services were included at the time the data were obtained for this study. This variable was not explored because the ELL threshold for Plan B eligibility is considered only at the time of enrollment, which usually occurs in the primary grades. Unlike FRPL, ELL services are progressive where learning expectations move across different levels and students exit the ELL program once they are considered to be at a fluent level of English language learning (Shneyderman, 2019). It is possible the students in this dataset might have exited the program. It is also important to note that students enrolled in the gifted program through Plan A might also be ELL and/or eligible for the FRPL subsidy; these variables are not considered for Plan A gifted eligibility.

The predictor variables used in this study were students enrolled in a gifted program through: (a) Plan A or Plan B eligibility criteria, and (b) eligibility for the FRPL subsidy. The outcome variable was gifted student achievement based on the science NGSSS assessment. For the Research Question 4, the predictor variables were ELA scores, mathematics scores, and gender predicting science scores. For Research Question 5, the predictor variables were Plan A or Plan B enrollment pathways predicting science performance.

In 2002, a policy was added to Plan B that did not include racial/ethnic background as a targeted population. A Matrix Scoring System (Table 8) is used in M-DCPS for Plan B. The total score of the four indicators is used. Students may be considered eligible for gifted services with a score of at least 9 points on the Matrix and a minimum score of 1 in the category of IQ

Table 8

M-DCPS Plan B Matrix for Gifted Eligibility with Underrepresented Students

Criterion	**Points**				
	4	3	2	1	0
Gifted Characteristics Checklist	25-23	22-20	19-17	16-13	< 13
Achievement Percentile Score	99-95	94-90	89-85	84-80	< 80
IQ	≥ 124	123-119	118-116	115-112	< 112
Creativity Measure Score	96-91	90-86	85-81	80-77	< 77

Note. Miami-Dade County Public Schools (M-DCPS) Form 7081 Gifted Eligibility Determination Form (Appendix A).

These four indicators determine eligibility for ELL or low-SES students for gifted program enrollment. The first indicator is the gifted characteristics checklist, which is completed by the teacher or parent to determine if the student should be referred for gifted evaluation. The second indicator is based on performance on the FSA in Mathematics and the FSA in ELA. The third indicator is used to determine if the student meets the minimum requirement IQ score of 112, which is above the average intelligence score range of 90-100 (NAGC, 2008). The fourth indicator is based on the Williams Creativity rating scale, which assesses creativity based on eight common behavior characteristics of creative children and is distributed to teachers to complete. The eight common behavioral characteristics include cognitive-thinking (fluency, flexibility, originality, elaboration) and affective-feeling (risk-taking, complexity, curiosity, imagination).

Procedures

The process of data collection commenced after both the Institutional Review of Board Research Compliance of Florida International University and the M-DCPS Research Review Committee approved the study. I retrieved the dataset from the Assessment, Research, and Data Analysis department of M-DCPS on a Microsoft Excel spreadsheet with non-identifier numbers to protect the identity of each student. The data were then transferred to the IBM SPSS Version 27 computer program for analysis.

Race was not identified because this is not used for the purpose of Plan A or Plan B gifted eligibility. In addition to 2018–2019 scores from fifth-grade gifted students' NGSSS science assessment, data for Research Hypotheses 1 and 5 identified students who qualified for the gifted program through Plan A or Plan B. For the Research Question 2, data were used from science scores and students identified as eligible for FRPL. The FRPL subsidy is used in the Plan B gifted eligibility criteria, but students from Plan A might also qualify for this subsidy. For Research Hypotheses 3 and 4, science scores and gender were identified as covariates. For Research Hypothesis 4, standardized scores from science, ELA, and mathematics were retrieved by using the Student Performance Indicator computer program. The data collected from the M-DCPS information system used students' scale score and level from each standardized Florida Standardized Assessment.

Statistical Analysis

I followed a non-experimental, ex-post facto research design. Statistical analyses were conducted using SPSS. Numeric values were input for each variable and data analysis was performed. To determine whether there was a significant difference between Plan A and Plan B gifted eligibility and science performance, an independent sample *t*-test was used to test the group mean differences. For Research Hypothesis 2, an independent sample *t*-test was used to determine group mean differences in science scores for the 2018–2019 school year between two groups: gifted students eligible for the FRPL subsidy and those who were not eligible. For the Research Question 3, an independent sample *t*-test was used to determine the group mean difference between Plan A and Plan B eligibility pathways, qualification for the FRPL subsidy, and gender. For Research Hypotheses 4a, 4b, and 5, regression analyses were conducted to determine the association between students' ELA and mathematics scale scores and the science standardized assessments, controlling for gender. A regression analysis was also conducted to find out whether Plan A or Plan B gifted eligibility predicted outcomes on the science standardized assessments.

The individual relationships between the criterion variable, performance on a fifth-grade science assessment, and each predictor variable was tested using linear regression (Laerd Statistics, n.d.). Using a linear regression, estimated relationships between independent variables (i.e., students in fifth-grade gifted program, students qualifying for FRPL subsidies) and dependent variables (i.e., science NGSSS test scores).

Summary of Methods

This study investigated the relationship between the criteria for selection of gifted students and their performance on a fifth-grade state science assessment. The study included predictor variables such as gender, standardized test scores on ELA and math, and FRPL qualification, which was used as a proxy indicator of student SES. The criteria also included the students' eligibility based on Plan A or Plan B pathways. The student population from this research was analyzed using M-DCPS's fifth-grade gifted student data from elementary and K-8 schools from the three regions of the county (North, Central, South) that were graded from the state as an "A" school in the school year 2018–2019 and had over 70% Hispanic population.

CHAPTER IV

RESULTS

The following chapter presents the descriptive and inferential statistics of the collected data in accordance with the procedures outlined in Chapter 3, as well as a summary of the results. Prior to analyses, the dataset was checked for potential missing data across all variables.

Sample Characteristics

Data were collected from 1,072 fifth-grade students enrolled in a gifted program from 42 schools in M-DCPS from each of the three regions (North, Central, South) of the county that had over 70% Hispanic population at their school. The sample population was fifth-grade gifted students. Fifth grade is the first year students in the state of Florida take a standardized science assessment. The sample included 51% females and 49% males. The student ethnicity and race include 90% Hispanic, 3% Black, 5% White, and 2% Asian (Table 9). Of the 961 gifted Hispanic population, 623 were eligible for the FRPL subsidy, and 338 were not eligible for FRPL.

Table 9

Demographic Data of Student Participants

Variable		*n*	Male	Female	Eligible FRPL	Not Eligible FRPL
Ethnicity						
	Hispanic	961 (90%)	462 (49%)	499 (47%)	623 (58%)	338 (32%)
	Asian	23 (2%)	12 (1%)	11 (1%)	14 (1%)	9 (1%)
	Black	34 (3%)	18 (2%)	16 (1%)	18 (2%)	16 (1%)
	White	54 (5%)	31 (3%)	23 (2%)	22 (2%)	32 (3%)
Gifted Eligibility						
	Plan A	436 (41%)	214 (20%)	222 (21%)	194 (18%)	242 (23%)
	Plan B	636 (59%)	309 (29%)	327 (31%)	483 (45%)	153 (14%)
FRPL						
	Not Eligible	395 (37%)	186 (17%)	209 (19%)	-	-
	Eligible	677 (63%)	337 (31%)	340 (32%)	-	-
Total		**1072**	**523 (49%)**	**549 (51%)**		

Note. FRPL = Free or Reduced-Price Lunch subsidy.

For this study, low-SES students were determined by eligibility for FRPL. This subsidy is used to determine SES where children can qualify for school meals based on household income and family size. The sample included predominantly low-SES students; 63% of the student sample was eligible for the FRPL subsidy. Among those who were eligible for gifted enrollment through Plan A, 18% were eligible for FRPL; 45% were eligible for gifted enrollment from Plan B. Students from households that meet the federal guidelines (about $46,000 annual income for a family of four) are eligible for FRPL (Food and Nutrition Service, U.S. Department of Agriculture, n.d.).

Test Performance

The FLDOE provides standardized achievement test results using levels and scale scores. For this research analysis, scale scores on the FSA ELA and FSA Mathematics and NGSSS Science assessment were used. It is important to note that each subject has different scale score ranges indicating *inadequate progress* (Level 1), *below satisfactory* (Level 2), *satisfactory* (Level 3), *above satisfactory* (Level 4), and *mastery* (Level 5). For this study, the scale scores were used to analyze the data. Refer to the key to these FLDOE score limits for the 2018–2019 assessments provided in Chapter 3, Table 5.

Table 10 shows that the mean score of student performance was at the *above satisfactory* level on ELA and science tests, while student performance in math was at the mastery level. Test performance within each subject area was close to normal distribution because the skewness and kurtosis values approach 0 and this is an acceptable range (Pedhazur & Pedhazur Schmelkin, 1991).

Table 10

Descriptive Statistics for Dependent and Predictor Variables

Subject	*M*	*SD*	Min.	Max.	Skewness	Kurtosis
Science	222 (Level 4)	15.65	177	260	0.18	0.09
ELA	348 (Level 4)	14.41	348	385	0.06	0.28
Math	351 (Level 5)	17.14	256	388	-0.14	0.77

Note. ELA = English Language Arts. Level 4 ranges for: Science = 215–224, ELA = 336–351; Level 5 range for Math = 350–388.

After disaggregating the student data based on gifted eligibility, students who qualified for gifted programs through both Plan A and Plan B pathways demonstrated *above satisfactory* performance in science and ELA (Level 4) and *mastery* in Math (Level 5; see Table 11).

Table 11

Descriptive Statistics for Criterion Eligibility Plan A or Plan B Students

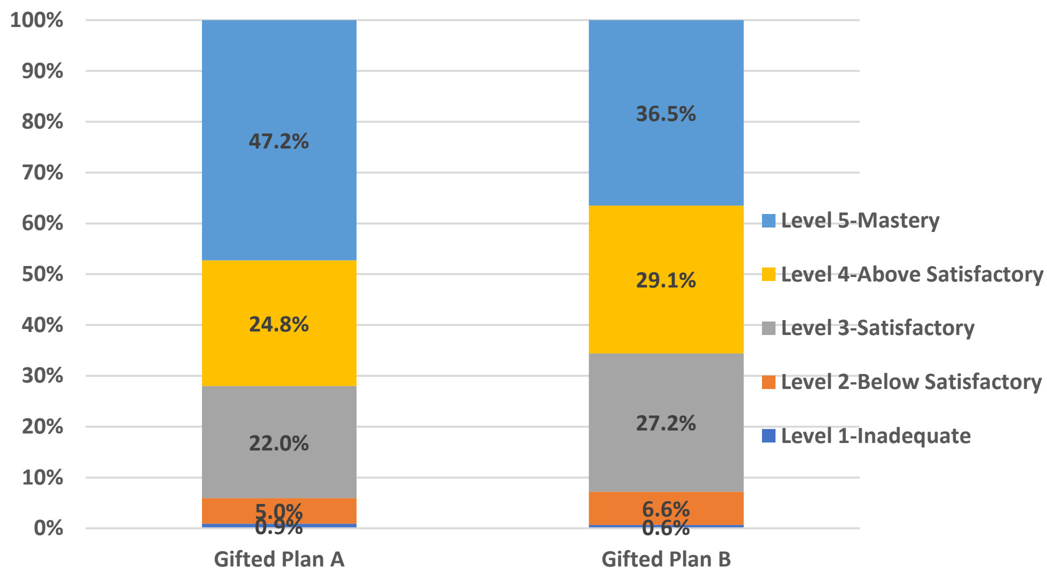
Variable	*n*	*M*	*SD*	Min.	Max.
Plan A Science	436	223.72	16.43	177	260
Plan B Science	636	220.42	14.96	178	260
Plan A Math	436	353.26	16.66	302	388
Plan B Math	636	350.00	17.33	256	388
Plan A ELA	436	349.86	14.33	304	385
Plan B ELA	636	346.69	14.33	296	385

Note. ELA = English Language Arts. Level 4 ranges for: Science = 215–224, ELA = 336–351; Level 5 range for Math = 350–388.

To present percentages of student results at each level of performance, a visual representation of the descriptive statistics using a bar graph for each subject area (science, ELA, and math) was created. In the science assessment, 41% of students enrolled in the gifted program performed at the *mastery* level (Figure 3); in the ELA assessment, 40% performed at the *mastery* level (Figure 4); and in Math, 53% performed at the *mastery* level (Figure 5).

Figure 3

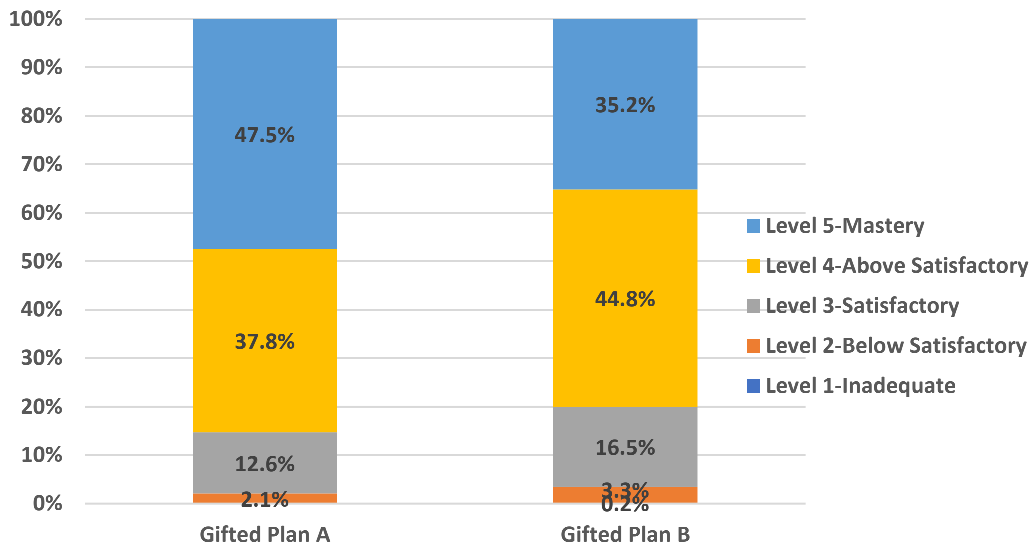
Science Level by Gifted Eligibility Pathway



Note. Level 1 = 140–184, Level 2 = 185–199, Level 3 = 200–214, Level 4 = 215–224, Level 5 = 225–260.

Figure 4

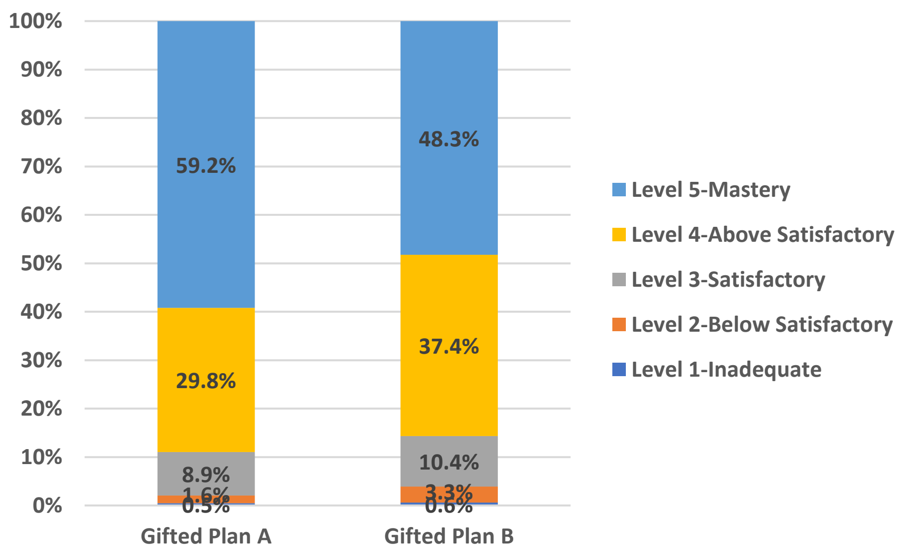
ELA Level by Gifted Eligibility Pathway



Note. ELA = English Language Arts. Level 1 = 257–303, Level 2 = 304–320, Level 3 = 321–335, Level 4 = 336–351, Level 5 = 352–385.

Figure 5

Mathematics Level by Gifted Eligibility Pathway



Note. Level 1 = 256–305, Level 2 = 306–319, Level 3 = 320–333, Level 4 = 334–349, Level 5 = 350–388.

Table 12 provides descriptive statistics for gifted students who qualified for the FRPL subsidy and science, mathematics, and ELA standardized assessment scores. The mean science score for gifted students eligible for FRPL and those not eligible for FRPL was *above satisfactory* (Level 4). The mean math score was at *mastery* (Level 5). The mean ELA score was *above satisfactory* (Level 4).

Table 12

Descriptive Statistics Criterion Eligibility Variable for Students on FRPL Subsidy

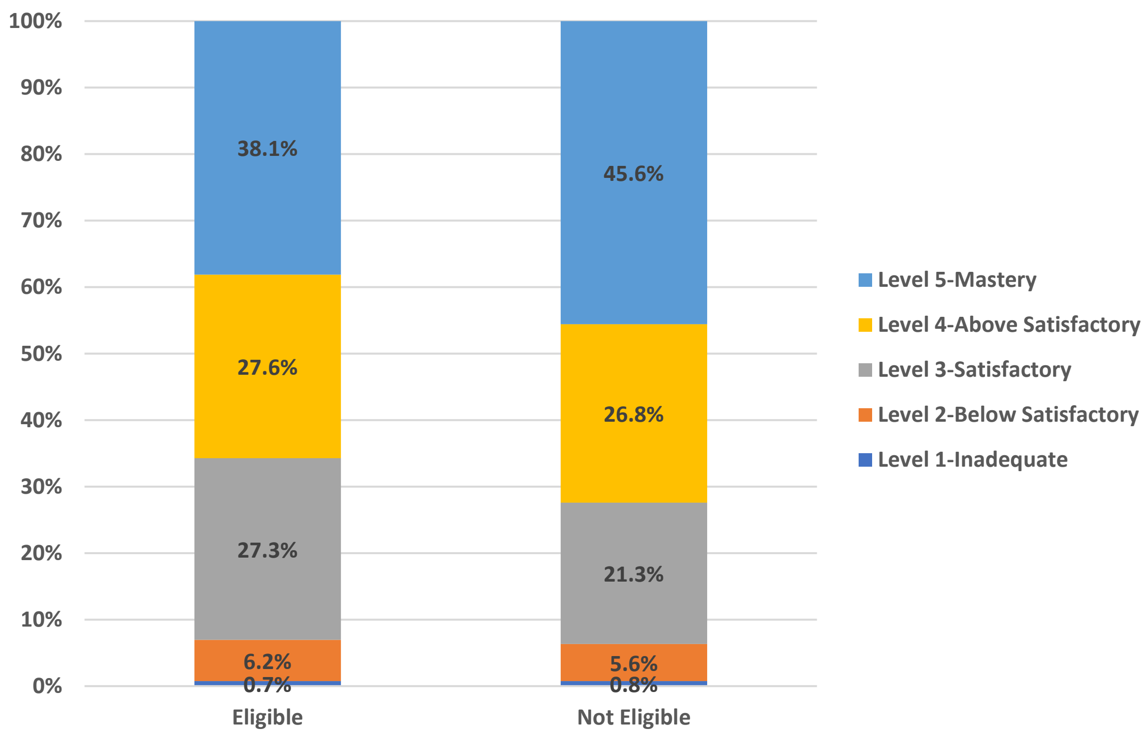
Variable	***n***	***M***	***SD***	**Min.**	**Max.**
Science Scores					
Not FRPL Eligible	395	223.3 (Level 4)	16.08	178	260
FRPL Eligible	677	220.83 (Level 4)	15.34	177	260
Math Scores					
Not FRPL Eligible	395	352.89 (Level 5)	17.52	300	388
FRPL Eligible	677	350.41 (Level 5)	16.86	256	388
ELA					
Not FRPL Eligible	395	349.90 (Level 4)	13.92	307	385
FRPL Eligible	677	346.85 (Level 4)	14.58	296	385

Note. ELA = English Language Arts, FRPL = Free or Reduced-Price Lunch. Level 4 range: Science = 215–224, ELA = 336–351; Level 5 range: Math = 350–388.

A bar graph relating student assessment scores in each subject area (science, ELA, and math) to FRPL subsidy qualification was created. On the science assessment, more students not eligible for FRPL (45.6%) performed at the *mastery* level than those ineligible for FRPL (38.1%; see Figure 6). The same applies to ELA (Figure 7) and math (Figure 8), with ELA having the greatest difference of students performing on mastery level who were ineligible for FRPL.

Figure 6

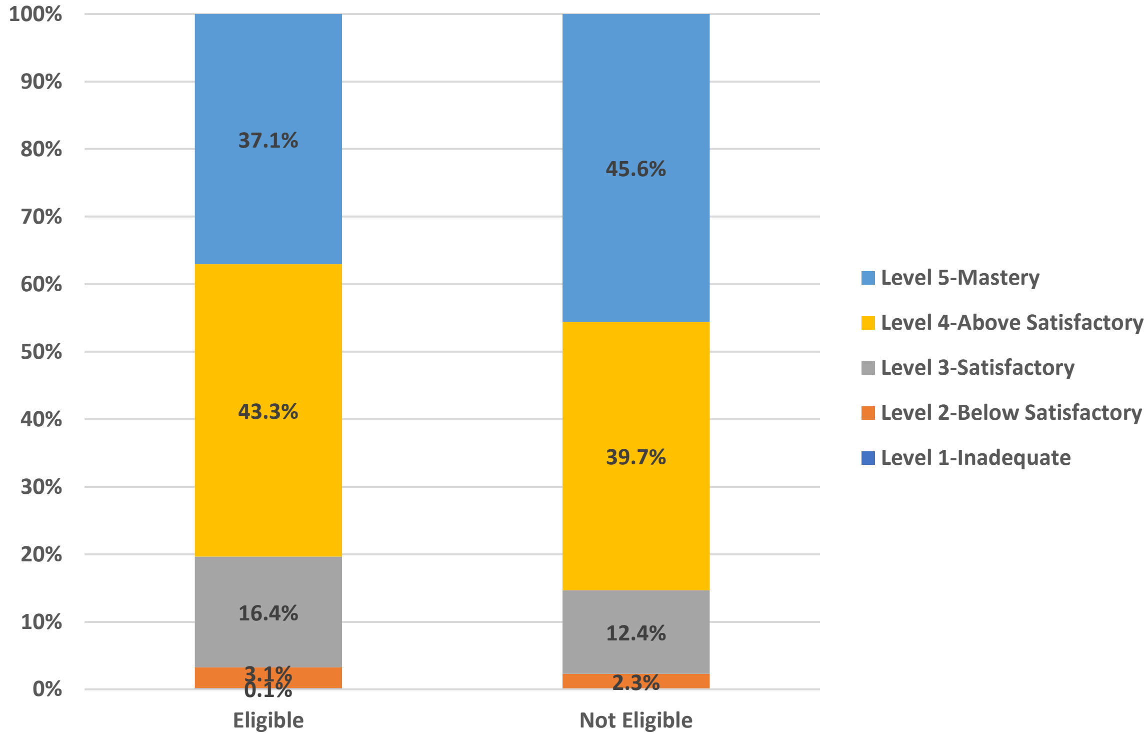
Science Level by SES



Note. SES = socio-economic status; Free and Reduced-Price Lunch (FRPL) subsidy eligibility was used as a proxy indicator for student socio-economic status. Level 1 = 140–184, Level 2 = 185–199, Level 3 = 200–214, Level 4 = 215–224, Level 5 = 225–260.

Figure 7

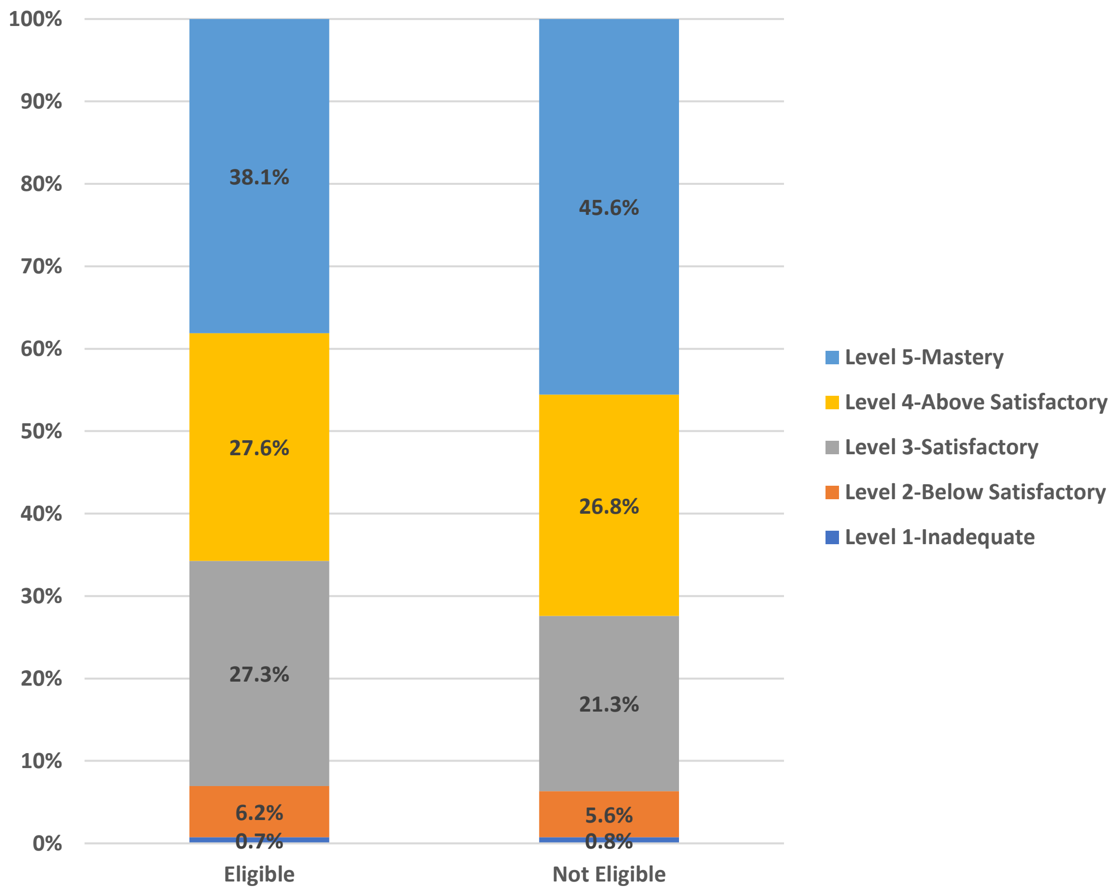
ELA Level by SES



Note. ELA = English Language Arts. SES = socio-economic status; Free and Reduced-Price Lunch (FRPL) subsidy eligibility was used as a proxy indicator for student socio-economic status. Level 1 = 257–303, Level 2 = 304–320, Level 3 = 321–335, Level 4 = 336–351, Level 5 = 352–385.

Figure 8

Math Level by SES



Note. SES = socio-economic status; Free and Reduced-Price Lunch (FRPL) subsidy eligibility was used as a proxy indicator for student socio-economic status. Level 1 = 256–305, Level 2 = 306–319, Level 3 = 320–333, Level 4 = 334–349, Level 5 = 350–388.

Correlation Matrix

A correlation matrix (Table 13) was developed to analyze the association between subject area tests. Science and math had the strongest correlation ($r = .610$, $p < .01$); science and ELA also had a strong positive correlation ($r = .590$, $p < .01$). There was also a positive correlation between math and ELA ($r = .527$, $p < .01$). There are strong inter-correlations within subject areas.

Table 13

Inter-Correlations for Subject Area Test Scores

Subject	1	2	3
1. Science	--	.610*	.590*
2. Math		--	.527*
3. ELA			--

Note: ELA = English Language Arts
*$p < .01$

A statistical analysis was conducted via the IBM SPSS Version 27 computer program to test the five research hypotheses. An independent sample *t*-test was first conducted at the significance level $\alpha = .05$ to determine if a statistically significant difference existed between the 2018–2019 science assessment scores of students enrolled in the gifted program who qualified under Plan A and Plan B.

Results of Testing the Research Hypotheses

Research Question 1

Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between students enrolled in the gifted program who qualified under Plan A and Plan B? I hypothesized that there would be a significant difference.

An independent sample *t*-test was used to compare the means of the two independent groups, Plan A students and Plan B students, in order to determine if there was a statistically significant difference in their 2018–2019 science test scores. There was a statistically significant difference between the science standardized test results of Plan A (*M* = 223.72, *SD* = 16.43) and Plan B students (*M* = 220.42, *SD* = 14.96), $p<.001$, $t(1070) = 3.42$. To measure the effect size of the association between the group means, Cohen's d was calculated ($d = 0.21$), which is considered a small effect size. In summary, students who qualified for gifted enrollment through Plan A had a mean higher score of 3.3 on the Science NGSSS compared to those who qualified through the Plan B pathway, and this difference was statistically significant.

Research Question 2

Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between enrolled gifted students who qualified for the FRPL subsidy and enrolled gifted students who did not qualify for FRPL? I hypothesized that there would be a significant difference.

An independent sample *t*-test was conducted to compare the means of the two groups, students eligible for FRPL subsidy and students not eligible for FRPL subsidy. There was a statistically significant difference in scores between students not eligible for FRPL subsidy (*M* = 223.35, *SD* = 16.08) and students eligible for the FRPL subsidy (*M* = 220.83, *SD* = 15.34), $p = .011$, $t(1070) = 2.55$. Students who were not eligible for the FRPL subsidy had a mean higher score of 2.52 compared to those who did qualify for the FRPL subsidy. This difference was statistically significant at a level $\alpha = .05$ and the null hypothesis was rejected. To measure the effect size of the association between the group means, Cohen's d was calculated ($d = 0.16$), which is considered a small effect size. There was a weak positive relationship between FRPL and science scores.

Research Question 3

Is there a significant difference in 2018-2019 science standardized test scores across gender of gifted fifth-grade students? I hypothesized that would be is a difference in the science test scores between males and females.

An independent sample *t*-test to compare the means of the two groups (males and females) was analyzed. A statistical assumption of equality of variance was checked using Levene's Test for Equality of variances, and the results of the analysis were $F(1,1049)=4.53$, $p = .03$, $t(1048)=4.67$. Consequently, the equal variance assumption for research hypothesis 3 was not supported. The independent sample *t*-test indicated statistically significantly difference in the means between the science assessment scores of males ($M = 224.03$, $SD = 16.23$) and females ($M = 219.60$, $SD = 14.78$), $p < .001$, $t(1070) = 4.68$. Male students enrolled in the gifted program had a mean higher science assessment score of 4.43 compared to females enrolled in this program. This difference was statistically significant at a level $\alpha = .05$; the null hypothesis was rejected. To measure the effect size of the association between the group means, Cohen's d was calculated ($d = 0.29$), which is considered a small effect size. A weak positive relationship existed between gender and science assessment scores.

Research Question 4a

Do gifted students' ELA and mathematics standardized scores predict science scores of gifted fifth-grade students in the 2018–2019 assessments? I hypothesized that ELA and mathematics scores would predict science scores.

In the regression analysis, the independent variables were ELA and mathematics scores and the dependent variable was science assessment scores. First, a simple linear regression was carried out to investigate whether math scores predicted science scores. The results of the regression (Table 14) indicated that the model explained 12% of the variance in science is explained by math, $F(1, 1070) = 476.995$, $p < .001$. A linear regression was then carried out to test whether ELA scores predicted science scores. The results indicated that 35% of the variance in science is explained by ELA, $F(1, 1070) = 570.523$, $p < .001$. Taken together, ELA and math scores explained 47% of the variance in science scores and the model was significant, $F(1, 1070) = 570.52$, $p < .001$. Therefore, the relationship can explain that every point increase in the ELA score will lead to a .403 increase in the science score and for every point increase in the math score will lead to a .378 increase in science scores. This further supports that ELA's change influences the change in science performance. For both simple linear regression models, the assumptions of the regression models were not violated. At the $p <.05$ level of significance, there exists enough evidence to conclude that ELA and math scores predict science scores.

Table 14

Linear Regression Predicting Science Scores Using ELA and Math Scores

Variables	**Unstandardized B**	***β***	***t***
(Constant)	-51.50	-	-5.73
ELA	.403	.371	14.19
Math	.378	.414	15.83

Note. ELA = English Language Arts.

Research Question 4b

Do ELA and mathematics standardized test scores predict gifted students' performance on a science standardized assessment while controlling for gender differences? I hypothesized that gender would contribute to ELA and math scores predicting Science performance.

A linear regression was carried out to test whether gender contributed to predicting science test performance. The results of the regression (Table 15) indicated that gender explained 2% more variance on the science assessment, $F(3, 1068) = 351.51$, $p < .001$. The results of this analysis indicated that gender is also a negative predictor of science performance where female students score 5.11 lower than male students on the science assessment. Therefore, 49% of the variance in science scores can be explained by ELA and math scores and gender.

Table 15

Linear Regression Predicting Science Scores Using ELA and Math Scores and Gender

Variables	**Unstandardized B**	β	***t***
(Constant)	-47.64	-	-5.42
Gender	-5.11	-.16	-7.32
ELA and Gender	.45	.41	15.75
Math and Gender	.35	.38	14.56

Note. ELA = English Language Arts.

Research Question 5

Does Plan A or Plan B eligibility predict science test scores for gifted students? I predicted that students' gifted enrollment pathways (Plan A or Plan B) would predict science scores. I hypothesized that gifted students' enrollment pathway (Plan A or Plan B) does predict science scores.

In the regression analysis (Table 16), the independent variable was a dummy variable for Plan A/B was used (0 = Plan A, 1 = Plan B) and the dependent variable was science test scores. A simple linear regression was carried out to test whether students' gifted enrollment pathway predicted science scores. The analysis used a categorical variable model (Plan A/B) which explained only 1% of the variance in the science assessment, $F(1, 1070) = 11.67$, $p < .00$. Therefore, based on the unstandardized beta, when gifted students are enrolled through Plan B, there is a 3.31 decrease in the science scores.

Table 16

Linear Regression Predicting Science Scores Using Gifted Eligibility Pathways

Variables	**Unstandardized B**	β	***t***
(Constant)	223.73	-	299.92
Gifted Plan A/B	-3.31	-.104	-3.42

Summary of Results

The results of these statistical analyses showed that for Research Hypothesis 1, there was a statistically significant difference at the level α = .05 level between the fifth-grade students' 2018–2019 science test scores and their gifted enrollment pathway (Plan

A or Plan B). For the Research Hypothesis 2, there was a statistically significant difference between the science test scores and students' qualification for the FRPL subsidy. Gender was analyzed in the Research Hypothesis 3; there was a statistical difference between science scores of gifted male and female students, with males scoring an average of 4.43 points higher than females. This was also a statistically significant finding. For the linear regression statistics, Research Hypotheses 4a, 4b, and 5, both math and ELA scores of gifted students' predicted science scores. The model explained 12% of the variance for math and 35% of the variance for ELA. Together, ELA and Math explained 47% of the variance in science and was statistically significant. Gender only explained 2% more variance on the Science assessment scores. Plan A or Plan B as a predictor variable indicated that the model explained only 1% of the variance in science scores.

Chapter 5 discusses these results as well as the implications they have for further research, theory, and practice.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

Chapter 5 presents a summary of the investigation, accompanied by a discussion of the conclusions extracted from the findings, theoretical and practical implications suggested by the outcomes, and implications for policy and research.

Summary of the Study

The following section offers a brief overview of the problem that this study investigated and a synopsis of the methods used. This chapter also includes a concise restatement of the specific research hypotheses tested. The purpose of this investigation was to examine the relationship between gifted enrollment criteria and performance on a science standardized assessment. I analyzed the Plan A and Plan B pathways to gifted eligibility among students eligible for the FRPL subsidy and the relationship between each group's performance on a science standardized assessment. Gender differences as well as math and ELA scores were analyzed to serve as a better predictor for science performance of students enrolled in gifted programs. This study augments existing research with the focus on increasing the representation of low-SES students in gifted classrooms while also looking at the effects of performance in science, ELA, and math for students enrolled through Plan A or Plan B.

Purpose of the Study

The purpose of this study was to investigate the relationship between gifted selection, Plan A and Plan B eligibility criteria, and performance of 1,072 fifth-grade students on a 2018–2019 science standardized assessment. To gauge the differences in performance of students enrolled in gifted programs, 42 schools with 70% or higher

Hispanic population were selected. The following data were collected from each student in the study: gender; ethnicity; Plan A or Plan B gifted eligibility; and science, ELA, and math scores from standardized state assessments.

Research Questions and Hypotheses

Research Question 1: Is there a significant difference in the 2018–2019 fifth-grade science standardized test scores between students enrolled in the gifted program who qualified under Plan A and Plan B?

H_1 There is a significant difference in the 2018–2019 science standardized test scores between students enrolled in the gifted program who qualified under Plan A or Plan B.

Research Question 2: Is there a significant difference in the 2018-2019 fifth-grade science standardized test scores between enrolled gifted students who qualified for the FRPL subsidy and enrolled gifted students who did not qualify for FRPL?

H_1 There is a significant difference in science standardized test scores between enrolled gifted students who qualify for FRPL and enrolled gifted students who do not qualify for FRPL.

Research Question 3: Is there a significant difference in 2018–2019 science standardized test scores across gender of gifted fifth-grade students?

H_1 There is a significant difference in the science test scores between males and females.

Research Question 4a: Do gifted students' ELA and mathematics standardized scores predict science scores of gifted fifth-grade students in the 2018–2019 assessments?

H_1 ELA and mathematics scores do predict science scores.

Research Question 4b: Do ELA and Mathematics standardized test scores predict the gifted students' performance on a science standardized assessment while controlling for gender differences?

H_1 Gender does attribute to ELA and mathematics scores, predicting standardized test performance in science.

Research Question 5: Does Plan A or Plan B eligibility predict science scores for gifted students?

H_1 Gifted students' enrollment pathway (Plan A or Plan B) does predict science scores.

Discussion of Results

Limited research has been conducted on achievement gaps among subgroups of students who perform at advanced levels (Plucker et al., 2010). This section discusses the results for the research questions in determining differences in achievement in science.

Research Question 1 tested the difference between science standardized test scores among students enrolled in the gifted program who qualified under Plan A or Plan B. Students who enrolled through Plan A performed marginally better than students enrolled through Plan B on science achievement; average levels of performance were similar between Plan A and Plan B. The Plan A eligibility pathway uses an IQ score of 130 or higher for eligibility, while Plan B uses multiple factors, including a lower IQ threshold; FRPL subsidy eligibility; ELL status; William's Scale Creativity Scores; and a gifted characteristics checklist, usually completed by the teacher or parent who referred the student for the program. As such, understanding when gaps emerge and what factors play an important role in the disparity in scores is the first critical step toward developing appropriate educational policy and intervention (Quinn & Cooc, 2015). Students enrolled in gifted programs in M-DCPS through Plan B performed slightly lower on a science assessment than students enrolled through Plan A. Although students enrolled in the gifted program through Plan B are considered gifted, the eligibility criteria used for this alternative pathway suggests there was a statistically significant difference in performance in science assessments, yet the differences were not very large. Plausibly, the results indicated that the use of Plan B gifted eligibility is a beneficial alternative for students who would not be traditionally eligible under Plan A.

Research Question 2 sought to determine differences in science test scores between enrolled gifted students who qualified for the FRPL subsidy and those who did not. Data indicated a statistically significant difference, yet there was only a small difference in the mean scores between the two groups. Although students who were not eligible for the FRPL subsidy performed higher on science achievement, compared to those who did qualify for the FRPL subsidy, the results revealed there were small differences. Hence, Plan B gifted identification may be seen as a useful pathway for students who may not have qualified under Plan A, considering that children from low socioeconomic backgrounds are often under-referred for gifted education.

Plucker et al. (2013) affirmed the differences in achievement between students eligible for the FRPL subsidy and students not eligible, with 2% of students eligible for the FRPL subsidy scoring above satisfactory on the NAEP, compared to 13% of students not eligible scoring at that same level. Bleiberg et al. (2019) argued that these gaps between students eligible for FRPL and those not eligible arise through multiple channels, with cultural differences being the reason for lower scores. Developing scientific literacy is an important goal for all students, yet these differences in science achievement related to student SES indicate educational inequity are closing achievement gaps with the use of alternative pathways for gifted enrollment. The results affirmed a more positive outlook for the underrepresentation subgroups in science related careers (Quinn & Cooc, 2015). Cultural norms and stereotypes related to science, preparation and achievement in science, and attitudes toward science play an important role in student performance in science (Quinn & Cooc, 2015).

Research Question 3 examined gender differences on the science test scores of gifted fifth-grade students who took the standardized assessment in 2018–2019. There was a statistically significant difference in the science scores of males and females enrolled in the gifted program. Male students performed better on the science test than female students, with a mean score that was almost 5% higher than females enrolled in the program. The gender gap between males and females favors males in science performance, yet few efforts have been made to determine why and how it can be remedied (Hill & Rogers, 2012). A persistent predictor of female underrepresentation in science related careers is the lack of interest that begins in the primary grades and continues throughout the middle and high school years (M.-T. Wang & Degol, 2017). These results align with findings from Curran and Kellogg (2016), who explained the link between gender and performance on standardized exams, finding consistency in the results of the sociocultural impact of gender differences in science learning experiences. Although their results demonstrated substantial science achievement gaps in the primary grades by race/ethnicity, they found no gender gaps in science achievement in these same primary grades (Curran & Kellogg, 2016). Related research by Quinn and Cooc (2015) found that gaps existed between ethnic and SES groups consistent throughout the grade levels and, when controlling for prior mathematics and ELA achievement, explained science gender gaps. The sample population for my research was fifth-grade students. Gaps by gender and ethnicity tend to remain stable as students progress through the elementary grades, but these gaps widen as students move in to the middle school and high school grades (Quinn & Cooc, 2015; M.-T. Wang & Degol, 2017).

Research Questions 4a and 4b explored whether ELA and mathematics standardized scores predicted science test scores of gifted fifth-grade students. The ability to read and interpret information in the science class requires understanding and synthesizing the content to attain mastery (Flick & Lederman, 2002). Reading comprehension and math application involve high-level thinking skills. As such, science requires these reading and math skills (Flick & Lederman, 2002). In my study, the relationship between reading and math performance and science performance underscored the importance of reading comprehension within the context of science and math to support higher levels of learning in gifted classes, specifically in science (Saqui et al., 2019).

These findings align with Bentancur et al. (2018) who concluded that the effects of ELA and math classes on science achievement call for the use of more complex forms of reasoning and integration of ELA and mathematics in science. By focusing reading fluency on science instructional passages, students demonstrate a positive effect on comprehension skills in fluency components and multisyllabic decoding (Saqui et al., 2019). Achievement in science is influenced by reading and math skills because fifth-grade science assessments require that students perform mathematical calculations and read complex text with abstract ideas and academic language (Quinn & Cooc, 2015). Although gifted standards include more rigor and acceleration of science achievement in gifted classrooms, these findings support the notion that students with lower math and reading skills will be at a disadvantage in science class (Curran & Kellogg, 2016; Quinn & Cooc, 2015).

Results from the study indicate performance on a science assessment was predicted by performance on ELA and math assessments when controlling for gender differences. A gender gap does exist in science achievement and attention should be given to address cognitive, motivational, and sociocultural factors in explaining differences in how males and females view science in their motivation, interests, and potential career goals (M.-T. Wang & Degol, 2017). Because gender contributed only slightly to the variance, much of the relationship was influenced by ELA and math assessment performance. Similarly, Quinn and Cooc (2015) found science achievement gaps by gender and SES, in which math and ELA skills explained a large portion of these gaps.

Research Question 5 sought to understand whether Plan A or Plan B eligibility predicted science scores for gifted students. Eligibility pathways explained only 1% of the variance; the model was statistically significant, but the differences are considered negligible (Pedhazur & Pedhazur Schmelkin, 1991). Despite the relationship between the two eligibility criteria and science scores, the small variance indicates this variable might not be the most important determinant to doing well on a standardized science test. Other factors that might contribute to achieving higher scores in science are exposure to labs (both “hand-on” and digital), field trips that expose students to science learning, and learning from people in STEM careers (Robinson et al., 2014). Plausibly, as with any assessment used with students in this age group, other factors such as the quality of instruction and exposure to science topics must be considered.

Implications

The results of this study contribute to existing theory, practice, research, and policy. The following section offers a discussion of the implications based on my findings.

Theoretical Implications

When the theory of the bio-ecological model was first explored in 1979 by Dr. Urie Bronfenbrenner, various aspects of child development emphasized the importance of understanding children's influences in educational and psychological development (Bronfenbrenner, 2005). As the framework for this theory evolved, its application was found useful in acknowledging systemic factors contributing to identification and development of high-ability students, such as educational policies regarding gifted education eligibility and SES. This framework considers the individual child, affiliations, organizations, and the community (Betancur et al., 2018). Although the study showed a small difference between gifted eligibility criteria and science achievement using data from a sample of elementary schools, the results indicate that the use of Plan B gifted eligibility is actually making a difference in capturing the students who would do well in gifted classrooms. Hence, going beyond the standardized process of just using an IQ test for gifted enrollment of the underrepresented population generates results that identify students more equitably (Card & Giuliano, 2016). There continues to be a national concern in leaving behind students from low-SES families in identification for gifted or advanced courses and the results from the study should serve as an example to other districts from around the nation. Excellence gaps between high- and low-income students who reach advanced levels of academic performance and those enrolled in gifted classes persist among students. Educational policymakers must take a stand to address the needs of all of the nation's students.

Research Implications

It was initially believed that accelerated education would produce citizens who would help the nation's economy (Gold, 1965). This movement was limited to a specific population of students. In 1956, Florida's intent to improve educational opportunity for students with unique educational needs was established (FLDOE, 2019). In the mid-1950s, Florida began to also recognize the need to fund gifted programs that included underrepresented populations.

Nationally, not enough has been done to improve access and support for underrepresented populations of students in the gifted classrooms. (Ecker-Lyster & Niileksela, 2017) With the use of an alternative pathway to gifted enrollment in Florida schools, both Plan A and Plan B eligibility give a more equitable opportunity for students to demonstrate similar achievement levels in science. Florida schools, specifically those in the M-DCPS district, have emerged as front runners in gifted enrollment and academic achievement (Rowe, 2017). Although problems with the identification and recruitment methods used to enroll students in gifted programs are frequently cited as major contributors to the underrepresentation of low-SES and minority students in these programs (Callahan, 2005; Card & Giuliano, 2016; Lakin, 2016; McClain & Pfeiffer, 2012), progress has been made in relation to the eligibility criteria and performance in science assessments. Research links the disparity of performance in class of the students enrolled through Plan A or Plan B in the gifted classroom to the lack of integrating multicultural curriculum for gifted education (Ecker-Lyster & Niileksela, 2017). Using various assessment criteria for the underrepresented population gives more opportunities for gifted enrollment of low-SES students and opens doors for these gifted students to receive more exposure and experiences, and achieve high performance in science classes (Lakin, 2016). Although both gifted eligibility pathways in Florida use IQ as the start to the eligibility process, the Plan B Matrix allows for a comprehensive and multi-method approach in identification of underrepresented population to become eligible for the program.

Results of my study support efforts to increase enrollment of underrepresented populations in gifted programs throughout the nation. The efforts being made in Florida serve as an example for the nation on the effects of the use of an alternative pathway for gifted enrollment (Rowe, 2017). The sole use of one standardized assessment, or IQ test, to determine giftedness should become an obsolete practice for districts throughout the nation (Rowe, 2017).The definition of “gifted” must continue to expand beyond IQ scores to find overlooked gifted students and develop their talents (Rowe, 2017). Policymakers must focus on early intervention efforts in science, particularly for low-SES students, if science achievement excellence gaps between students from low- and high-income families are to be narrowed or closed (Morgan et al., 2016). As such, the outcomes from my study warrant broadened research to provide plausible explanations for excellence gaps between subgroups of students in gifted programs in science achievement, beginning in the primary grades.

Universal screening bypasses the gifted referral process by assessing all students, either to identify giftedness directly through standardized tests or to identify the potential for giftedness (Callahan, 2005; Card & Guiliano, 2016; Ford et al., 2008; McClain & Pfeiffer, 2012). Training parents and teachers to make referrals more equitable in the process of enrollment of students from underrepresented populations is essential (Card & Guiliano, 2014). The results of my study suggests that although progress has been made in gifted referrals in Florida, there is more to be done related to equitable enrollment for ELL and low-SES students.

Few studies have been done specifically analyzing gifted eligibility criteria and how they relate to standardized achievement scores in science. Research on excellence gaps that exist within high-achieving subgroups has found a need to remedy the growing gap in achievement scores between low-SES students and their more affluent peers in math, ELA, and science (Plucker et al., 2010). Previous researchers have focused more on increasing gifted enrollment for students from underrepresented populations. Research on science achievement disparities by ethnicity, gender, and SES, continue to account for excellence gaps in advanced classes (Plucker & Peters, 2016). These outcomes warrant broadened research to provide plausible explanations for differences in performance between the different gifted eligibility pathways and science achievement.

Implications for Practice and Policy

Several implications related to practice can be derived from the results of my study. School leaders at the county, district, and building level should make a concerted effort to ensure that updated criteria to meet the current needs of ELL and low-SES populations is met. As the country continues to grow in the diverse ethnic population, educational services must also grow. Gifted programs must continue to evolve to address the special needs of all students, not only in the eligibility process for gifted education, but also intertwining science, reading, and math skills.

Leaders and policymakers in the school district's advanced academic programs should continue to update gifted and advanced programs that attract and retain the brightest students from underrepresented populations to perform at their highest levels. Educators must provide high achieving minority students experiences with the type of thinking skills used in assessing science. Concerning science achievement gaps, an expanded focus on math and ELA achievement in the early grades is suggested. The results of my study indicated that science performance is predicted by ELA and math achievement. Therefore, introducing the academic language of science in ELA and math in the early grades would expose students prior to taking a state standardized science assessment in the fifth grade. Studies addressing the needs of ethnic diversity in curriculum suggest the need to infuse multicultural education in all core subjects for an equitable understanding of topics and events that are relevant to the current population of students (Benson & Borman, 2010; Ecker-Lyster & Niileksela, 2017).

Limitations

There are several limitations of my research that should be mentioned. The data used for this study did not analyze student IQ scores from initial eligibility, nor were data retrieved from the four indicators on the underrepresented population Matrix score (the Gifted Characteristics Checklist, a variety of standardized academic achievement test data, an IQ test, and the Williams Creativity Scale; Advanced Academic Programs for M-DCPS, 2019). Although the two eligibility pathways use an IQ score as the primary criteria for eligibility, challenges related to using cognitive ability tests for culturally and linguistically diverse students have been well document (Card & Giuliano, 2014; Ford et al., 2008; McGlonn-Nelson, 2005). The lack of data examining IQ test scores limited the analysis to better understand whether this was the main determinant in predicting science scores compared with other measures. The study was limited to the data provided by one school district in Florida and did not include data from all the gifted eligibility checklists for Plan B.

Another significant limitation was related to educational history and the date of data collection. This information did not include the actual date of enrollment of the sample population into the gifted program. This limited the analyses of data of ELL levels at the time of enrollment, the second eligibility criteria, besides FRPL, that is used for gifted program enrollment.

Additionally, without the date of enrollment for students in gifted programs, the Williams Creativity checklist, which is embedded in Plan B data from this checklist, was not included in my analysis. The purpose for the use of this criteria measure is for curriculum differentiation of gifted students (McBee, 2012).

A final limitation of this research was the schools selected for analysis. The student samples were from 42 of the 392 schools from around the county that had been graded “A” by the state. Therefore, the entire population of students identified in M-DCPS as gifted—but not necessarily enrolled in the gifted program—were not analyzed. Results are not generalizable to other school districts in the state or country.

Recommendations for Further Research

Although some of the hypotheses tested were supported, additional questions developed as the study was being conducted, which led to further recommended research. Based on the findings of this cross-sectional study, the following actions are recommended:

1. Provide a culturally responsive approach to eligibility by revising gifted eligibility criteria to use IQ tests as an option, but not as the principal criterion. By implementing this approach, the gap in the gifted classroom will be significantly reduced, closing excellence gaps within the gifted classrooms.
2. This study should be replicated to include all the students who have been identified in M-DCPS as gifted who might not be enrolled in a gifted program.
3. This study should be expanded to include a cross-sectional (collect data from early grades) vs. longitudinal design (collect data repeatedly from the same sample population).
4. Future researchers should compare the means of the sample population of these fifth-grade scores to their future eighth grade science standardized assessment scores. This will allow for further analysis of differences in the eligibility criterion of gifted students and the long-term effects while also determining whether gaps increase or decrease over time related to gender, SES, and ethnicity.
5. This study should be replicated and expanded to include students enrolled in gifted programs from different regions of the United States and how their eligibility criteria differ from region to region.

6. Data were not collected when students were first enrolled in the gifted education program. The sample population for this study used only fifth–grade students, but the date of entry into the program for these students could have been as early as kindergarten or as late as fifth grade. This study should be expanded to include data about initial enrollment.
7. Further studies should be done comparing these results to students enrolled in general education classes who have not been identified as gifted.

Summary

Overall, findings revealed a relationship between gifted eligibility pathways (Plan A and Plan B) and student performance on a fifth-grade science assessment. There was a statistically significant difference in science performance on the standardized test between students enrolled in the gifted program through Plan A compared to Plan B. Eligibility for gifted Plan B uses FRPL eligibility and this study revealed a statistically significant difference in science performance between students eligible for FRPL and those who were ineligible. Gender differences were also analyzed to reveal that male students performed better on the science assessment than female students. Additionally, when gender was analyzed to make a prediction on performance of ELA and math as a predictor for science scores, ELA and math scores results predicted science scores. .

Findings suggest that criteria for gifted eligibility should be revised to include a universally accepted definition of "giftedness" and better serve the needs of the diverse population of the students in this county. Less reliance on standardized IQ scores and more on proximal context investigation of high ability students from the diverse populations of our nation is recommended. M-DCPS has a minority-majority student population, with over 70% of students identifying as Hispanic. The ELL population of students enrolled in the district is close to 90% Hispanic. As such, the emphasis on IQ as the main criterion for gifted eligibility should be broadened to include a more culturally inclusive enrollment process and bypass referrals to include a universal screening process.

The use of a more equitable approach to teaching science, math, and ELA, by integrating ELA and math in the science curriculum, would also help close these gaps among subgroups of gifted students. Addressing the diverse learning needs of all students will better prepare them for their future and create a new milestone in history for the success of our education system. Examining the relationships from the dataset for this study contributes to the understanding of inclusive selection criteria for gifted enrollment and performance.

Using different pathways for eligibility has generated a positive outcome in past decades with an increase in enrollment. The results of this study indicates that Plan A and Plan B gifted eligibility students are working at similar achievement levels on standardized assessments, yet the differences in their scores indicate that more efforts are needed by policymakers to improve the eligibility process and improve educational opportunities and learning outcomes for all students.

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