# IMPLICATIONS FOR SCHOOL LEADERS OF THE IMPACT OF MATH, SCIENCE, AND TECHNOLOGY MAGNET PROGRAMS ON MIDDLE SCHOOL STUDENT ACHIEVEMENT

A Doctoral Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment of the
Requirements for the Degree

Doctor of Education
in Professional Leadership

by

Lupita Hinojosa

May, 2012

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## DEDICATION

To my parents – for truly believing in and loving their children so much! Their dedication to the well-being and success of their children is selfless and pure. Throughout their lives, they have been a true example of perseverance, dedication, sacrifice, and love. Working day and nights, they sacrificed their needs and their wants to ensure that their children had everything they needed in school and in life. Advocating for their children and often ignored because of their lack of language or education, they negotiated a new educational system in order for their children to have access to schooling they never had. They never gave up on securing the best life for their children. Their tenacity, strength, and grace was centered in God and focused on their children. Their continued support and encouragement sustains each one of us. Their love and inspiration has given me the courage to overcome the barriers, challenges, and any discouragement that has come my way. I am so proud that they are my parents!

> "Mijita tu puedes. Con la ayuda de Dios primeramente, Él te ilumina y te da sabiduría. Nosotros te queremos mucho y siempre te apoyamos. Adelante, primeramente Dios y para el beneficio de los niños."

I also dedicate this work to my Lord Jesus Christ, because it is through His love and wisdom that I have reached this accomplishment. He carried me through the many challenges and gave me the wisdom, confidence, strength, and perseverance to overcome the obstacles and struggles. I can do all things through Christ who strengthens me.

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## ABSTRACT

Although many national studies have been conducted on the effectiveness of magnet programs, there is limited research involving math, science, and technology magnet schools and their influence on student academic performance, especially at the middle school level. The purpose of this study was to determine whether a statistical difference existed between those students' academic achievement who participated in math, science, and technology magnet programs in middle school and those who did not. Specifically, this study explored possible differences of students' academic achievement in math and science as measured by the state achievement test as a function of participation in a math, science, and technology magnet program and non-magnet program for the full three years of middle school (i.e., sixth- through eighth-grade). In addition, this study examined if ethnicity, socioeconomic, and/or gender have a moderating effect on math and/or science achievement.

This study was conducted in a large urban school district in Texas. The test scores of a total of 1,551 eighth grade students who had participated in math, science, and technology magnet programs and non-magnet programs for the full three years of middle schools were analyzed. To measure student achievement, the math and science Texas Assessment of Knowledge and Skills (TAKS) exams were examined.

In general, the students who participated in the magnet programs had higher math and science achievement as measured by the TAKS exams. The key findings are as follows:

1. A significant statistical difference existed between the magnet and non-magnet students in the science academic achievement as measured by the Grade 8 science TAKS exam. In science, students enrolled in the magnet programs outperformed the students attending a non-magnet school;
2. There was no significant difference on the Grade 8 math TAKS scores between the magnet and non-magnet students;
3. When analyzing the covariates of ethnicity, socioeconomic status, and gender, it was determined that there was a statistical significant difference in the math and science scores as it relates to gender and ethnicity;
4. A further investigation of the magnet Grade 8 math and science TAKS scores revealed that male students performed statistically significantly higher in science;
5. Additionally, it was determined that female students in magnet schools performed statistically significantly higher in math than those female students not in magnet programs; and
6. Finally, Hispanic students attending math, science, and technology magnet schools performed statistically significantly higher in math as measured by the Grade 8 math TAKS exam.

There are several conclusions and recommendations as a result of this research. In general, it is recommended that district leaders must carefully analyze and place great emphasis upon the following areas: (a) the financial cost of adequately funding a magnet program; (b) the accountability standards; and (c) the ultimate goal of magnet programs. This research has demonstrated in a general framework that magnet programs do produce higher achieving students. Therefore, appropriate, immediate, and necessary steps must be taken to ensure equity in access to high quality magnet programs for all students.

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# CHAPTER ONE

# INTRODUCTION

## Background

The term "magnet schools" was coined in Houston, Texas, when describing the unique effect of its Performing and Visual Arts High School that seemed to attract students like a "magnet" (Waldrip, 2007). A magnet school is defined across the United States as one that attracts and enrolls students from across the school district including those students who would normally attend other in-district, out of district, private, or charter schools (Junetune, 1999). Some magnet schools are individual campuses where the entire student population applied for and was selected to attend the magnet program. These types of magnet schools are called school-wide magnet programs or separate and unique schools (Junetune, 1999). However, regardless of this unique feature, the majority of the magnet programs are located in a traditional school campus. This approach is typically known as a school-within-a-school magnet program. Schools that house school-within-a-school magnet programs are often located in a part of the district that is characterized as a low socioeconomic neighborhood with a high number of minority ethnic groups (Junetune, 1999).

A distinctive component of the magnet school structure is the way that schools focus their programs on a central theme, such as fine arts, technology, or science. Theme-based learning at magnet schools involves an interdisciplinary approach as a primary method of teaching and learning (U.S. Department of Education, Office of Innovation and Improvement, 2004). Thus, magnet teachers create interdisciplinary units to incorporate individual courses/subjects typically taught separately during the day. The goal is to make these individual courses/subjects more relevant to the students and, thereby, motivate him/her to excel (Hausman & Brown, 2002).

In the identified large urban school district in Texas, as in many districts across the country, the historical foundation for the creation of magnet schools was designed to desegregate the public schools (Goldring & Smrekar, 2002). Students from across the district were bused to a magnet school in an attempt to achieve racial diversity within the schools. And, by June 2007, the United States Supreme Court officially declared that using race for school assignments was unconstitutional (Parents Involved in Community Schools v. Seattle School District, 2007). Other foundations for the existence of magnet schools include the district's belief and commitment to offering parents school choice (Goldring & Smrekar, 2002), and in support of using theme-based approaches to learning (Junetune, 1999). Currently, magnet schools are viewed as one means to improve academic achievement (Goldring & Smrekar, 2000; US Department of Education, 1989) – namely, by providing parents a choice in schools for their children (Hausman & Brown, 2002). In the identified large urban school district in Texas and, again, in various districts across the United States, parents can choose to enroll their child or children into their neighborhood public school, which many times may be low-performing. Alternatively, parents may also select the district magnet school, which often tends to be high-performing by comparison (Banks & Green, 2008). Gamoran (1996b) concluded that the achievement benefits of magnet schools were substantial when compared to private Catholic and private schools and comprehensive high schools.

## Statement of the Problem

Although many national studies have been conducted on the effectiveness of magnet programs, there is limited research involving math, science, and technology magnet schools, especially with regard to their potential influence on student academic performance. Moreover, the dearth of this research is especially lacking at the middle school level in particular. Therefore, this study specifically addressed the differences among science and math achievement as a function of participation in a math, science, and technology magnet program in middle schools in the identified large urban school district in Texas.

## Need for the Study

A study designed to compare the differences among science and math achievement as a function of participation in a math, science, and technology magnet program in middle schools is needed due to the fact that scores are not disaggregated and/or reported by the state. A magnet school will receive a total math achievement score and a total science achievement score. This score is not related to the students' curriculum or linked to an instructional program – in this case, more specifically, the magnet program. Thus, by analyzing the students' achievement on the state's exam as a relation to the magnet program in which they were enrolled, the present research will enable school district officials the ability to use the data presented herein to make administrative decisions. As a direct and indirect result, the daily roles and responsibilities of budget, personnel, curriculum, instruction, transportation, policy-makers, to name a few, could be affected by the results.

**Significance of the Study**

Several studies have been conducted investigating the impact of magnet schools on student achievement. The results of these studies have varied depending on the schools investigated, how the variables were controlled, and have appeared to be a function of the overall school (Goldring & Smrekar, 2002). In Texas, as across the United States, assessment scores of students participating in magnet programs are integrated with those of the non-magnet students located in the same school. The schools' academic performance is reported as one overall score. Currently, there appears to be no published work that has analyzed state-wide assessment data as a function of magnet school program participation. A careful examination of this student assessment data by magnet versus non-magnet students will provide an initial indication of the difference in student achievement.

In the 2007-2008 school year, the science component of the No Child Left Behind (NCLB, 2001) act became a requirement. The establishment of this mandate meant that schools across the country were now required to test and report upon science achievement performance at Grade 5 and Grade 8. Corroborating a statistically significant link between a math, science, technology magnet middle school and the performance on the state Grade 8 science TAKS test will be important to not only the magnet schools, but also to the non-magnet middle schools.

School district decision makers will be able to use the data presented in this study to provide information regarding the value of implementing magnet programs in the district. As mentioned above, budget, personnel, curriculum, instruction, transportation, and other policy areas could be affected by the results of this study in determining the feasibility of expanding and/or enhancing and redirecting, and/or discontinuing the existing magnet programs within a district.

## Purpose of the Study

The primary goal of this study was to determine whether a statistical difference existed between the students' academic achievement who participated in math, science, and technology magnet programs in middle school and those who did not. Specifically, this study explored possible differences of students' academic achievement in math and science as measured by the state achievement test as a function of participation in a math, science, and technology magnet program and non-magnet program for the full three years of middle school, sixth through eighth grades. Additionally, this study determined (a) if ethnicity had a moderating effect on math and/or science achievement; (b) if socioeconomic status had a moderating and/or mediating effect on math and/or science achievement; and (c) if gender had a moderating effect on math and/or science achievement.

## Research Questions

Although magnet schools offer an option to the traditional neighborhood schools, there is very little research focusing on the educational impact (i.e., achievement) on students choosing to attend a math, science, and technology magnet middle school. The following research questions were answered:

1. Is there a significant difference between students' academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle

school, sixth through eighth-grade as compared to students not participating in a math, science, and technology magnet program?

2. Is there a significant difference between students' academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade as compared to students not participating in a math, science, and technology magnet program?
3. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade?
4. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade?

**Theoretical Framework**

The theory that was utilized as the primary focal point throughout the present study was constructivism. This particular theoretical framework is generally attributed to Jean Piaget, who suggested that through processes of accommodation and assimilation, individuals construct new knowledge from their experiences. In addition, this theory is used in many fields including psychology, communication, and education. With its roots in the same cognitive psychology that underlies social cognitive theory, Constructivism has two principles stating that (a) students do not passively receive knowledge, but rather actively assimilate received knowledge, and that (b) students construct new ideas or interpret concepts based upon their current and past knowledge (Glasersfeld, 1989). Constructivism emphasizes the importance of the learner being actively involved in the learning process, unlike previous educational viewpoints where the responsibility rested with the instructor to teach and where the learner played a passive, receptive role. Glasersfeld (1989) emphasizes that learners *construct* their own understanding and that they do not simply mirror and reflect what they read.

As opposed to being characterized as a social constructivist, Ernst von Glasersfeld is perhaps the clearest example of a theorist who also is far from the "nature as instructor" end of the continuum in that he stressed that knowledge construction is an individual matter (Phillips, 1995). Phillips (1995) also suggests that von Glasersfeld provides a striking rejection of the "nature as template" view, and affirms that it is the cognitive effort of the individual that results in the construction of knowledge: “The notion that knowledge is the result of a learner's activity rather than that of the passive reception of information or instruction, goes back to Socrates and is today embraced by all who call themselves constructivists” (Phillips, 1995, p. 8).

As applied to this study, this theory holds that the independent variable (i.e., participation in a math, science, and technology middle school magnet program) will influence the dependent variable (student achievement in the areas of math and science) because this learning approach is specifically recommended to be implemented in the identified large urban school district in Texas math, science, and technology magnet classrooms, and because it is part of the tenets of thematic learning in magnet programs. Additionally, a conservative position held by the philosopher of science Imre Lakatos states that “knowledge is actively built up over time within a research program that progresses as it responds to intellectual considerations” ( Phillips, 1995, p. 10). Once again, this conservative position would also indicate an increased student achievement for those students who participated in the science and math magnet programs.

In a constructivist classroom, interactivity through hands-on experiences and practice is at the heart of the curriculum. Therefore, in teaching science, teachers understand that learning something new, or attempting to understand something familiar in greater depth, is not a linear process. Furthermore, within an authentic constructivist-minded classroom, science teachers understand that students will try to make sense of new things using their prior experience and the first-hand knowledge gained from new explorations. The construction of knowledge is an *active* process, but the activity can be described in terms of individual cognition or in terms of social and political processes (Phillips, 1995). Thus, teachers begin by stirring curiosity in a science topic usually by introducing an intriguing phenomenon. Guided by their curiosity and the teacher’s encouragement and direction, students will probe, inquire about, and explore these various phenomena until they become less mysterious. As students begin to investigate new ideas, they put together bits and pieces of prior explorations as they scaffold their understanding. Hence, constructivism critically builds and depends upon the concept of scaffolding (Glasersfeld, 1989).

Finally, in the domains of science and mathematics education, one prominent researcher (Confrey, 1990) summarizes the beneficial influence of radical constructivism as follows:

> When one applies constructivism to the issue of teaching, one must reject the assumption that one can simply pass on information to a set of learners and expect that understanding will result. Communication is a far more complex process than this. When teaching concepts, as a form of communication, the teacher must form an adequate model of the student's ways of viewing an idea and s/he then must assist the student in restructuring those views to be more adequate from the student's and from the teacher's perspective. Constructivism not only emphasizes the essential role of the constructive process, it also allows one to emphasize that we are at least partially able to be aware of those constructions and then to modify them through our conscious reflection on that constructive process (p. 109).

**Definition of Terms**

**Constructivism:** A theory of learning or making meaning through which individuals create their own new understandings on the basis of an interaction between what they already know and believe, as well as the ideas and knowledge with which they come into contact.

**Dedicated Magnets:** A term used to describe a unique curriculum and single educational focus for all students attending the school. Since this type of school has no attendance zone, every student in a dedicated magnet is a transfer student. The High School for

Performing and Visual Arts in the identified large urban school district in Texas is an example of a dedicated magnet.

**Magnet Program:** A program that offers students educational choices from among a variety of specialized programs at grade levels K-12. Magnet programs offer an integrated and enriched curriculum designed around a specialized theme that meets students' interests, talents, and needs and has relevance in today's society. Teachers receive specialized training in the field of study based on the school's thematic focus. Additionally, these schools seek to recruit and draw an ethnically diverse student body from throughout the city. Finally, strong community and business partnerships support the relevance of the theme with a real-world view. This term is used to define the magnet instructional program within a neighborhood traditional school. Many times, as delineated in the literature, another term that is used interchangeably is "school-within-a-school."

**Magnet School:** A term used to describe a school which implements a focused, specialized curriculum and serves students from across the district.

**Mediator:** An independent variable that has an indirect causal effect on a dependent variable.

**Moderator:** A variable that has an effect on the relationship strength between two other variables.

**Neighborhood Schools:** Traditional schools with a rigorous instructional program supported by an effective leader and effective teachers. Often times, these schools have a thematic focus, such as literature or environmental sciences.

**Non-magnet Programs:** Public schools with a neighborhood attendance zone. The curriculum implemented in non-magnet programs traditionally follows the state curriculum guidelines.

**Non-zone Students:** Students who reside outside of the Board of Education (BOE) approved school attendance boundary.

**School Wide Magnets:** A term used to exemplify a specialized program that is added on to the school's regular curriculum. Every student in the school receives instruction in the specialty area taught by teachers qualified in that area. Students attending a fine arts Magnet school, for example, are exposed to in-depth experiences in the fine arts, which may include lessons in instrumental and choral music, dance, art, drama, and gymnastics.

**School-Within-A-School (SWAS):** A term used to describe the instruction in a specialized area to a specific group of students in an existing school. Although these students meet separately for the specialty classes, they may join with the rest of the student body for studies not related to the area of specialization. The High School for Engineering Professions, located on the campus of Booker T. Washington High School in the identified large urban school district in Texas, is an example of a SWAS program for students interested in engineering or other science-related fields.

**Socio-Economic Status (SES):** A term used to identify students based on the federal lunch program. Students who receive free or reduced lunch will represent “low” SES, and those students who are not eligible will represent “high” SES.

**STEM:** A program that offers science, technology, engineering, and math instruction through problem-solving and independent critical-thinking skills, while emphasizing laboratory exploration and hands-on activities in classroom laboratory settings and real world experiences through student internships.

**Student Achievement:** Student achievement will be measured by the state-wide test, Texas Assessment of Knowledge and Skills (TAKS).

**Zone Students:** Students residing within the Board of Education (BOE) approved school attendance boundary.

## Limitations

There are several constraints inherent in the present study. The study only focused on the student population enrolled in math, science, and technology magnet middle school programs and neighborhood middle schools in the identified large urban school district in Texas. Additionally, only the Texas Assessment of Knowledge and Skills (TAKS) scores for Grade 8 math and science were reviewed. The use of the TAKS exams limited the study to Texas and no other state.

There were several other limitations that were also foreseen in the implementation of this study. First, a history effect may have occurred in one group of students at anyone of the math, science, and technology magnet middle school programs. That is, a specific event (other than the planned curriculum) may have occurred. As a result, this particular event – should it have occurred – may have influenced the dependent variable. Additionally, there may have been an ambiguous temporal precedence threat. The researcher was not to be able to specify which variable preceded which other variable. The independent variable (i.e., participation in a math, science, and technology magnet program) may have challenged the dependent variable of student achievement.

Therefore, a perceived confusion exists as to which variable was the cause and which variable was the effect.

Furthermore, another possible threat to the internal validity of the study that was considered was maturation. Maturation refers to the physical or mental changes which may have occurred while data was being collected on the students who participated in the math, science, and technology magnet programs for all three years of middle school (Grade 6 through Grade 8). Such changes could have affected the students' performance on the dependent variable, which was student achievement.

Another threat to the internal validity of the study that was considered was attrition. Attrition refers to the fact that some students may not have completed the outcome measures such as taking the TAKS exams. Other students may have moved out of the district or not qualified to continue participation in the identified math, science, and technology magnet schools.

This study also had external validity concerns. Threats exist to the generalization of the results of this study to and across student populations. Will data from this study of Grade 8 students involved in math, science, and technology programs be applicable to the state and national student population? As such, the results of this study should not be generalized beyond this school district. Additionally, ecological validity was also considered. Can the results of this study be generalized across settings? Will the results of the identified large urban school district in Texas be applicable to other states and also to rural settings? The generalizability of this study must be limited as the study was designed to represent students in the identified large urban school district in Texas.

An additional limitation which must be considered is that the research did not analyze whether parent involvement might influence the students' academic achievement. At a minimum, entrance to any magnet program across the country requires an application. Therefore, one can assume that there may be greater parent involvement in magnet schools than in non-magnet school by the mere fact of having to secure, complete, and submit a magnet application. However, this study did not measure the impact, if any, that parent involvement may have on academic achievement of students in magnet programs.

Moreover, another factor which may be a drawback is that this study was not a longitudinal study. A longitudinal study may be a better indicator of the impact of magnet programs on the students' academic achievement. A study which begins at 5$^{th}$ grade, continues through 8$^{th}$ grade, and culminates with the 11$^{th}$ grade TAKS exams may better depict the impact of magnet programs on the students' academic achievement.

Furthermore, the findings of the study were based on the results of the TAKS exams at a given point in time. This research did not address the potential impact of student motivation, the students' test preparation, focus, and students' self-efficacy.

Finally, another potential limitation of this study is that it did not analyze the impact teachers' years of experience, amount of classroom preparation, amount of specialized teacher training, and expertise in the field of math, science, or technology.

**Organization of the Study**

This study is divided into five chapters. This first chapter included the following: The introduction; statement of the problem; need for the study; significance of the study; purpose of the study; research questions; theoretical framework; definitions or terms; and the limitations of the study. Chapter Two provides a review of the literature related to magnet schools in general. The literature review focuses on a general and historical overview of magnet schools. In addition, Chapter Two provides a discussion on other potential factors, such as gender, ethnicity, and socio-economic status, which may impact student achievement in magnet schools. Chapter Three presents the methodology used to answer the research questions. Chapter Four presents and analyzes the data collected using the methodologies described in Chapter Three. Chapter Five provides conclusions based on the data presented in Chapter Four. Chapter Five also describes recommendations for the future research on this topic.

## CHAPTER TWO

## REVIEW OF THE RELATED LITERATURE

The purpose of this literature review was to investigate the influence of math, science, and technology magnet programs on middle school student achievement. First, the literature review provides a historical perspective and description of magnet programs in the United States. Secondly, it discusses other factors such as ethnicity, socioeconomic status, and gender which may impact theme-based learning including science and math instruction.

### History of Magnet Schools

As recorded in Rossell (2005): "The year was 1968. Martin Luther King had been assassinated, and American cities were erupting in flames because of King's violent death and the decades-long smoldering resentments from racism" (p. 44). In the fall of 1968, Tacoma, Washington, opened the nation's first "magnet" school at McCarver Elementary (Rossell, 2005). Sergienko (2005) stated that while he was assistant superintendent of schools in Tacoma, they had begun work on segregation issues several years earlier. Sergienko (2005) described how a citizen's committee was created to actively seek solutions stumbled upon an article about Pittsburgh advocating the establishment of a so called "magnet school". The Tacoma school district wrote a proposal entitled *The Exemplary Magnet Program* and, in the summer of 1968, received a $200,000 Title III grant (Sergienko, 2005). Then, in the following September, the school opened with a minority enrollment down from 91% African American to 64%, and under 50% two years later (Sergienko, 2005). McCarver Elementary is still open today. According to the Tacoma Public School District website, the racial makeup of McCarver Elementary as of October 2009 is 49% African American, 9.3% Asian, 4.47% American Indian, 10.5% Hispanic, 24.6% White, and 1.6% Other. Therefore, even though McCarver Elementary is no longer categorized as a magnet school, it continues to attract a diverse student population.

In 1969, the country's second magnet school was opened in Boston, Massachusetts, soon became an epicenter for race-based school wars (Rossell, 2005, p. 44). According to the founder of Magnet Schools of America, Donald R. Waldrip, the first "super" high school was opened in Dallas, Texas in 1971 (Waldrip, 2007). Namely, Skyline High School was designed around the career strands and attracted students of all kinds and from the entire city (Waldrip, 2007). At approximately the same time, Houston, Texas, opened its High School for Performing and Visual Arts, which was said to function like a "magnet" in attracting students (Waldrip, 2007). Subsequently, by the year of 1975, the term "magnet" was being used to describe the program (Waldrip, 2007). The U.S. Department of Education Office of Innovation and Improvement (2004) also expounds:

> The theory behind magnet schools as a desegregation tool is simple: Create a school so distinctive and appealing- so magnetic- that it will draw a diverse range of families from throughout the community eager to enroll their children even if it means having them bused to a different and, perhaps, distant neighborhood. To do so, the school must offer an educational option- a specialty- that is not available in other area schools (pp. 2-3).

In addition, according to the U. S. Department of Education Office of Innovation and Improvement (2004), the theme-based approach of magnet schools includes many of the factors associated with effective schools, such as "innovation in program and practice, highly trained teachers, specially designed curriculum, increased parent and community involvement, and greater student engagement" (p. 3). Dentler (1991) defined magnet schools as having the following traits:

1. Distinctive curriculum has a unique theme or instructional style;
2. Unique role within the school district is to voluntarily desegregate the student population;
3. Program choice is voluntary by student and parent; and
4. The choice is available to students beyond the attendance zone.

Another similar definition of magnet schools proposed by Inger (1991) states key features as curriculum based on them, enrollment open to students in a broad attendance area, and parents choose the school for their child. The hope was that these "well-funded, themed schools would ignite a passion for learning as well as spark a movement to voluntary integrate schools" (Rossell, 2005, p. 45).

**Purposes and Characteristics of Magnet Schools**

Policymakers have long advocated magnet schools as a tool for voluntarily desegregating school districts (Goldring & Smrekar, 2000). Rossell (1990) holds that magnet schools have also been approved by the courts as a constitutionally permissible remedy to correct unlawful segregation in the public school systems. Additionally, according to Barr and Parrett (1997), school districts and federal judges began developing schools of choice in hopes that they would serve as "magnets" to attract both white and minority parents to voluntarily attend integrated schools. In particular, with such a hope in mind, Barr & Parrett (1997) stated the following:

> Many parents were given the choice of being "forced bused" to an alien, often violent neighborhood across town or volunteering to attend one of the new "special theme" magnet schools. One overriding goal of the first magnet schools was to slow the "white flight" to the suburbs that always seemed to accompany school desegregation. (p. 109)

Furthermore, according to Barr and Parrett (1997), some creative school districts began to develop magnet programs and schools to avoid judicial mandates to desegregate.

The magnet school concept has matured and evolved from the political quick fix to pacify white middle-class parents to become one of the most impressive success stories in large urban and middle-sized school districts across the nation (Barr & Parrett, 1997). Today, urban school districts, such as Houston ISD, have developed dozens of the most creative and effective magnet programs and schools.

Smrekar and Goldring (2000) discuss how, in the early 1960s, the NAACP brought a law suit in Cincinnati on behalf of African American school children as a means of challenging the conditions of racial segregation that existed in that particular city's schools. The Cincinnati case (*Deal v. School Board*) was dismissed because the de facto theory was rejected. The de facto theory had hoped to prove that although evidence might be produced that public officials had deliberately segregated the schools, it was sufficient for the plaintiffs to show that a condition of segregation existed in the schools and that the school authorities had failed to take corrective action (Smrekar & Goldring, 2000).

Later, in 1974, a new suit was filed by the NAACP on behalf of different plaintiffs around the issue of school segregation (Smrekar & Goldring, 2000). In this particular case, however, the suit cited the segregation laws and policies that were pursued by the State of Ohio in the 19th century and contemporary practices by school officials, such as manipulating school zones, selecting sites for new schools, and assigning teachers to schools evidenced a deliberate intent to racially segregate the schools. In this instance, the case was tied up in technical legal proceedings for a period of ten years. Finally, in 1984, on the eve of the trail, a settlement of the case was reached by plaintiffs, the Cincinnati school system, and the State of Ohio (Smrekar & Goldring, 2000). The Cincinnati settlement (*Bronson v. Board*) was based on two initiatives that had taken place after the case was filed. One was the creation of a series of magnet schools and programs that the school system had begun in the early 1970s, which intensified after the *Bronson v. Board* case was filed (Smrekar & Goldring, 2000). The school district dubbed this effort as “alternative schools”. The schools had specialized themes or educational methodologies and invited parents to apply under guidelines designed to achieve racial balance (Smrekar & Goldring, 2000). By and between 1993 and 1994, the alternative school program expanded to 44 of the district’s 85 school sites (Smrekar & Goldring, 2000). While desegregation could not have been accomplished without boundary changes, school closings, and a variety of other initiatives, the school board was able to trumpet the fact that a very large number of students were attending desegregated schools through choice rather than through mandatory assignments (Smrekar & Goldring, 2000).

The second initiative that Cincinnati had implemented was the adoption of the Taueber Index as a measuring rod for the desegregation progress. The index measures the extent to which each school within the district reflects the racial composition of the district as a whole (Smrekar & Goldring, 2000). According to researchers, the index was 76 when the lawsuit was brought in 1974; thus, reflecting a very high degree of segregation (Smrekar & Goldring, 2000). By 1984, though, the index had been reduced to 53. With heavy involvement by the courts, Cincinnati established magnet programs to help reduce minority student isolation in its schools.

According to the following work of Rossell (1990), the desegregation statistics in Cincinnati lent support to her comprehensive examination of voluntary desegregation plans: "Racism is not so deeply embedded in American society that substantial proportions of Americans cannot be persuaded to enroll their children voluntarily in desegregated magnet schools" (p.216).

With regard to the political history of the Boston magnet schools, Gelber (2008) indicated that they were also designed to reduce racial segregation through a voluntary process. Gelber (2008) explored the historical artifacts and notes which indicated that the Boston Magnet schools were initially only designed to combat the racial balance and never intended to focus primarily on academics. However, when the district pushed for higher academic achievement, the magnet schools also became a primary focus. Additionally, the magnet schools received an influx of money for new and better equipped facilities and were exempted from the city-wide teacher layoffs in order to keep the lower teacher-student ratio needed for individualized instruction. At one point, the Boston magnet schools were perceived as elite enclaves and became symbols of yet more inequality in the school district. Nonetheless, in his final analysis, Gelber (2008) stated that the overall academic performance of the magnet schools were not significantly different than that of the non-magnet schools.

In another study, Dickinson, Holifield, Holifield, and Creer (2000) conducted a 6-year examination that focused on the social interactions of Blacks and Whites within urban magnet schools in a Southern county. Their examination suggested a number of interesting findings: (a) Blacks appeared less willing than Whites to interact; (b) racial considerations seemed more pronounced among girls than among boys; (c) black female students were the most reluctant group to interact across racial lines; and (d) no trend toward higher percentages of students choosing to mix across racial lines was detected (Dickinson, Holifield, Holifield, and Creer, 2000). Finally, the conclusion from this study suggested that students are more likely to cross the racial lines when the activity was task related. The students tended to interact with members of their own race in social settings which lack defined academic goals.

**School Choice Movement**

With desegregation diminishing as a public goal, magnet schools have maintained support by connecting themselves with the school-choice movement (Rossell, 2005). More recently, magnet schools have also flourished in urban school districts as a means on improving the quality of education. This is "especially critical in inner-city schools districts, which often lack what James Coleman refers to as 'social capital' – that is, strong social networks in which norms, expectations, trust, and a sense of interpersonal obligations prevail" (Gamoran, 1996a, p. 42). According to the 43$^{rd}$ Annual Phi Delta Kappa (PDK) /Gallup Poll (2011), Americans increasingly support choice — allowing students and parents to choose which public schools to attend in their community regardless of where they live — and this support is consistent across age differences and political affiliation.  Even regardless of their residence, seventy-four percent of the respondents favored allowing families to choose which public schools their children attend (PDK, 2011, p. 23).  This particular figure represents an increase from the PDK/Gallup Poll in 1995, where 69% favored allowing families to choose which public schools their children attended (PDK, 2011).

Hirschman (1970) furnished the market theory rationale for greater entrepreneurial activity and responsiveness to parents by principals of schools of choice. Market theory speculates that competition between schools will lead to improvement. According to Hausman (2000) on the "demand side" of the market, parents and students are presumed to be rational and motivated consumers.  It is believed that parents will “shop around” for the school that best meets their needs.  Hausman (2000) further theorizes that on the "supply side", schools will be compelled to improve in order to attract and retain students, or they may face going out of business.  Hirschman's (1970) also provides a similar logic – explicitly, on the context of education, that voice is the expression of one's opinions to influence how the school is operating.  “Voice” in the forms of protest, negotiation, and discussion is often expressed when parents are dissatisfied with services received.  If the school fails to improve sufficiently, parents may choose to leave and enroll their children elsewhere (Hausman, 2000).  Therefore, from the market perspective, students and families are clients – as opposed to products – of the education system. Accordingly, in a choice environment, schools must be more responsive to the needs of families or face being shut down (Hausman, 2000).  Finally, since principals of schools of choice generally do not have access to guaranteed student enrollments, they must market their schools and be responsive to families in order to attract and retain their students.

According to Rossell (2005), the total number of magnet schools has not declined. Rossell (2005) attributed the following three reasons for the resiliency of magnet schools: “(a) [T]he great triumph of the civil rights movement to get Whites to support the principle of racial diversity in schools, (b) magnet schools have been incorporated into the school choice movement as a means of improving achievement and into No Child Left Behind as a way of increasing the opportunities available to children in low-performing schools, and (c) parents like school choice.” (Rossell, 2005, p. 49)

Even though many parents may choose to enroll their children in theme-based schools in order to enable them to pursue a passion, most parents are probably more interested in theme-based education as a means of igniting a passion (Rossell, 2005, p. 49).

According to the National Center for Education Statistics, Institute of Education Sciences, and the U.S. Department of Education, 31 states designated magnet schools in 2007-2008 (Hoffman, 2009). This 2007-2008 report presents findings on the numbers and types of public elementary and secondary schools in the United States, using data from the Public Elementary/Secondary School Universe Survey of the Common Core of Data (CCD) survey system (Hoffman, 2009). The CCD is an annual collection of data that are reported by state education agencies (SEAs) to the National Center for Education Statistics (NCES) through the U.S. Department of Education’s ED*Facts* collection system (Hoffman, 2009). After closely reviewing the report, Texas did not report any magnet programs. Therefore, it is believed that the number of magnet schools in the United States is actually larger than reported by the NCES.

**Admissions and Selection Process**

A unique characteristic of magnet schools is the admissions process. Depending on the school district, students may be asked to complete several applications and/or activities in order to be selected to attend the magnet program. According to the U. S. Department of Education (1989), in order "to keep the selection of students fair and open to all students that are interested, multiple criteria should be used for selection of students from the applicant pool" (pp. 22-23). Students may need to perform auditions, complete an admissions test, or submit a portfolio depending on the focus or theme of the magnet program (Goldring & Smrekar, 2000).

With increased interest for admission into a magnet program, many districts implement a lottery system to select students. The following is an example of a lottery system that is similar to the one implemented in the Hillsborough County Public Schools, Florida (2010 Magnet Schools Assistance Program Grant Application):

1. A seven-digit number is randomly assigned to every student.
2. Each randomly assigned student number is divided into a random set of numbers, i.e. 9-0-4-1-4-9-3.
3. Numbers are generated beginning with the digit 1 followed by a decimal carried out to 10 places.
4. The five digit random number used to determine placement is constructed using the digits found in decimal places 6-10.

5. The sequence is ascending.

Other factors that may be considered in the selection process include first come first served, priority selection based on a sibling already enrolled, race, geographical attendance zone, and (sometimes) admissions criteria. Litigations have resulted from students not being accepted into magnet programs. It is recommended that districts with magnet programs ensure a "level playing field" for potential candidates based on some predetermined selection procedure that allows equal access for eligible students.

While the seats may be limited in a magnet program, the courts have historically upheld the use of the lottery system as a method of selection. In the 1985 case titled *Bennett v. City School District of New Rochelle*, the lottery system was challenged by parents of gifted children who were eligible for admission yet not selected (Stephens, 2000). According to Stephens (2000), the court ruled that the lottery system did not violate the Constitution or any New York state statutes governing the local school district's authority to provide a free and appropriate education of children in the state.

Stephens (2000) explains that although the concept and practice of implementing a lottery system as a selection tool for magnet programs is judicially supported by the courts, the race factor remains open to judicial review and action. Admission practices that allow racial preference are under litigation throughout the country (Stephens, 2000).

The identified large urban school district, as other school districts, require a packet of information that includes the magnet application, reference letters from teachers and parents, an essay explaining specifically why they want to attend the magnet program, a copy of the student’s last report card, achievement test scores, a record of community service, and good disciplinary records.

The U.S. Department of Education Office of Innovation and Improvement (2004) recommends complete fairness and strict guidelines are imperative in the admissions process. The most common method for selection is the use of a lottery system where students are selected randomly (Goldring & Smrekar, 2002).

**Unique and Specialized Curriculum and Instruction**

The appeal of the magnet program is rooted in its curricular theme, method of teaching, or pedagogical tenets. These characteristics are usually combined with student interest in order to define the school's academic mission for innovative programming. The 1997 Report on Citizen's Commission on Civil Rights indicates that 99 percent of parents within the Nashville Public Schools magnet programs based their participation on the academic reputation of the school. The 1997 Report on Citizen’s Commission on Civil Rights further relates that parents of all races tend to select magnet programs based on the theme and academic reputation of the program. Steel & Levine (1994) report that mathematics, science and technology, aerospace technology, and Montessori are the most popular themes for elementary programs, with high school popularity based on vocational or career themes.

The 2004 U. S. Department of Education, Office of Innovation and Improvement report states that to create successful magnet school programs, teachers must have more autonomy in shaping curriculum and instruction. Yet, one must ask a pertinent question: Are there real and significant differences in the curriculum and instruction offered in magnet and non-magnet schools? Smrekar and Goldring (1999) reported that there are few substantial or remarkable differences. In their study, Smrekar and Goldring (1999) indicate that teachers in both magnet and non-magnet schools offer the large majority of instruction in self-contained classrooms. In their findings Smrekar and Golding (1999) indicate that "teachers in magnet schools report less standardization in the curriculum (p. 84). Additionally, according to this research, magnet school teachers are more likely than non-magnet school teachers to report that they have more flexibility in their curriculum to meet the needs of the individual students (Smrekar & Goldring, 1999). Hausman and Brown (2002) also report in their study that magnet teachers report less standardized curriculum and higher levels of autonomy.

Another key aspect of innovation in magnet schools is the use of instructional strategies. Once again, in their evaluation of the use of specific instructional strategies in magnet schools, Smrekar and Goldring (1999) delved into the following areas of study: The frequency of teachers' use of whole-class lecture; homogeneous ability grouping; peer-tutoring; seatwork; and individualized instruction. According to their subsequent findings, Smrekar and Goldring (1999) discovered that there is some indication that magnet school teachers are using more varied instructional strategies. In addition, the researchers found that the "magnet schools are less likely to group students homogeneously by ability and teachers implement less written seatwork than do non-magnet teachers" (Smrekar & Goldring, 1999, p. 84). With regard to their research efforts, Hausman and Brown (2002) also analyzed the use of instructional strategies by magnet and non-magnet school teachers, which similarly revealed minimal differences between magnet and non-magnet schools. More specifically, Hausman and Brown (2002) found that non-magnet school teachers described a more frequent reliance on written seatwork. These researchers also found "no significant differences in the frequency of use of whole class lecture, peer tutoring, individualized assignments, or grouping strategies" (Hausman & Brown, 2002, p. 265). Therefore, "either non-magnet schools are more innovative than they are given credit for, or magnet schools do not spur as much innovation in instructional practices as the classroom level as predicted" (Hausman & Brown, 2002, p. 265).

**Student Achievement**

Magnet programs are one of the methods being used to purportedly help students increase academic achievement. The theme-based programs allow students interested in science to have the opportunity to pursue one of their favorite subjects. Additionally, since many magnet schools are equipped and supplied with instructional materials needed for hands-on learning (Goldring & Smrekar, 2002), science exploratory lessons are conducted on a regular basis. Therefore, because of the increased funding and focus on science themed instruction, many math, science, and technology magnets are highly sought after not only by students, but also teachers interested in pursuing their passion (Goldring & Smrekar, 2002).

In a research study conducted in Florida, Poppell and Hague (2001) focused on the comparison of academic achievement between those students in magnet programs and those in traditional neighborhood schools. After reviewing the combined data of 75 schools, the researchers concluded that the academic achievement of students enrolled in magnet school programs exceeded that of students enrolled in traditional schools at all levels (Poppell & Hague, 2001). Additionally, Bank and Spencer (1997) found that graduates of magnet programs had significantly higher goals than did students who graduated from traditional school programs. In a 1980 study conducted in magnet schools in Los Angeles, Estes, Levine, and Walter (1990) also reported that students in magnet programs scored the same or above the district and national levels on the standardized test in reading and math. In another study conducted in a New York magnet program, Estes, Levine, and Walter (1990) found that students at all levels and all races scored higher on math and reading standardized tests than students in non-magnet schools. Finally, in his longitudinal study that began in 1988, Gamoran (1996b) tracked the achievement of 2,400 8th graders from public and private schools across the United States. Gamoran (1996b) used 48 magnet schools and 213 non-magnet schools. He found that students enrolled in public magnet programs scored the same or above in science and math, but significantly higher in social studies and English in comparison to students in non-magnet public schools. Gamoran (1996b) also reported that the students who attended magnet programs significantly performed better than their non-magnet peers in social studies, science, and reading.

Fourteen years ago the Connecticut's *Sheff vs. O'Neil* desegregation court ruling led to a spurt in education funding; more specifically, a $2 billion expansion of magnet schools and renewed attention to the state's troubled urban districts (Long, 2002). According to Long (2002), the state Supreme Court in 1996 ordered state officials to reduce racial and economic isolation in Hartford's mostly black and Hispanic public schools, which was considered one of the state's worst-performing school systems at the time. As in various other court cases, Frahm (2010) explains that magnet schools became the central strategy to comply with the desegregation order, and state officials supported the creation of dozens of the popular schools with them, such as science, mathematics, and the arts. Frahm (2010) further reports that in the studies of middle schools and high schools in Hartford, New Haven, and Waterbury, researchers concluded that the magnet schools provide an academic climate similar to that of wealthy suburban schools and produce measurable improvements among low-include and minority students.

According to Frahm (2010), in part of the Connecticut study, the research team compared magnet students with other students who had applied for magnet schools yet were denied admissions under random lotteries. Some of the findings are as follows:

- On statewide achievement tests for tenth-graders, magnet school students from the cities made greater gains in both reading and mathematics than did city students of similar backgrounds;
- City students who attended magnet middle schools made greater gains in reading and marginally more progress in mathematics compared with students in other city middle schools;
- Suburban students, too, made large gains in reading and had slightly better improvement in mathematics at magnet middle schools in comparison to suburban children in traditional schools;
- In magnet high schools, suburban students improved achievement in reading and math "at least as much as they would in their home district school";

- Compared with their peers in traditional city schools, city students who attended magnets reported more positive influences of adults in their school on college expectations, stronger support for achievement among their classmates, and less social pressure against academic success and effort; and
- Magnet school students were less likely to miss school or skip classes than students in traditional city or suburban schools. (Frahm, 2010, p. 2)

There is also a body of research that does not conclude that magnet schools programs are more effective than non-magnet school programs in regard to student achievement. According to Adcock and Phillips (2000), an in-depth research study in Prince George's County Schools revealed that the increase of student achievement in magnet programs was largely due to self-selection of parents to choose the magnet school. Adcock and Phillips (2000) further concluded that when the student's ability level was factored in the evaluation, non-magnet students performed better than magnet students. Finally, these same researchers concluded that gifted students in magnet programs did not perform academically as well as gifted students in non-magnet school programs (Adcock & Phillips, 2000).

**Other Potential Factors Impacting Student Achievement**

As previously discussed, research exists to indicate that students in magnet programs achieved a high level of academic achievement (Caldwell, 2005). However, the questions still remain: Do magnet programs achieve academic success for all students? Do magnet programs achieve the goal of reducing minority isolation and ensuring high academic achievement for all students regardless of gender, ethnicity, or socio-economic level? Does gender, ethnicity, or socio-economic level impact student achievement in magnet programs?

***Gender*.** Is it a myth that girls are not as successful in science- and mathematics-based courses? There are several studies that indicate potential reasons why such gender difference continue to persist. For example, research conducted by Geiger and Litwiller (2005) indicates that males have greater memory ability than females. According to Von Secker and Lissitz (1999), critical thinking skills tend to widen the academic achievement gap in science for both females and minorities. Additionally, Scott-Jones & Clark (1986) state that gender is the weakest indicator for student achievement and does not usually manifest itself until high school. Furthermore, Manning (1998) states that by the time the students reach high school, the gender gap typically favors male students. Finally, a study by Cheng and Seng (2001) indicates that gender differences in mathematics achievement in most Asian countries began to develop in eighth grade; with male students achieving a higher academic proficiency.

In 2006, focusing on engineering, Cantrell, Pekcan, Itani, and Velasquez-Bryant (2006) conducted research to analyze student academic achievement. Through the Teachers Integrating Engineering into Science (TIES) Program, faculty from the College of Education and the College of Engineering at the University of Nevada, Reno paired with middle school science teachers to create three units that included engineering design using an assortment of interactive learning activities in order to engage a wide range of students (Cantrell et al., 2006). Moreover, the specific units created in this effort “included a Web-based simulation activity, lesson plans, a design project, and three types of assessments that were standard across schools” (Cantrell et al., 2006, p. 301). In addition to the standardized TIES assessments, the researchers analyzed the results of the eighth-grade Nevada standardized Criterion Referenced Test (CRT) in science, and the results for gender show that “males tend to score higher when science is taught using the engineering design process than do females” (Cantrell et al., 2006, p.307). While scores on the pencil/paper unit tests show slight differences between males and females, much larger differences occurred for both the project scores and particularly for the interview scores (Cantrell et al., 2006, p.307). The design project required the use of tools and materials, exact measurements, and many-iterative steps. Therefore, it may be that females lacked the background and experience in working with tools and materials to a greater degree than did the males in the study (Cantrell et al., 2006, p.307). It is also possible that females lacked the vocabulary and confidence necessary to verbalize their conceptual knowledge relative to the engineering design experience when asked about it during individual interviews; although, when the same knowledge was assessed on the unit tests, females did much better (Cantrell et al., 2006, p.307).

***Ethnicity.*** Muller, Stage, and Kinzie (2001) state that gender differences are small in comparison to the ethnic differences. According to Muller et al. (2001), ethnicity remains largely unexamined. Muller et al. (2001) state that – in accordance to Scott, Rock, Pollack, Ingels and Quinn (1995) – racial-ethnic differences show that Asian American and White students show higher science achievement scores, as well as disproportionately greater science achievement gains, during middle school and high school than their Latino/a and African American counterparts (p. 984). Furthermore, Muller et al. (2001) also argued that – in accordance with the work of Peng, Wright, and Hill (1995) – Asian American and White students are overrepresented in high school, college science courses, and scientific and technical careers (p. 984). With reference to racial-ethic differences between students, the researchers also stated:

> In general, these racial-ethnic differences on standardized science tests appear much earlier than gender difference (Dossey, Mullis, Lindquist, & Chambers, 1998; Mullins, Dossey, Owen, & Phillips, 1993), and the racial-ethnic difference in science achievement are generally larger throughout all grades than are gender differences (Hanson, 1996). Research studies show that race-ethnicity explains much more of the variance in science achievement scores than does gender, and females and males within racial-ethnic categories are much more similar with regard to achievement than are females across racial-ethnic categories (Clewell & Ginorio, 1996; Creswell & Houston, 1980). (Muller et al., 2001, p. 984)

Finally, according to Muller et al. (2001), African American and Latino students continue to perform far below Whites and Asian Americans in terms of pre-college science achievement. In fact, with the exception of Latino males, the growth rates of those students traditionally underrepresented in science, mathematics and engineering (SME) fields is so minimal that African American and Latina students' final twelfth-grade achievement level still falls well below the initial 8th-grade achievement of Whites and Asian Americans (p. 1003). In other words, consistent with Muller et al. (2001), White and Asian American eighth-grade students generally have similar science achievement to twelfth-grade African American students and female Latina students.

Research conducted by Scott-Jones and Clark (1996) states that ethnicity is a significant predictor of academic achievement and that white students outperform black students. However, the researchers point out that the difference in academic achievements appears to be a result of primarily two reasons. First, Scott-Jones and Clark (1996) indicate that in certain ethnic groups, the family and cultural concerns may take precedence over school work. Additionally, their second reason is that sometimes teachers may have the tendency to marginalize black students either by action or lack of action.

Cantrell et al. (2006) investigations found that ethnicity comparisons provided mixed results when comparing ethnic groups assessed on explicit engineering modules. The specific findings of this examination discovered the following:

- Black and Hispanic students who previously performed below the mean, demonstrated academic achievement above the mean when learning through the use of engineering modules in both the TIES assessment and the Nevada CRT assessment;
- The performance of white students dropped from well above the mean to just above the mean for traditional paper and pencils tests and performance assessments, to below the mean when the verbal assessment was scored as measured by the TIES assessments;
- Asian students who historically score well above the mean on the state tests, further improved their academic achievement in both the TIES assessments and the Nevada CRT assessment; and

- American Indians scores dropped from approximately three percent below the mean to about 28% below the mean for the verbal assessments in the TIES assessment.

The authors of the study acknowledge that the sample size for American Indians may have artificially inflated the achievement gap. Nevertheless, the outcome of the study was very clear in that the achievement gaps for American Indians and for Whites were increased while gaps for Blacks and Hispanics were diminished. Asian students out-performed all other ethnic groups and moved farther from the mean in a positive direction.

***Socio-economic level.*** Jeynes (2002) defines the socioeconomic status (SES) of a child as determined by combing parent's educational level, occupational status, and level of income. According to several research studies, (Baharudin and Luster 1998; Jeynes 2002; Eamon 2005; Majoribanks 1996; Hochschild 2003; McNeal 2001; Seyfried 1998), SES affects student outcomes. Students who have a low SES earn lower test scores and are more likely to drop out of school (Eamon 2005; Hochschild 2003). According to Seyfried (1998), low SES students have been found to score about ten percent lower on the National Assessment of Education Programs than higher SES students. Research indicates that low SES negatively affects academic achievement because low SES prevents access to vital resources (Eamon 2005; Majoribanks 1996; Jeynes 2002).

Almost fifty years ago, the federally authorized Coleman Report (1966) *Equality of Educational Opportunity* —which is "widely regarded as the most important educational study of the twentieth century"—found that the most powerful predictor of academic achievement is the socioeconomic status of a child's family, and the second most important predictor is the socioeconomic status of the classmates in her school challenge (Kahlenberg, 2012, p. 1). In other words, being born poor imposes a disadvantage; but attending a school with large numbers of low-income classmates presents a second, independent, challenge (Kahlenberg, 2012). Coleman asserted that the influence of student background was greater than anything that goes on within schools. Poverty is indeed a factor among many children in the United States. In their 18 nation *Luxembourg Income Study,* Rainwater and Smeeding (1995) found that, during the 1990s, families of children in the United States had lower real income than families of children in almost every other nation. The researchers also stated, "The issue of socioeconomic status and its relationship to student achievement is more complex than Coleman's (1966) report first intimated" (Rainwater & Smeeding, 1995).

In their study title, *The Effects of Engineering Modules on Student Learning in Middle School Science Classrooms,* Cantrell et al. (2006) also analyzed the socio-economic levels of the students. According to the researchers, the achievement gaps for low SES students were diminished (Cantrell et al., 2006). Engaging low income students in engineering design experiences required the use of tools and materials that provided the students with opportunities that they may not have previously experienced (Cantrell et al., 2006, p.305). Hands-on activities and engagement may have provided a rich learning experience that resulted in their increased ability to design and build an object and verbalize their conceptual understanding better than they could otherwise do on a pencil/paper test.

**Challenges Facing Magnet Schools**

Black (1996) states that more than 1.5 million students attended magnet school program options in the United States. School choice in the form of magnet schools clearly exist, yet it is less certain whether or not they have a consistently positive impact on student achievement over non-magnet schools when comparing similar student populations. In spite of these positive findings, at least three major areas of concern have been identified. Barr and Parrett (1997) present that a large national study which found that more than half of all secondary magnet schools, and approximately a quarter of elementary magnet schools, utilized some type of admissions testing. Barr and Parrett (1997) also report that many magnet programs use admission tests to help identify and select the students they are seeking. In addition, the researchers contend that this type of selective admissions can limit equal opportunity (Barr & Parrett, 1997).

A second concern regarding magnet schools is that many of them spend more per pupil than other schools in their district (Barr & Parrett, 1997). According to Nathan (1996), magnet schools cost more per student than non-magnet schools. In St. Louis, for instance, magnet programs cost 42% more per student; while in Boston, Chicago, and New York, magnet programs cost 27% more per student (Nathan, 1996). Therefore, due to the additional funds required to maintain magnet programs, it is important for district officials to examine and evaluate magnet schools' true effect on student achievement.

A third concern involves the aspect of transportation. In order for magnet programs to be successful, school districts must offer transportation to the students as a means to leave their neighborhood schools and travel directly to a magnet school. According to Barr and Parrett (1997), the most frequently used approach by some school districts involves transportation cycles. These researchers state, "Students are picked up in their local neighborhood school and carried to 'staging areas', where they transfer to another bus to be transported to their magnet school" (Barr & Parrett, 1997, p. 121).

Across the country there are some school districts that are unable to provide all children with bus transportation. For example, as reported by Barr and Parrett (1997), "In Los Angeles, parents apply for a P.F.T., a Permit for Transportation and a particular magnet program (or their top three choices)" (p. 121). If students do not receive a P.F.T. permit, parents are expected to drive their children to the magnet schools or use the city bus services.

Additionally, according to Barr and Parrett (1997), in Chicago, elementary students are provided transportation at no cost if they live at least 1 ½ mile from the school, yet transportation is not provided to high school students. The identified large urban school district has a similar transportation policy. More specifically, only students who live two or more miles from their school of their choice are provided free transportation.

**Summary**

Originally, magnet schools were first created to facilitate public school desegregation. The ultimate goal was to better balance the student population racially and ethnically by attracting students from across neighborhood as well as the entire city. As a result of this effort, specialized curriculum and instructional approaches became a bi-product of magnet schools. Unfortunately, as cited by Chen (2007), the desire to attend a magnet school often overpasses the enrollment capacity of magnet schools today. Therefore, this very situation leaves many of those students and families desiring the magnet school experience relegated within their zoned neighborhood public schools (Chen, 2007).

The goal of each magnet theme is to promote high achievement, cultural diversity, and choice of curriculum delivery. Magnet schools often maintain a high standard of education as a result of the extra funding they receive, and their “restricted and/or selected” student population (Chen, 2007).

In general, the research supports the long held belief that magnet programs support student achievement. The research also indicates that several school districts use magnet programs as a means to reform and restructure struggling schools. Additionally, the research reveals that many districts spend additional funds in magnet programs. Therefore, it is imperative that school district administrators understand whether or not a magnet program is making a significant difference in student achievement.

# CHAPTER THREE

# METHODOLOGY

In this chapter, the researcher presents the research questions, setting and population, procedures, design and research methodology, which were used to accomplish the objective of the present study. In addition, the chapter concludes with a description of the instrument, hypothesis, variables and statistical analysis of the data that was used for this study.

## Research Questions

The study addressed the following questions:

1. Is there a significant difference between students' academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade as compared to students not participating in a math, science, and technology magnet program?
2. Is there a significant difference between students' academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade as comdpared to students not participating in a math, science, and technology magnet program?

3. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade?
4. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade?

**Research Design**

The quantitative research design selected for this study was causal-comparative analysis; that is, the students were not randomly assigned to treatment groups. Rather, the already formed groups in the identified math, science, and technology magnet middle school programs and non-magnet classrooms in the identified large urban school district were used. Ultimately, at the end of this study, information was produced about the magnet and non-magnet students being studied in order to identify further areas that can potentially be investigated. This design was appropriate because researchers rarely survey the entire population for two central reasons: (a) the cost is too high, and (b) the population is dynamic in that the students making up the population may change over time.

**Setting**

For the purpose of the present study, magnet middle schools and non-magnet neighborhood middle schools were selected and documented with predetermined codes in order to maintain the confidentiality of the results. The schools are associated with the identified large urban school district in Texas that consists of 301 square miles within the greater city of Houston. Further, the identified large urban school district is the seventh-largest public school system in the nation and the largest in Texas. The district maintains a total of 298 campuses, which include 55 elementary magnet schools, 31 middle school magnet schools, and 27 high school magnet schools. According to the 2010-2011 district fact sheet, the total district enrollment is 203,066 students, and 42,469 students participate in the magnet programs (roughly 20% of the student enrollment). The data illustrated in Table 3.1 indicates the number of students by grade level; the data in Table 3.2, by ethnicity; and the data in Table 3.3, by program.

Table 3.1

*Campuses and Enrollment*

| Academic Level | Number of Schools | Enrollment | % of All Students |
|---|---|---|---|
| Elementary | 166 | 108,071 | 53.2% |
| Middle | 41 | 33,436 | 16.5% |
| High | 44 | 46,661 | 23.0% |
| Combined/Other | 28 | 14,898 | 7.3% |
| Total | 279 | 203,066 | 100% |

Table 3.2

*Students by Ethnicity*

| Ethnicity | Number of Students | % of All Students |
|---|---|---|
| American Indian/Alaskan Native | 474 | 0.2% |
| African American | 51,015 | 25.1% |
| Asian | 6,668 | 3.3% |
| Hispanic | 126,711 | 62.4% |
| Native Hawaiian/Other Islander | 224 | 0.1% |
| Two or More | 1,526 | 0.8% |
| White | 16,448 | 8.1% |
| Total | 203,066 | 100% |

Table 3.3

*Students by Program*

| Program | Number of Students | % of All Students |
|---|---|---|
| LEP * | 60,639 | 29.9% |
| ESL ** | 12,829 | 6.3% |
| Bilingual | 42,330 | 20.8% |
| At Risk *** | 125,758 | 61.9% |
| Title 1 | 191,346 | 94.2% |
| Special Education | 15,900 | 7.8% |
| Gifted/Talented | 30,591 | 15.1% |
| Magnet | 42,469 | 20.94% |
| Economically Disadvantaged **** | 163,199 | 80.4% |

**Limited English Proficient*
*** English as a Second Language*
**** At Risk as defined by the Texas Education Agency*
*****Meets federal criteria for free and reduced-price lunches.*

The demographics of the district are represented by Hispanic (62%), Caucasian (8.1%), African American (25.1%), Asian (3.3%), and Native American (0.2%). Of the student population, 80.4% qualify as Economically Disadvantaged and 29.9% are considered limited English proficient. During the 2010-11 school year this district earned a Texas Education Agency (TEA) ranking as an Acceptable District as documented on the Academic Excellence Indicator System (AEIS) report.

**Selection of Participants**

The student sample for this study was drawn from the identified large urban school district in Texas. Students identified as the magnet group were selected from the Grade 8 students who attended one of the math, science, and technology magnet schools and the non-magnet group were selected from the students who attended the same school district non-magnet middle schools. According to the Academic Excellence Indicator System (AEIS) report, the data in Table 3.4 specifies the number of magnet students in schools with math, science, and technology magnet programs. Additionally, based on the AEIS report, the data in Table 3.5 presents the Grade 8 enrollment in comparable non-magnet schools. Finally, as shown in Table 3.6, the total enrollment in magnet schools was large enough as well as ethnically and socio-economically diverse such that the research findings may be generalized to other populations within the school district.

Table 3.4

*Magnet Student Sample in Grade 8*

| School | Number of Grade 8 Students | % of All Students |
|---|---|---|
| Magnet School A | 306 | 30.6% |
| Magnet School B | 132 | 29.9% |
| Magnet School C | 312 | 35.3% |
| Magnet School D | 481 | 34.5% |
| TOTAL | 1,231 | |

Table 3.5

*Non-magnet Student Sample in Grade 8*

| School | Number of Grade 8 Students | % of All Students |
|---|---|---|
| Comparison School E | 151 | 30.8% |
| Comparison School F | 390 | 36.1% |
| Comparison School G | 197 | 30.5% |
| Comparison School H | 366 | 35.5% |
| TOTAL | 1,104 | |

Table 3. 6

*School wide Demographics*

| School | Total | Ethnicity | | | | | Economically Disadvantage |
|---|---|---|---|---|---|---|---|
| | | African American | Hispanic | White | Native Amer | Asian Pac/Is | |
| Magnet A | 1,001 | 242 | 675 | 70 | 3 | 6 | 849 |
| Magnet B | 441 | 235 | 190 | 14 | 0 | 0 | 416 |
| Magnet C | 883 | 285 | 484 | 48 | 3 | 51 | 786 |
| Magnet D | 1,396 | 41 | 1,292 | 26 | 4 | 33 | 1,255 |
| Comparison E | 490 | 108 | 338 | 36 | 0 | 1 | 451 |
| Comparison F | 1,080 | 55 | 1,001 | 21 | 2 | 1 | 1,027 |
| Comparison G | 646 | 52 | 591 | 3 | 0 | 0 | 611 |
| Comparison H | 1,032 | 204 | 753 | 16 | 0 | 59 | 990 |
| TOTAL | 6,969 | 1,222 | 5,324 | 234 | 12 | 151 | 5,255 |

**Instrumentation**

The Texas Assessment of Knowledge and Skills (TAKS) scores for science and math were utilized for the assessment of the academic achievement. The TAKS exams, which were administered in April, are criterion-referenced tests with a normative component, and students' scores are scaled to determine the students' academic ability. The TAKS performance standards relate test performance directly to the state curriculum (i.e., the Texas Essential Knowledge and Skills [TEKS]) in terms of what students are expected to learn by the completion of each grade level. Performance standards, therefore, are based on the content standards for each assessment. The product of the standard setting process is a set of cut scores that classify students into an appropriate performance level. The TAKS scores for students in the study groups will be evaluated for determination of students' math and science achievement data.

The scaled scores [instead of the raw scores] were used to interpret student academic achievement levels. The Texas Education Agency (2011) specifically states the following:

> Unlike raw scores, scale scores can be interpreted across different sets of test questions. Scale scores allow direct comparisons of student performance between specific sets of test questions from different test administrations. A scale score is a conversion of the raw score onto a scale that is common to all test forms for that assessment. The scale score takes into account the difficulty level of the specific set of questions on which it is based. It quantifies a student's performance relative to the passing standards or proficiency levels.

**Procedures and Time Frame**

All procedures of the University of Houston Human Subjects Committee were followed prior to conducting the research. With this process in mind, the present researcher's primary and central objective was to ensure that there was no potential harm to the participants of this study because all results were kept anonymous.

The academic achievement was evaluated based on the student achievement scores on the 2011 TAKS administration. TAKS data was collected for Grade 8 students in the area of science and math. A comparison of the student achievement was made for magnet and non-magnet eighth grade students. The time frame of this study was from the cohort's first year in middle school (2008-2009 in grade 6) through their 3rd year in middle school (2010-2011 in grade 8). Finally, the data was collected from the 2011 TAKS spring administration.

**Variables**

The primary goal of this study was to determine whether a difference existed between those students' academic achievement who participated in math, science, and technology magnet programs in middle school and those who did not. Specifically, this study explored possible differences of students' academic achievement in math and science as measured by the state achievement test as a function of participation in a math, science, and technology magnet program and non-magnet program for the full three years of middle school; that is, sixth through eighth grade. In addition, this study analyzed whether there was a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math or science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade.

After reviewing the literature on magnet school programs and achievement, dependent and independent variables were identified and selected for this study. The dependent variable in this study was student academic achievement in science and math as measured by the state exams (i.e., TAKS). This variable was evaluated for students who attended a math, science, and technology middle school magnet program for all three years (sixth through eighth grade) versus those who did not. The primary independent variable was the participation in a magnet or non-magnet school; however, there were also three other covariates, ethnicity, socioeconomic status, and gender.

**Data Analysis**

After checking the data for normality, and as a method to examine the central research questions, the inferential statistical tests used in this non-experimental quantitative study were the *t*-tests for independent groups. According to Graziano and Raulin (2000), the *t*-tests assess whether the mean of two groups are statistically different from each other. The *t*-test is appropriate when a comparison is being made between the two means or averages of two groups. Therefore, the *t*-test was performed to determine if there was a statistically significant difference between students' academic achievement in math and science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade, as compared to students not participating in a math, science, and technology magnet program in a large urban school district in Texas. The level of significance was set at .05.

A chi square analysis was used to determine the effectiveness of the magnet program in the achievement of math and science as it relates to the covariates of ethnicity, socioeconomics, and gender. A series analysis of covariance tests were employed to measure the differences in student achievement. Descriptive data and a *t*-test were employed to explain the results.

**Methods**

The quantitative research design selected for this study was causal comparative; that is, the students were not randomly assigned to treatment groups. Rather, already formed groups in the identified math, science, and technology magnet middle school programs and non-magnet schools in the identified large urban school district in Texas were used. At the end of this study, information was produced about the magnet and non-magnet students being studied in order to identify further areas of possible investigation.

**Limitations**

It is important to note that there were also several deliberate boundaries inherent in the completion of this study. For instance, the present study only focused on the student population enrolled in math, science, and technology magnet middle school programs, and neighborhood middle schools in a large urban school district in Texas. Additionally, only the Texas Assessment of Knowledge and Skills (TAKS) scores for eighth grade math and science were reviewed. Hence, the sole use of the TAKS exams inevitably limited the study to generalizations within the realm of Texas and no other state.

There were several other limitations which were foreseen in the implementation of this study. Firstly, a history effect may have occurred in one group of students at one of the math, science, and technology magnet middle school programs and/or one of the non-magnet schools. That is, a specific event, other than the planned curriculum, may have occurred. This theoretical event could have inevitably influenced the dependent variable. Additionally, there may have been an ambiguous temporal precedence threat and the researcher may not be able to specify which variable preceded which other variable. The independent variable (i.e., participation in a math, science, and technology magnet program) may challenge the dependent variable of student achievement. Will there be confusion as to which variable was the cause and which was the effect?

Furthermore, another possible threat to the internal validity of the study was maturation. This particular term refers to the physical or mental changes that may have occurred while data was being collected on the students who participated in the math, science, and technology magnet programs for all three years of middle school (sixth- through eighth grade). Such changes could have affected the students' performance on the dependent variable, which was student achievement. Finally, another threat to the internal validity one must consider was attrition, which is a term that refers to the fact that some students may not complete the outcome measures, such as taking the TAKS exams. In addition, other students may have moved out of the district or not qualified to continue participation in the identified large urban school district in Texas math, science, and technology magnet schools.

This study may also have had external validity concerns. And, threats may exist to the generalization of the results of this study to and across student populations. Will data from this study of eighth grade students involved in math, science, and technology programs be applicable to the state and national student population? As such, the results of this study should not be generalized beyond the school district. Additionally, ecological validity must also be considered. Can the results of this study be generalized across settings? Will the results of the identified large urban school district and urban school setting in Texas be applicable to other states and also to rural settings? The researcher realizes that the generalizability may be limited as the study was designed to represent students in a large urban school district in Texas. Finally, the findings of the study were based on the results of the TAKS exams at a given point in time. Such results may vary according to the students' test preparation, focus, and other influences of unknown factors.

**Summary**

The purpose of this study was to determine whether there was a significant difference between students' academic achievement in math and science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school (sixth through eighth grade) as compared to students not participating in a math, science, and technology magnet program in a large urban school district in Texas. In addition, this study analyzed whether there was a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math or science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade.

This purpose of this chapter was to acquaint the reader with a description of the research methodology which was used in this study, a description of the subjects in the study, description of the instrument used to measure the dependent variables, and a description of the statistical procedures that were followed. Chapter Four presents the results of the analyses and explanation of charts and tables.

# CHAPTER FOUR

# RESULTS OF THE STUDY

## Restatement of the Problem

Although many national studies have been conducted on the effectiveness of magnet programs, there is limited research in the area of math, science, and technology magnet schools, especially with regard to their potential influence on student academic performance. Moreover, the dearth of this research is particularly scant at the middle school level in particular. Additionally, a significant gap exists between minority and non-minority student achievement, as well as between poor and non-poor children (Kahlenberg, 2012). This achievement gap presents a dilemma for policy makers, who have been unsuccessful thus far in determining how best to address it. This achievement gap is the result of many different causes ranging from teacher competencies and certifications; to curriculum and instruction; to instructional materials and resources; to class and school size; funding; and to racial and economic compositions, as well as the integration of neighborhoods. It is important to note that many of the causes for this gap in achievement are addressed within magnet schools. For instance, teachers in these unique educational environments have higher expectations, and usually more advanced degrees; instructional materials and resources are available; students' motivation is usually higher as they self-select or are selected based on stringent criteria; and parents are expected to participate in school activities (Goldring & Smrekar, 2002; Kahlenberg, 2012). Therefore, this study specifically addressed the differences among science and math achievement as a function of participation in a math, science, and technology magnet program in middle schools in the identified large urban school district in Texas.

In addition, this study also determined whether ethnicity, socioeconomic status, and gender had a moderating and/or mediating effect on math and/or science achievement.

The research questions addressed in this study are as follows:

1. Is there a significant difference between students' academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?
2. Is there a significant difference between students' academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?
3. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?
4. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in

a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?

This study included 1,551 grade 8 students from magnet and non-magnet middle schools in a large urban school district in Texas. Students who took the grade 8 math and science TAKS were included in the study if upon entering sixth grade, they remained in the same school through the eighth grade. The requirement that the student attend the same school from sixth grade through eighth grade in order to be included in the study was implemented in order to minimize the effect of transferring from school to school and program to program – thus, eliminating possible errors in data analysis. Eighth grade math and science TAKS test scores would theoretically show the result of three years of consistent education in one school. After a careful analysis of the data, there were 826 students identified from magnet schools and 725 students from non-magnet schools that met the discussed criteria.

Data in relation to student achievement was collected from four magnet and four non-magnet schools using the 2010-2011 TAKS database. Math and science TAKS scores from the eighth grade students in each school type were collected yielding categorical data of scale scores (i.e., Met Standard and Commended Performance).

**Data Analysis**

This study served as a retrospective cohort study and utilized a variety of statistical methods for data analysis to examine relationships between its dependent variable (i.e., TAKS test results), independent variables (i.e., types of school: magnet/non-magnet), and covariates (i.e., gender, ethnicity, and socioeconomic status). The data analysis is presented in three sections. First, a general summary is presented of the students in both magnet and non-magnet students who were part of this study. Next, the four research questions are addressed. Finally, the researcher wanted to determine whether there were achievement differences when the co-variables in this study were linked to the school program: magnet and non-magnet. Therefore, the last part of this data analysis presents a discussion on the moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in science and math as measured by the Grade 8 TAKS as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade.

***Summary of students in the study***. Students selected for this study must have entered sixth grade and remained in the same school through the eighth grade. The requirement that the student attend the same school from sixth grade through eighth grade in order to be included in the study eliminated possible errors in data analysis by excluding students who had not spent all three consecutive years of middle school in the same school. It was important to ensure consistency in the educational program and thus eliminating the potential effects of a new curriculum, different materials, teacher impact and even school environment. As shown in Table 4.1, out of the 2,226 students enrolled in the selected large urban school district magnet and the non-magnet schools in 2010-2011, only 1,551 students met the criteria of having been in the same school for all three consecutive years of middle school. There were 826 magnet students (53%) and 725 non-magnet schools students (47%) who were continuously enrolled and took the Grade 8 math and science TAKS exam in 2010-2011.

Table 4.1

*Basic Demographics for Students in Math, Science, Technology Magnet Middle Schools*

| Variable | # of Students | Mean | Std. Dev. | Min. Scale Score | Max. Scale Score |
|---|---|---|---|---|---|
| Magnet | 1551 | .5325596 | .4990997 | 0 | 1 |
| Gender | 1551 | .5009671 | .5001603 | 0 | 1 |
| Eco. Disadvantage | 1551 | .8994197 | .3008691 | 0 | 1 |
| Hispanic | 1551 | .8117344 | .3910502 | 0 | 1 |
| Non- Hispanic | 1551 | 2.855577 | .5722898 | 1 | 7 |
| Science Score | 1551 | 2287.146 | 228.2968 | 1514 | 3025 |
| Met standard | 1551 | .8259188 | .3793016 | 0 | 1 |
| Commended | 1551 | .31657 | .4652881 | 0 | 1 |
| Math Score | 1551 | 849.4075 | 319.9527 | 535 | 2525 |
| Met Standard | 1551 | .8439716 | .3629993 | 0 | 1 |
| Commended | 1551 | .2217924 | .4155862 | 0 | 1 |

In reviewing Table 4.2, the data indicates that this cohort has a higher percentage of Hispanic students when compared to the district's demographic data shown in Table 3.2. The identified large urban school district in Texas in 2010-2011 reported 62% Hispanic students, while the schools in this study reported 81% Hispanic students. In general, the demographics of the district are not represented in the schools selected for this study. In 2010-2011, the district reported 62% Hispanic, 25% African American, 8% White, and 3% Asian students. According to Table 4.2, the schools in this study had 81% Hispanic, 13% African American, 3% White, and approximately 2% other. The differences in the demographic data may be due in part to the selective nature of magnet programs. Students must either self-select or meet academic criteria to attend a magnet program in the district. Additionally, the location of each school may have impacted the decision for students to attend or not attend the identified schools. Therefore, for the purpose of this study, the student groups will be identified as Hispanic or non-Hispanic.

Table 4.2

*Students by Ethnicity in Middle Schools in the Study (n=1551)*

| Ethnicity | # of Students | Percent (%) |
|---|---|---|
| White | 43 | 2.77 |
| African American | 207 | 13.35 |
| Hispanic | 1,259 | 81.17 |
| Asian | 28 | 1.81 |
| Pacific Islander | 7 | 0.45 |
| American Indian | 1 | 0.06 |
| Two or more | 6 | 0.39 |
| Total | 1,551 | 100.00 |

Figure 1 indicates a proportion estimation of the 1,551 students represented in this study. As shown in Figure 1, the majority of the students in the study was economically disadvantaged, of Hispanic origin, and met the state's achievement standard in both the math and the science 2010-2011 TAKS exams. However, when analyzed, this sample of students is not representative of the demographics of the larger district as a whole. Therefore, generalizationability of this work must be carefully analyzed before the results, implications, and recommendations can be applied to other districts.

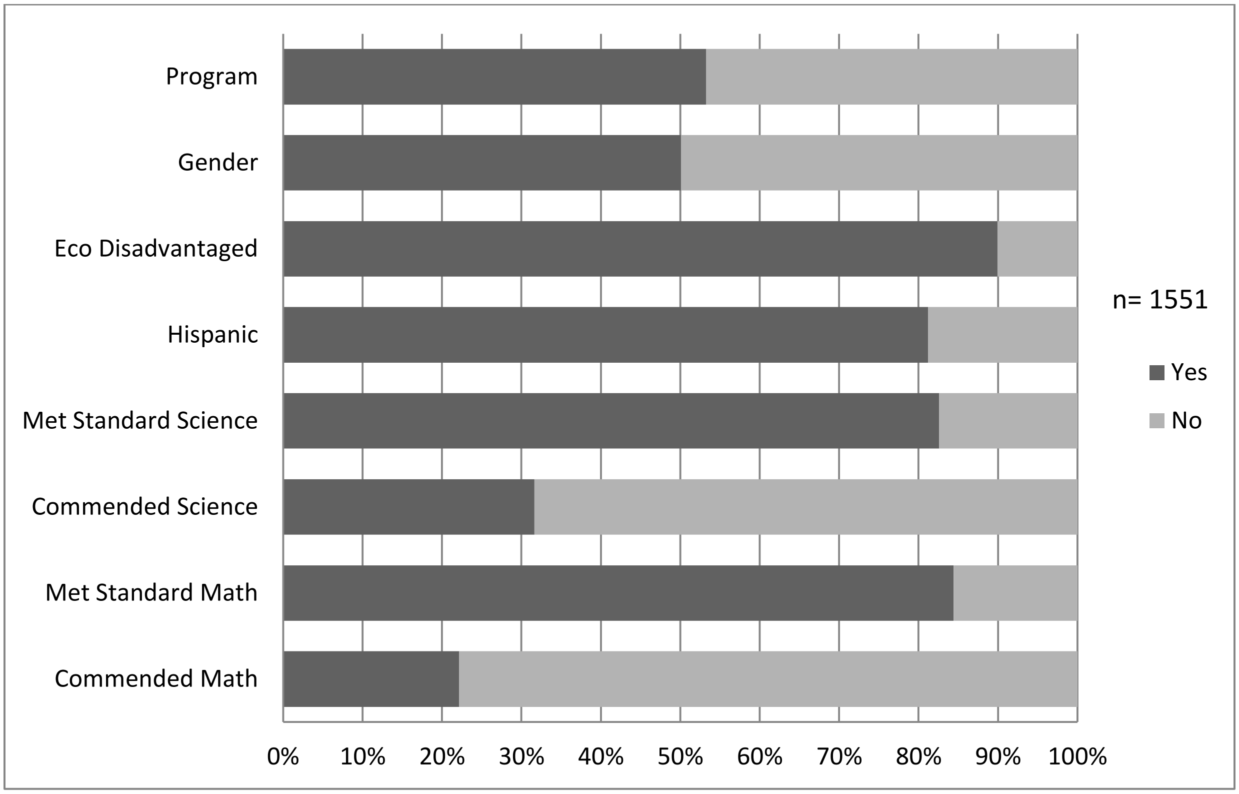


*Figure 1*. Summary of students in the study. This figure illustrates the proportion of students in this study who were economically disadvantaged, of Hispanic origin, and met standard in both the math and the science 2010-2011 TAKS exams.

The federally authorized Coleman Report (1966) *Equality of Educational Opportunity* found that the most powerful predictor of academic achievement is the socioeconomic status of a child's family, and the second most important predictor is the socioeconomic status of the classmates in her school challenge (Kahlenberg, 2012). In Table 4.3, the schools in this cohort reported 90% of its student body as economically disadvantaged. In Table 3.3, the district reported 80% of its student body as economically disadvantaged, which is approximately 10% lower than the cohort study. One reason for the higher percentage of economically disadvantaged students in the identified schools may coincide with the large number of minority students enrolled at each school. Another reason for the higher percentage of economically disadvantaged students at the identified schools may be due in part to the demographical location of each school.

Table 4.3

*Summary of Students in Middle Schools in the Study (n = 1551)*

| Characteristic | Percentage (%) | Std. Err. | 95% *Confidence Interval* | |
|---|---|---|---|---|
| Magnet | 53% | .0126731 | .5077015 | .5574178 |
| Non-magnet | 47% | .0126731 | .4425822 | .4922985 |
| Female | 50% | .0127 | .4741219 | .5239439 |
| Male | 50% | .0127 | .4760561 | .5258781 |
| Eco Disadvantage | 90% | .0076396 | .8844346 | .9144048 |
| Not Eco Disadvantage | 10% | .0076396 | .0855952 | .1155654 |
| Hispanic | 81% | .0099295 | .7922577 | .831211 |
| Non-Hispanic | 19% | .0099295 | .168789 | .2077423 |
| Met Science Standard | 83% | .0096312 | .8070273 | .8448102 |
| Did not meet science standard | 17% | .0096312 | .1551898 | .1929727 |
| Commended Science | 32% | .0118145 | .2933958 | .3397441 |
| Did not achieve commended science | 68% | .0118145 | .6602559 | .7066042 |
| Met Math Standard | 84% | .0092172 | .8258921 | .8620512 |
| Did not meet standard math | 16% | .0092172 | .1379488 | .1741079 |
| Commended Math | 22% | .0105525 | .2010937 | .2424911 |
| Did not achieve commended math | 78% | .0105525 | .7575089 | .7989063 |

Table 4.4 shows a summary of the math and science TAKS scale scores for both the magnet and non-magnet middle schools in the study. The average science TAKS

scale score was 2287, with a minimum scale score of 1514 and a maximum scale score of 3025. The average math TAKS scale score was 849, with a minimum scale score of 535 and a maximum scale score of 2525.

Table 4.4

*Summary of Math and Science TAKS Scale Scores for both Magnet and Non-magnet Middle Schools in the Study*

| Variable | # of Students | Mean | Std. Dev. | Min. Scale Score | Max. Scale Score |
|---|---|---|---|---|---|
| Science | 1551 | 2287.146 | 228.2968 | 1514 | 3025 |
| Math | 1551 | 849.4075 | 319.9527 | 535 | 2525 |

Furthermore, Tables 4.5-4.6 show a comparison in the average TAKS scale scores between the students in the magnet schools and those students enrolled in the non-magnet schools. The average science TAKS scale score for the 826 students enrolled in the magnet middle schools is 2305, with a minimum score of 1514 and a maximum scale score of 3025. The average science TAKS scale score for the 725 students in enrolled in the non- magnet middle schools is 2266, with a minimum score of 1715 and a maximum scale score of 3025. The average science TAKS scale score was higher at the magnet schools; however; the minimum science scale score was higher in the non-magnet schools.

The average math TAKS scale score for the 826 students attending the magnet middle schools is 853, with a minimum score of 535 and a maximum scale score of 2525. The average math TAKS scale score for the 725 students attending the non-magnet middle schools is 844, with a minimum score of 535 and a maximum scale score of 2344. Once again, the average math TAKS scale score was higher at the magnet schools; however, the maximum math scale score was higher in the non-magnet schools.

Table 4.5

*Summary of Science and Math Scale Scores for Magnet Middle Schools*

| Variable | # of Students | Mean | Std. Dev. | Min. Scale Score | Max. Scale Score |
|---|---|---|---|---|---|
| Science | 826 | 2305.524 | 233.422 | 1514 | 3025 |
| Math | 826 | 853.5339 | 299.8748 | 535 | 2525 |

Table 4.6

*Summary of Science and Math Scale Scores for Non-Magnet Middle Schools*

| Variable | # of Students | Mean | Std. Dev. | Min. Scale Score | Max. Scale Score |
|---|---|---|---|---|---|
| Science | 725 | 2266.207 | 220.6138 | 1715 | 3025 |
| Math | 725 | 844.7062 | 341.5412 | 535 | 2344 |

**Data Analysis for Research Questions**

***Research question one***. Is there a significant difference between students' academic achievement in *science* as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?

An independent two sample *t*-test with equal variance was conducted. Table 4.7 of the 2010-2011 TAKS exam indicates that the average science scale score for magnet students was 2305, while the average science scale score for the non-magnet students was 2268. As Table 4.7 illustrates, there is a statistically significant difference (*t*=.0007) between the students who participated in a math, science, technology magnet for the full three years of middle school, sixth through eighth grade as compared to students who did not participate in a math, science, and technology magnet program. The average scale score of 2305 was statistically significantly higher ($p < .05$) at the magnet schools.

Table 4.7

*Two-Sample t Test with Equal Variances of Science TAKS Scores*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 826 | 2305.524 | 8.121791 | 233.422 | 2289.582 | 2321.466 |
| Non-magnet | 725 | 2266.207 | 8.193392 | 220.6138 | 2250.121 | 2282.293 |
| Combined | 1551 | 2287.146 | 5.796874 | 228.2968 | 2275.775 | 2298.516 |
| Difference | | -39.31732 | 11.57914 | | -62.02977 | -16.60486 |

*t* = -3.3955 degrees of freedom = 1549

Ha: diff != 0

**Pr(|T| > |t|) = 0.0007**

***Research Question Two.*** Is there a significant difference between students' academic achievement in *math* as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?

When conducting the independent two sample *t*-test with equal variance to analyze the math performance as measured by the Grade 8 TAKS, it was determined that on the 2010-2011 TAKS exam the difference was not statistically significant ($t$ =0.5879, $p > .05$). On average, the math score for magnet students was higher (M = 853, SE = 10.43) than the math score for the non-magnet students (M = 844, SE= 12.68). As Table 4.8 illustrates that, although the magnet students outperformed the non-magnet students with a higher average TAKS math scale scores, there was no significant statistical difference between the students who participated in a math, science, technology magnet for the full three years of middle school, sixth through eighth grade as compared to those students who did not participate in a math, science, and technology magnet program.

Table 4.8

*Two-sample t test with equal variances of Math TAKS Scores*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 826 | 853.5339 | 10.43398 | 299.8748 | 833.0536 | 874.0142 |
| Non-magnet | 725 | 844.7062 | 12.68452 | 341.5412 | 819.8034 | 869.609 |
| Combined | 1551 | 849.4075 | 8.124186 | 319.9527 | 833.4719 | 865.343 |
| Difference | | -8.827691 | 16.28664 | | -40.77389 | 23.1185 |

*t* = -0.5420 degrees of freedom = 1549

| | | |
|---|---|---|
| Ha: diff < 0 | Ha: diff != 0 | Ha: diff > 0 |
| Pr(T < t) = 0.2939 | **Pr(\|T\| > \|t\|) = 0.5879** | Pr(T > t) = 0.7061 |

***Research Question Three.*** Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in *science* as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?

A two-sample *t* test with equal variances was used to determine the effects of ethnicity, socioeconomic status, and gender on the academic achievement in science as measured by the Grade 8 TAKS as a function of having attended a math, science, and technology magnet middle school program for the full three years of middle school. Table 4.9 shows the interaction effects of ethnicity, socioeconomic status, and gender upon the science academic achievement. The results of the *t* test show that gender had a significant statistical effect (*t* = 0.000) in the science academic achievement in the magnet middle schools as measured by the TAKS exam. There was no significant effect of ethnicity (*t* = 0.780) and socioeconomic status (t = 0.469) on the science academic achievement as measured by the Grade 8 Science TAKS exam.

Table 4.9

*Effects of Ethnicity, Socioeconomic Status and Gender on Science Achievement*

| Science Scale Score | Coef. | Std. Err. | *t* | P>\|*t*\| | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 39.98184 | 11.63853 | 3.44 | *0.001* | 17.15286 | 62.81082 |
| Hispanic | 4.144427 | 14.83762 | 0.28 | 0.780 | -24.95955 | 33.24841 |
| Eco disadvantage | -13.96737 | 19.29467 | -0.72 | 0.469 | -51.81386 | 23.87912 |
| Gender | 56.1187 | 11.47913 | 4.89 | *0.000* | 33.60239 | 78.63502 |
| Constant | 2246.938 | 23.48226 | 95.69 | 0.000 | 2200.877 | 2292.998 |

***Research Question Four.*** Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in *math* as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?

A two-sample *t* test with equal variances was used to determine the effects of ethnicity, socioeconomic status, and gender on the academic achievement in math as measured by the Grade 8 TAKS as a function of having attended a math, science, and technology magnet middle school program for the full three years of middle school. Table 4.10 shows the interaction effects of ethnicity, socioeconomic status, and gender on the math academic achievement. The results of the *t* test show that ethnicity (t = 0.000) and gender (t = 0.021) had a significant statistical effect in the math academic achievement in the magnet middle schools as measured by the TAKS exam. There was no significant effect of socioeconomic status (*t* = 0.399) on the science academic achievement as measured by the Grade 8 Science TAKS exam.

Table 4.10

*Effects of Ethnicity, Socioeconomic Status and Gender on Math Achievement*

| Math Scale Score | Coef. | Std. Err. | *t* | P>\|*t*\| | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | .978765 | 16.29835 | 0.06 | 0.952 | -30.99044 | 32.94797 |
| Hispanic | -118.5888 | 20.77827 | -5.71 | **0.000** | -159.3454 | -77.83226 |
| Eco disadvantage | 22.80149 | 27.01983 | 0.84 | 0.399 | -30.1979 | 75.80088 |
| Gender | 37.22073 | 16.07513 | 2.32 | **0.021** | 5.689375 | 68.75208 |
| Cons | 905.9944 | 32.88405 | 27.55 | 0.000 | 841.4923 | 970.4964 |

***Interaction effects.*** The researcher wanted to determine whether there were achievement differences when the co-variables in this study were linked to the school program: magnet and non-magnet. Therefore, a two-sample *t* test with equal variances analysis was conducted to determine if there were any interactions among school type, ethnicity, and socioeconomic status.

***Gender differences in science academic achievement.*** Table 4.11 and Table 4.12 show the results of the two-sample *t* test with equal variances that was conducted to determine the effects of gender differences on the science academic achievement as measured by the Grade 8 science TAKS exam. As shown in Table 4.11, there was no statistical significant difference (*t* = 0.1669) in the science academic achievement of female students attending a math, science, and technology magnet middle school for three consecutive years.

Table 4.11

*Female Science Scale Score*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 421 | 2269.482 | 10.92824 | 224.2288 | 2248.001 | 2290.963 |
| Non-magnet | 353 | 2247.603 | 11.32846 | 212.8424 | 2225.323 | 2269.883 |
| Combined | 774 | 2259.504 | 7.880419 | 219.24 | 2244.034 | 2274.973 |
| Difference | | -21.87879 | 15.81267 | | -52.91971 | 9.16214 |

t = -1.3836 degrees of freedom = 772

| Ha: diff < 0 | Ha: diff != 0 | Ha: diff > 0 |
|---|---|---|
| Pr(T < t) = 0.0834 | **Pr(\|T\| > \|t\|) = 0.1669** | Pr(T > t) = 0.9166 |

As shown in Table 4.12, the two-sample *t* test with equal variances that was conducted to determine the effects of gender differences on the science academic achievement as measured by the Grade 8 science TAKS exam indicates that there was a statistical significant difference (*t* = 0.0004) in the science academic achievement of male students attending a math, science, and technology magnet middle school for three consecutive years.

Table 4.12

*Male Science Scale Score*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 405 | 2342.99 | 11.78341 | 237.1366 | 2319.826 | 2366.155 |
| Non-magnet | 372 | 2283.86 | 11.74962 | 226.6185 | 2260.756 | 2306.964 |
| Combined | 777 | 2314.681 | 8.390631 | 233.8865 | 2298.21 | 2331.152 |
| Difference | | -59.12991 | 16.6725 | | -91.85852 | -26.4013 |

*t* = -3.5466 degrees of freedom = 775

| Ha: diff < 0 | Ha: diff != 0 | Ha: diff > 0 |
|---|---|---|
| Pr(T < *t*) = 0.0002 | **Pr(\|T\| > \|t\|) = 0.0004** | Pr(T > *t*) = 0.9998 |

***Gender differences in math academic achievement.*** Table 4.13 and Table 4.14 show the results of the two-sample *t* test with equal variances that was conducted to determine the effects of gender differences on the math academic achievement as measured by the Grade 8 science TAKS exam. As shown in Table 4.13, there was a statistical significant difference (*t* = 0.0218) in the math academic achievement of female students attending a math, science, and technology magnet middle school for three consecutive years.

Table 4.13

*Gender Differences: Female Math Scale Score*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 421 | 851.8052 | 14.87952 | 305.3022 | 822.5576 | 881.0528 |
| Non-magnet | 353 | 804.7649 | 13.5806 | 255.1564 | 778.0555 | 831.4742 |
| Combined | 774 | 830.3514 | 10.21984 | 284.3246 | 810.2895 | 850.4133 |
| Difference | | -47.04035 | 20.46238 | | -87.20886 | -6.871842 |

*t* = -2.2989 degrees of freedom = 772

| Ha: diff < 0 | Ha: diff != 0 | Ha: diff > 0 |
|---|---|---|
| Pr(T < t) = 0.0109 | **Pr(\|T\| > \|t\|) = 0.0218** | Pr(T > t) = 0.9891 |

As shown in Table 4.14, the two-sample *t* test with equal variances that was conducted to determine the effects of gender differences on the math academic achievement as measured by the Grade 8 math TAKS exam indicates that there was no statistical significant difference (t = 0.2795) in the math academic achievement of male students attending a math, science, and technology magnet middle school for three consecutive years.

Table 4.14

*Gender Differences: Male Math Scale Score*

| Group | # of Students | Mean | Std. Err. | Std. Dev. | 95% *Confidence Interval* | |
|---|---|---|---|---|---|---|
| Magnet | 405 | 855.3309 | 14.63351 | 294.4938 | 826.5635 | 884.0982 |
| Non-magnet | 372 | 882.6075 | 20.92693 | 403.6241 | 841.4572 | 923.7578 |
| Combined | 777 | 868.39 | 12.59326 | 351.0337 | 843.6691 | 893.1109 |
| Difference | | 27.27666 | 25.20649 | | -22.20443 | 76.75776 |

*t* = 1.0821 degrees of freedom = 775

| Ha: diff < 0 | Ha: diff != 0 | Ha: diff > 0 |
|---|---|---|
| Pr(T < t) = 0.8602 | **Pr(\|T\| > \|t\|) = 0.2795** | Pr(T > t) = 0.1398 |

***School differences in math and science academic achievement.*** Additional questions arose during the process of data analysis. Using the Pearson's chi-square test, the researcher wanted to determine if a difference existed between magnet and non-magnet schools in the number of commended scores in both the math and the science TAKS scores. Contingency tables were created in order to determine whether or not effects were present. A statistical significant effect in this hypothesis test means that a relationship exists between the schools and the commended performance TAKS scores. A non-significant effect means that any differences in the commended TAKS scores could be explained by chance.

Tables 4.15 and 4.16 show the contingency tables for both the magnet and non-magnet commended science and math TAKS scores. Table 4.15 indicates that the non-magnet schools had a statistical significant effect on the commended science TAKS scores, but not in the math TAKS scores. Interestingly, at 45.32% of commended science TAKS scores, Comparison F may have skewed the results and may, thus, be considered an outlier.

Table 4.15

*Non-Magnet School Commended Science and Math TAKS Scores*

| School | Commended Science | | | | | Commended Math | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | (%) | Yes | (%) | Total | No | (%) | Yes | (%) | Total |
| Comparison E | 69 | 76% | 22 | 24% | 91 | 84 | 92% | 7% | 8% | 91 |
| Comparison F | 196 | 75% | 64 | 25% | 260 | 222 | 85% | 38 | 15% | 260 |
| Comparison G | 76 | 55% | 63 | ***45%*** | 139 | 125 | 90% | 14 | 10% | 139 |
| Comparison H | 170 | 72% | 65 | 28% | 235 | 199 | 85% | 36 | 15% | 235 |
| Total | 511 | 70% | 214 | 30% | 725 | 630 | 87% | 95 | 13% | 725 |

Pearson $\chi^2(3)$ = 21.3334 *Pr = 0.000* Pearson $\chi^2(3)$ = 4.9971 *Pr = 0.172*

Table 4.16 indicates that the math, science, and technology magnet middle schools had significantly higher percentages of both science and math commended TAKS scores. Magnet C had 39% of their students achieve commended science TAKS scores, and Magnet A had 34% of their students achieve commended math TAKS scores. The data in Table 4.16 reveals that the magnet schools had a statistically significant effect on the percentage of commended science TAKS scores. While the magnet middle schools had higher percentage of commended math TAKS scores, it was not significantly higher than the non-magnet schools.

Table 4.16

*Magnet School Commended Science and Math TAKS Scores*

| School | Commended Science | | | | | Commended Math | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | (%) | Yes | (%) | Total | No | (%) | Yes | (%) | Total |
| Magnet A | 167 | 76% | 54 | 24% | 221 | 145 | **66%** | 76 | ***34%*** | 221 |
| Magnet B | 102 | 65% | 55 | 35% | 157 | 108 | 69% | 49 | 31% | 157 |
| Magnet C | 234 | 61% | 151 | ***39%*** | 385 | 278 | 72% | 107 | 28% | 385 |
| Magnet D | 46 | 73% | 17 | 27 | 63 | 46 | 73% | 17 | 27% | 63 |
| Total | 549 | 66% | 277 | **34%** | 826 | 577 | 70% | 249 | **30%** | 826 |

Pearson $\chi^2(3) = 15.1667$ *Pr = 0.00* Pearson $\chi^2(3) = 3.2860$ *Pr = 0.350*

***Gender differences in math and science academic achievement***. Finally, the researcher further analyzed the gender differences in math and science academic achievement as it relates to the commended math and science TAKS scores. Table 4.17 and Table 4.18 do not indicate an overall significant gender bias towards females or males. Nonetheless, both tables clearly indicate that some schools are more successful with a specific gender verses another. For instance, Table 4.17 indicates that female students had a higher percentage of commended science TAKS scores in Comparison G school and a higher percentage of commended math TAKS scores at Magnet B school. However, Table 4.17 also indicates that female students had a significant lower percentage of commended math TAKS scores at the non-magnet schools. Therefore, this researcher concludes that female students who spend all three years in the same middle school are more likely to achieve commended math TAKS scores at magnet schools versus non-magnet schools.

Table 4.17

*Female Commended Science and Math TAKS Scores*

| School | Commended Science | | | | | Commended Math | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | (%) | Yes | (%) | Total | No | (%) | Yes | (%) | Total |
| Magnet A | 98 | 82% | 21 | 18% | 119 | 82 | 69% | 37 | 315 | 119 |
| Magnet B | 50 | 68% | 24 | 32% | 74 | 50 | 68% | 24 | 32% | 74 |
| Magnet C | 131 | 65% | 70 | 35% | 201 | 150 | 75% | 51 | 25% | 201 |
| Magnet D | 20 | 74% | 7 | 26% | 27 | 22 | 81% | 5 | 19% | 27 |
| Comparison E | 37 | 76% | 12 | 24% | 49 | 43 | 88% | 6 | 12% | 49 |
| Comparison F | 98 | 78% | 28 | 22% | 126 | 108 | 86% | 18 | 14% | 126 |
| Comparison G | 43 | 61% | 28 | 39% | 71 | 63 | 89% | 8 | 11% | 71 |
| Comparison H | 83 | 78% | 24 | 22% | 107 | 92 | 86% | 15 | 14% | 107 |
| Total | 560 | 72% | 214 | 28% | 774 | 610 | 79% | 164 | 21% | 774 |

Pearson $\chi^2(7) = 20.5011$ *Pr = 0.005* Pearson $\chi^2(7) = 28.2363$ *Pr = 0.000*

Table 4.18 indicates that male students had a higher percentage of science commended TAKS scores at Comparison G school with 51% of the eighth grade students achieving a commended TAKS scores. However, male students received a higher percentage of commended TAKS scores in the magnet schools. Table 4.18 also indicates that male students had a significantly lower percentage of math commended TAKS scores at Comparison E, Comparison F, Comparison G, and Comparison H schools with only 2% of the male students achieving commended TAKS scores at Comparison E school. Overall, male students who spent all three years in the same middle school had a significantly lower percentage of math commended TAKS scores in non-magnet middle schools.

Table 4.18

*Male Commended Science and Math TAKS Scores*

| School | Commended Science | | | | | Commended Math | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | (%) | Yes | (%) | Total | No | (%) | Yes | (%) | Total |
| Comparison E | 32 | 76% | 10 | 24% | 42 | 41 | 98% | 1 | *2%* | 42 |
| Magnet A | 69 | 68% | 33 | 32% | 102 | 63 | 62% | 39 | 38% | 102 |
| Magnet B | 52 | 63% | 31 | 37% | 83 | 58 | 70% | 25 | 30% | 83 |
| Magnet C | 103 | 56% | 81 | 44% | 184 | 128 | 70 | 56 | 30% | 184 |
| Magnet D | 26 | 72% | 10 | 28% | 36 | 24 | 67% | 12 | 33% | 36 |
| Comparison F | 98 | 73% | 36 | 27% | 134 | 114 | 85% | 20 | *15%* | 134 |
| Comparison G | 33 | 49% | 35 | ***51%*** | 68 | 62 | 91% | 6 | *9%* | 68 |
| Comparison H | 87 | 68% | 41 | 32% | 128 | 107 | 84% | 21 | *16%* | 128 |
| Total | 500 | 64% | 277 | ***36%*** | 777 | 597 | 77% | 180 | 23% | 777 |

Pearson $\chi^2$ (7) = 22.4054 *Pr = 0.002* Pearson $\chi^2$ (7) = 49.2721 *Pr = 0.000*

**Summary**

The major findings of this study revealed a statistically significant difference ($p < .05$) in the mean achievement of the students attending a math, science, and technology magnet middle school for three consecutive years as shown in the Grade 8 science and math TAKS scores when compared to those students who did not attend a math, science, and technology magnet school. A statistical significant difference existed between the magnet and non-magnet students in the science academic achievement as measured by the Grade 8 science TAKS exam. There was no significant difference between the Grade 8 math TAKS scores between the magnet and non-magnet students. When analyzing the covariates of ethnicity, socioeconomic status, and gender, it was determined that there was a statistical significant difference in the math and science scores as it relates to gender and ethnicity. A further investigation of the magnet Grade 8 math and science TAKS scores revealed that male students perform statistically significantly higher in science and female students performed statistically significantly higher in math. Finally, Hispanic students performed statistically significantly higher in math as measured by the Grade 8 math TAKS exam.

The next figure provides a summary of the research findings as it relates to student achievement as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth-grade.

| Student Achievement as measured by TAKS | |
|---|---|
| Science | Math |
| Significant difference ($p < .05$) in the mean achievement of the students attending a magnet program when compared to students in non-magnet programs. Students participating in a magnet program outperformed those students who did not participate in a magnet program. | |
| Magnet students performed statistically significantly higher than non-magnet students | No significant difference between the magnet and non-magnet students |
| Male students in magnet programs perform statistically significantly higher in science than male students in non-magnet programs | Female students in magnet programs performed statistically significantly higher in math than female students in non-magnet programs |
| | Hispanic students magnet programs performed statistically significantly higher in math than Hispanic students in non-magnet programs |

Figure 2. *Summary of Research Findings*. This figure provides a summary of the research findings as it relates to student achievement as measured by the science and math TAKS exams.

# CHAPTER FIVE

# CONCLUSION

This chapter includes a summary of the results from this study as outlined in Chapter Four. In addition, this chapter includes interpretative comments and discussion of the implications of the conclusions of this study to school administrators and to future research.

In particular, this study addressed the following research questions:

1. Is there a significant difference between students' academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?
2. Is there a significant difference between students' academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade as compared to students not participating in a math, science, and technology magnet program?
3. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in

a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?

4. Is there a moderating effect of ethnicity, socioeconomic status, and gender on the academic achievement in math as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school, sixth through eighth grade?

This research was designed as a causal comparative to determine whether a statistical difference existed between those students' academic achievement who participated in a math, science, and technology magnet programs in middle school and those who did not. Specifically, this study explored possible differences of students' academic achievement in math and science as measured by the state achievement test as a function of participation in a math, science, and technology magnet program and non-magnet program for the full three years of middle school (i.e., sixth through eighth grade). Furthermore, this study determined whether ethnicity, socioeconomic status, or gender had a moderating effect on math and/or science achievement.

The student sample for this study was drawn from a large urban school district in Texas. Students identified as the magnet group were selected from the Grade 8 students who attended one of the math, science, and technology magnet schools, and the non-magnet group were selected from the students who attended the same school district non-magnet middle schools. After reviewing the data of four magnet and four non-magnet schools, it was determined that 1,551 students met the requirement of continuously attending the same school for the three years of middle school.

The Texas Assessment of Knowledge and Skills (TAKS) scores for science and math were utilized to measure the students' math and science academic achievement. The TAKS exams, which were administered in April 2011, are criterion-referenced tests with a normative component, and students' scores were scaled to determine the students' academic ability. Finally, rather than utilizing the raw scores, the scaled scores were used to interpret student academic achievement levels.

Inferential statistical tests used in this non-experimental quantitative study were the *t*-tests for independent groups. According to Graziano and Raulin (2000), the *t*-tests assess whether the mean of two groups are statistically significantly different from each other. The *t*-test is appropriate when a comparison is being made between the two means or averages of two groups. Therefore, the *t*-tests were performed to determine whether there was a statistical significant difference between students' academic achievement in math and science as measured by the Grade 8 Texas Assessment of Knowledge and Skills (TAKS) as a function of participation in a math, science, and technology magnet middle school program for the full three years of middle school sixth through eighth grades, as compared to students not participating in a math, science, and technology magnet program in the identified large urban school district. The level of significance was set at $P < .05$. A chi-square analysis was also used to determine the effectiveness of the magnet program in the achievement of math and science as it relates to the covariates of ethnicity, gender, and socioeconomics. A series analysis of covariance tests were employed in measuring the differences in student achievement. Descriptive data and *t*-tests were employed to explain the results.

Finally, it is important to note that there were several deliberate boundaries pre-established in this study. For instance, this study only focused on the student population enrolled in math, science, and technology magnet middle school programs, and non-magnet (neighborhood) middle schools in a particular large urban school district in Texas. Further, only the Texas Assessment of Knowledge and Skills (TAKS) scores for eight grade math and science were reviewed. Hence, the generalizations of this study will only relate to Texas and no other state.

There are several other limitations that were identified. Based on the research results, it is believed that a history effect may have occurred in one group of students at one of the comparison schools; that is, a specific event, other than the planned curriculum, may have occurred to account for the significantly higher average in science TAKS scale scores and a higher percentage of commended science TAKS scores. Therefore, this theoretical event could inevitably have influenced the dependent variable, student achievement.

Furthermore, due to the self-selection factor and/or due to the entrance and selection criteria to participate in a magnet school, there may have been an ambiguous temporal precedence and the researcher was not be able to specify which variable preceded which other variable. Were the high average TAK scores at a particular school the results of participation in the magnet program, or were they the result of the selection process to enter the magnet school? Was the dependent variable of student achievement the result of the independent variable (i.e., participation in a math, science, and technology magnet program)?

Another threat to the internal validity that was encountered was attrition. Of the approximately 2226 students enrolled in the selected magnet and non-magnet schools in the 2010-2011 school year, only 1551 students met the criteria of having been in the same school for all three consecutive years of middle school. In addition, the student sample of the study had a larger percentage of students identified as economically disadvantaged (90%), as compared to the district's 80% of its students identified as economically disadvantaged. Finally, 81% of the students in the study were identified as Hispanic, as compared to the district's 62%. The researcher, therefore, analyzed the ethnicity data as Hispanic and non-Hispanic. Consequently, due to the external validity concerns and threats discussed, the results' generalizability should be carefully reviewed prior to implementing beyond this school district.

## Summary of Findings

***Key findings*.** The major findings of this study revealed a statistically significant difference ($p < .05$) in the mean achievement of the students attending a math, science, and technology magnet middle school for three consecutive years as shown in the Grade 8 science and math TAKS scores when compared to those students who did not attend a math, science, and technology magnet school. Students participating in a magnet program outperformed those students who did not participate in a magnet program.

Specifically, the increased performance outcomes on the part of those students participating in a magnet program are as follows:

1. A statistical significant difference existed between the magnet and non-magnet students in the science academic achievement as measured by the Grade 8 science TAKS exam. In science, students enrolled in the magnet programs outperformed the students

attending a non-magnet school. This key finding mirrors several studies which were outlined in the literature review of this study. According to Frahm (2010), in part of the Connecticut study, on statewide achievement tests for tenth-graders, magnet school students from the cities made greater gains in both reading and mathematics than did city students of similar backgrounds in non-magnet schools. Furthermore, in a research study conducted in Florida, Poppell and Hague (2001) concluded that the academic achievement of students enrolled in magnet school programs exceeded that of students enrolled in traditional schools at all levels.

2. There was no significant difference on the Grade 8 math TAKS scores between the magnet and non-magnet students. This finding is similar to the work completed by Estes, Levine, and Walter (1990) who also reported that students in magnet programs scored the same or above the district and national levels on the standardized test in reading and math.

3. When analyzing the covariates of ethnicity, socioeconomic status, and gender, it was determined that there was a statistical significant difference in the math and science scores as it relates to gender and ethnicity. Cantrell et al. (2006) investigations found that ethnicity comparisons provided mixed results when comparing ethnic groups assessed on explicit engineering modules. The specific findings of this examination discovered that Black and Hispanic students who previously performed below the mean, demonstrated academic achievement above the mean when learning through the use of engineering modules in both the TIES assessment and the Nevada CRT assessment. Musemeci and Szcypkowski (1993) found that the disparity and gap between achievement in different

ethnic backgrounds and gender was less in the magnet programs than in the non-magnet schools.

4. A further investigation of the magnet Grade 8 math and science TAKS scores revealed that male students perform statistically significantly higher in science. These finding are similar to the work conducted by Cantrell, Pekcan, Itani, and Velasquez-Bryant (2006). Focusing on engineering, the research analyzed student academic achievement in science, and the results for gender show that "males tend to score higher when science is taught using the engineering design process than do females" (Cantrell et al., 2006, p.307). Gamoran (1996b) in his work also reported that the students who attended magnet programs significantly performed better than their non-magnet peers in social studies, science, and reading.

5. Additionally, it was determined that female students in magnet schools performed statistically significantly higher in math than those female students not in magnet programs. These findings are similar to what was reported in the Teachers Integrating Engineering into Science (TIES) Program. Faculty from the College of Education and the College of Engineering at the University of Nevada, Reno paired with middle school science teachers to create three units that included engineering design using an assortment of interactive learning activities in order to engage a wide range of students (Cantrell et al., 2006). The scores on the pencil/paper unit tests show slight differences between males and females with the females performing much better on the math unit tests (Cantrell et al., 2006, p.307).

6. Finally, Hispanic students attending math, science, and technology magnet schools performed statistically significantly higher in math as measured by the Grade 8

math TAKS exam. As previously cited, a New York study reported that students of all ethnicities in magnet programs scored the same or above the district and national levels on the standardized test in reading and math (Estes, Levine, and Walter, 1990).

**Recommendations**

The overall achievement of eighth grade students who had been continuously enrolled in a math, science, and technology magnet program for all three years in middle school experienced statistically significantly higher science TAKS scores than the students not enrolled in a magnet middle school program. Females and Hispanics experienced statistically significantly higher math TAKS scores when enrolled in a math, science, and technology magnet program for all three years in middle school. Males experienced statistically significantly higher science TAKS scores when enrolled in a math, science, and technology magnet program for all three years in middle school. As this research has documented, middle school students who participated in a math, science, and technology magnet program for all three years while in middle school had higher average scale scores in both math and science TAKS exams; therefore, further research should be conducted to determine the benefit of the magnet school experience to students once they leave the magnet school environment and enter high school. Additional long-term studies must be conducted in order to compare the success of magnet students with non-magnet students after graduation from high school; hence, to determine whether the magnet experience has a carryover effect once the students leave the public school setting.

Another recommendation of this study is that school district administrators must carefully evaluate the academic achievement of students in the magnet programs in comparison to those students not enrolled in magnet programs. It is also important to note that this study had several limitations, such as a higher percentage of Hispanic and economically disadvantaged students, which may have skewed the results and thus restricted its generalizability. The higher enrollment of Hispanic and economically disadvantaged students in the selected magnet schools may be attributed to the geographical location of the magnet schools. Therefore, further research must include a larger, more robust participant pool so that it is more representative of the ethnicity, gender, and socioeconomic status of the entire district. With a more robust participant pool, the study will be able to control the moderating effects of ethnicity, socioeconomic status, and gender on the students' academic achievement. Moreover, if this task cannot be accomplished within the math, science and technology magnet theme, a different magnet theme may be studied with the ultimate goal of having a more robust district wide student group in order to have student achievement results which could be generalized across the district and state.

An accompanying investigation is to analyze the impact of the student selection system being implemented at the magnet schools. Since the majority of the students "self-select" to apply to magnet programs, they are more highly motivated to achieve. Additionally, many magnet programs implement stringent student entrance criteria, that the students who do qualify for the programs are usually already high performing students. Therefore, a further quantitative study must be conducted to include control methods which identify, isolate, measure, and account for highly performing students prior to entering the magnet program.

As discussed in this study, magnet programs by design provide a specialized curriculum taught by highly trained teachers, using advanced resources and materials. The school district should conduct further analysis to determine whether the implementation of a school wide magnet would be more beneficial than limiting the number of students to a select few to participate in a magnet program within the school. Likewise, the district should consider whether to offer the teacher training to more teachers in the district to ensure that all teachers are equipped to meet not only the instructional needs of the students, but also to challenge them and provide a more rigorous and specialized curriculum.

In this study, from the initial 2,226 students in the sixth grade cohort, only 1,551 had been continuously enrolled for the three years of middle school and took the TAKS exam in April 2011. Therefore, if equity in education for all students is to be achieved, this district must analyze the enrollment patterns and mobility rate of the students to determine how long the magnet population actually stays in the magnet school before they return to their zoned school. A longitudinal research on students enrolled in magnet programs would track the students throughout the district, and potentially statewide, to determine their actual attendance and academic achievement even after they left the magnet school.

Further study should also be conducted in the area of parental involvement. As this research has shown, parents of magnet students are more highly-engaged in their child's education. The process begins from the time that the parents begin to research the magnet programs in elementary, through the application process, and finally, in the ongoing involvement at the magnet school while their child is enrolled. Parents who are motivated to fill out a magnet application form and sign entrance agreements to agree to have their child attend the magnet school may be more apt to be involved in their child's education. These parents may be more inclined to provide support, guidance, and oversight for their child's academic success at the magnet school than parents who do not go through the magnet process. Thus, additional analysis must be conducted to measure the impact of parent involvement and engagement on the student achievement of students enrolled in magnet programs.

Finally, this research did not consider any qualitative factors that may have influenced the results outlined in this study. Factors such as school climate, teacher-student relationship, school culture, student and teacher efficacy, teacher expectations, and qualities of the school leader must also be analyzed. It is recommended that further research be conducted to analyze these variables and how they impact student achievement in magnet programs.

**Implications**

Magnet schools make up the largest system of choice in the U.S. They were originally conceived to accomplish the twin goals of innovation and integration. According to Kahlenberg (2012), magnet schools emerged in the United States in the 1960s as one means of remedying racial segregation in public schools, and they were written into law in Sec. 5301 of the Elementary and Secondary Education Authorization. Magnet schools are a significant part of the Nation's effort to achieve voluntary desegregation and thus promote school choice in our Nation's schools. According to the US Department of Education (2012), the use of magnet schools has increased dramatically since the inception of the magnet schools assistance program under this Act

– with approximately 2,000,000 students nationwide attending such schools, of whom more than 65 percent are non-white. With the continued growth of magnet school programs as a means to provide school choice to families comes an additional financial burden to already financially strapped districts. Moreover, the basic nature of magnet programs to offer a specialized curriculum, with distinctive resources and materials, and highly trained teachers places an additional cost per student to school districts. Furthermore, as the country continues to be challenged with a deficit budget and a trend to under fund public schools; adequate funding of magnet programs will become increasingly difficult. Therefore, because of the unequal distribution of funds to schools with magnet programs, additional research on the impact of magnet school programs on student achievement is essential. The topic must be deliberated as to whether the students who are not participating in a magnet program would perform better if they were provided with the same educational opportunities and resources as students in the magnet program.

A further implication is the accountability of magnet programs. Students participating in public education across the nation must be prepared to be global citizens. Therefore, schools must no longer focus on simply graduating a student; rather, they must focus on having student prepared to be college and career ready. Our students must not only be prepared to compete locally, but internationally as well. Additionally, schools are being held accountable to both state and federal standards of increased student achievement. This accountability requires district administrators to consider innovative approaches to education. One of the approaches recognized by the federal government and labeled as an innovative reform model are magnet programs. Therefore, along with the state and federal accountability systems, the district administrators must have local accountability standards which magnet programs must meet.

An additional implication for school districts is to establish a clear purpose for their magnet programs. School districts must determine an alternative purpose for their magnet school programs if student achievement is not higher when comparing students in magnet schools to students in non-magnet schools. As discussed in this research, magnet programs may be offered as a vehicle for school choice or even as a means to offer students a highly specialized public education. Magnet programs have been extremely successful in helping students discover their skills and talents; and, thus, preparing them to be highly qualified to enter the workforce or a career or a university of their choice. In sum, as explored in this research, magnet programs have been successful in achieving many goals in public education, from integration, to school choice, to developing talents, to preparing students for college and/or career. It behooves school district administrators to be cautious not to narrow their sole purpose to academic achievement as it may dilute the potential impact of magnet programs.

**Conclusion**

In conclusion, given the rich history of magnet programs and the high expectations on student achievement, district leaders must carefully analyze and place great importance upon the following areas: (a) the financial cost of adequately funding a magnet program; (b) the accountability standards; and, (c) the ultimate goal of magnet programs. If the goal of magnet programs is to produce academic achievement for all students, then all magnet programs should be adequately funded, consistently evaluated, and school leaders should be held accountable. It is absolutely critical that district leaders not rely on past achievements to continue to implement programs, which may not be benefiting the entire student population. As this research has demonstrated in a general framework, magnet programs do produce higher achieving students. Therefore, appropriate, immediate and necessary steps must be taken to ensure equity in access to high quality magnet programs for all students.

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