

the academic performance and persistence of quota students majoring in STEM fields in a public university in Brazil.

The major research questions guiding this study were: (1) In what ways do institutional factors affect quota student persistence and academic performance in STEM fields? (2) To what extent does campus climate affect the academic performance of quota students in STEM fields? (3) What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ? (4) What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?

Using qualitative methods and an ethnographic case study design, semi-structured interviews were conducted with ten undergraduate quota students, two graduate students, and six university personnel. In addition, the researcher observed students on campus, both in and out of class. Additional observations were made of location students frequented such as the residence hall, library, campus restaurants, and the physics, chemistry, and engineering buildings. Findings revealed four broad themes: pre-college experiences, college experiences, college outcomes, and barriers to graduation and institutional responses. Participants indicated that their pre-college academic experiences had the largest effect on their academic achievement and persistence. Quota students in STEM disciplines routinely reported having failed their core math and science courses during the first year and experiencing difficulty with others as they matriculate. This was largely attributed to the fact that they entered with a lack of a strong academic base. Additional barriers students faced were lack of finances, and a lack of family support and cultural capital. While the university has implemented various financial supports to address quota students' needs, they lack structured academic supports such as bridge programs, supplemental instruction, and tutoring.

FACTORS AFFECTING THE ACADEMIC ACHIEVEMENT AND PERSISTENCE OF
QUOTA STUDENTS IN STEM: A CASE STUDY OF A PUBLIC UNIVERSITY IN BRAZIL

By

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Dedication

This work is dedicated to all students, past and present, whose road to a fair and equal education has been blocked. May you continue to persevere.

To my lovely daughter, may you live in a world without limits; one where neither your gender, race, nor sexual orientation limits your goals and dreams.

To my grandfather, CD, because you always said I would be the doctor in the family.

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Hellen Keller once said, “Alone we can do so little; together we can do so much.” This piece of work was a true collaboration - a meeting of many great minds and spirits. To all of you, I am grateful.

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Chapter One: Introduction

In order to maintain competitiveness in the global economy nations around the world are heavily investing in access to higher education and more specifically the production of skilled workers in science, technology, engineering, and math (STEM). Whereas upper-class majority males have traditionally dominated this field, the expansion of university enrollments as well as the presence of rapidly growing minority populations means that a large percentage of students in the educational system will be composed of minorities and women. This in turn signals a shift in which a larger number of minorities and women will add to the STEM talent pool. As such, “Increasing the success of racial and ethnic minority students in science, technology, engineering, and mathematics (STEM) has become a critical issue” (Museus, Palmer, Davis, Maramba, 2011, p. vii). Consequently, researchers, educators, and policy makers have recognized the urgent need to increase academic preparedness among minorities in STEM fields (Gasman, 2010; Harmon, 2012; Harper & Newman, 2010; Palmer, Maramba, & Dancy, 2011; Strayhorn, 2013).

Current research has suggested that several factors influence the success of racial and ethnic minorities in STEM. Initially, higher education institutions targeted students’ primary and secondary education in order to identify disparities in STEM participation and success. In the K-12 system factors such as unequal school funding (Aldeman, 2006; Flores, 2007; Oakes, 1990), an overrepresentation of unqualified teachers (Haycock, 2001; Museus et al., 2011), low teacher expectations (Fergus, 2009), stereotype threat (Lent, Hackett, & Brown, 1999; Museus et al., 2011), and racial oppression (Museus et al., 2011) impact minority students’ participation and success in STEM. Upon entering college and their prospective STEM fields minorities face an additional set of challenges. Lack of academic preparedness largely affects the success of minority

students as they are often underprepared to perform well in college level math and science courses (Aldeman, 1998; Strayhorn, 2011, 2013). In that many of the introductory math and science courses serve as gatekeepers, deficiencies in these areas can have long term and debilitating effects to students wishing to enter STEM fields (Babco, 2003).

Minority students' ideals about themselves and perceptions about their campus play an important role in how they experience college. Research on minority retention has found that racial and ethnic minorities on predominantly white campuses feel that the campus climate is inhospitable (Ponterotto, 1990). According to students, an unfriendly campus climate is manifested by both overt forms of racism and less subtle microaggressions (Ponterotto, 1990). Studies have shown that when minority students have a poor perception of their university they are more likely to experience alienation and marginalization (Allen, 1992; Cole & Espinoza, 2013; Davis, 1994; Fries-Britt & Turner, 2002; Green & Glasson, 2009; Museus et al., 2011; White & Shelley, 1996). "A lack of fit or cultural congruity between students and the institution can result in a less favorable college experience and negatively affect the academic persistence of underrepresented racial ethnic minority (URM) students" (Cole & Espinoza, 2013, p. 48).

A second issue minority students in STEM must contend with is the lack of role models (Grandy, 1998; Lewis & Collins, 2001; Ponterotto, 1990; Taylor & Olswang, 1997). The small number of minority students enrolled in STEM majors and working in the professoriate often means that role models are scarce. "A black student's decision to pursue a STEM field is strongly influenced by having other Black role models within these disciplines as teachers, professors, and professionals" (Gray, 2013, p. 88). The absence of positive role models may reinforce stereotype threat; thereby influencing both the faculty and students' beliefs about the academic ability of minority students (Seymour & Hewitt, 1997). Green (1988) posits that in order to attract and retain

minority students a critical mass, or 30 percent of the campus population, should be comprised of minority students. Hurtado, Milem, Clayton-Pedersen, and Allen (1998) support this notion suggesting that an increase in a university's structural diversity is, "an important step toward improving the climate" (p. 286). In a study on quota students admitted to the law program at a public university, Cicalo (2013) found that the presence of race-based quotas helped to enhance the context of identification for black university users. Milem, Change, and Antonio (2005) found that campuses that are more racially and ethnically diverse enhance student learning by creating more varied educational experiences.

Lastly, funding remains an issue for minority students majoring in STEM. "Financial factors are one of the most important predictors of decisions to leave college among racial and ethnic minority students in STEM" (Museus et al., 2011, p. 56). Minority students are more likely to come from lower income families and need additional resources to attend and stay in school. Seymour and Hewitt (1997) found that insufficient financial resources was one of the leading causes behind minority STEM students' higher attrition rates.

As the STEM talent pool becomes increasingly diverse, universities are examining how to attract and retain underrepresented minorities. To date, much of the research has focused on women and underrepresented racial and ethnic minorities in universities in the U.S. (Espinoza & Cole, 2008; Museus et al., 2011, St. John & Musoba, 2011). Few studies have focused on the academic achievement and persistence of underrepresented minorities in countries and institutions outside of the United States and none have specifically targeted minority students who are beneficiaries of affirmative action policies. Furthermore, an abundance of research exists on the impact of K-12 factors on minority student achievement in STEM while factors directly related to higher education institutions (HEIs) are less discussed. Finally, although educational institutions

are using various programs to support underrepresented minorities in STEM, only a handful have shared their results. This gap in literature has led to the development of the current study. The current study seeks to explore factors that affect the academic performance and persistence of quota students majoring in STEM fields in a public university in Brazil.

The outline of the study is as follows. The first chapter gives a context of the study by examining the urgent need for minority students in STEM fields. This is followed by a section that outlines the use of affirmative action as a method to increase access for minorities in higher education in general and STEM in particular. The subsequent section contextualizes the obstacles and barriers minority STEM students face and describes the types of institutional support used to combat these obstacles. This general background of the problem is followed by the purpose of the study and research questions. The research design, significance of the study, and definition of terms follow. The chapter concludes with a description of the organization of the study.

Background and Problem Statement

The Structure and State of Education in Brazil. Basic education in Brazil dates back to 1549. Part of the first colonial expedition, the Jesuits established schools for the Indians and colleges for the elite settlers of Portuguese origin. The system of separate schooling for the underprivileged and elite led to a dual system of education that has persisted through the years. Today, basic education in Brazil consists of infant education, fundamental education, and high school.

There are two types of administrative categories for educational institutions in Brazil: public and private. Public schools are established, maintained, and administered by the government. The public school system is composed of federal technical schools, state public schools, municipal public schools, and military schools. Though all of the aforementioned schools

are public they are funded and run by different entities (i.e. the federal government, state government, or local municipalities) and have been known to have varying levels of quality. In contrast private schools are funded and run by individuals and governed by private law. Overall, basic education offered through the private sector is thought to be of higher quality than the education offered in public schools. Kugel (2010) acknowledged this fact suggesting that public schools are for people who have no other choice. “In big cities almost the entire elite and upper-middle classes send their children to private schools, as do those middle class families that can afford it” (Kugel, 2010, para 4). Moreover, Curi and Menezes-Filho (2009) note that 80 percent of students enrolled in private schools are from elite families.

Although current reforms in education have led to small gains, Brazil’s education system has systematically been acknowledged as being, “significantly deficient in the quality of education that it offers” (Rodriguez, Dahlman and Salmi, 2008, p. 10). According to recent studies, the average educational attainment for the Brazilian population age 15 and older is only 4.3 years (Rodriguez et al., 2008). Approximately half of Brazilian 15 year olds have difficulty in reading and three quarters cannot manage basic mathematical operations (Pearson Foundation, 2011; Rodriguez et al., 2008). Furthermore, Brazil was the lowest performing country in the 2000 PISA tests of 15 year old students, and still remains well below the OECD average (OECD, 2010a). In large part Brazil’s poor rankings are due to high repetition and low enrollment rates as just over 50% of students completed the mandatory eight consecutive years of education; many taking an average of 12 years to do so (Guimares de Castro & Tiezzi, 2004).

The basic education offered by the public school system is vastly inferior to the basic education offered by private schools. While the majority of upper class families send their children to private school the cost of tuition can be a heavy burden for low income families. Akkari (2013)

reported that in some areas the monthly cost of a private school education is nearly identical to the governments' annual per student cost. "To provide an education that guarantees entry into higher education institutions, a family can spend approximately R\$ 2,756 per month for high school. This value is close to what the government spends annually for a student in public secondary schools" (Akkari, 2013, p. 4). Consequently, low-income public school graduates are at a disadvantage as they cannot afford a private school education that will prepare them to pass the entrance exams required to gain admittance to the public universities.

The Need for Minority Students in STEM. Over the past decade, nations large and small have had a renewed interest in science, technology, engineering, and math. Understanding the need to develop a dynamic and innovative knowledge-based economy, governments are seeking to enhance performance and boost enrollment in STEM fields. Brazil, in its quest to become a major global competitor, has followed suit.

In the past fourteen years, Brazil has made a concerted effort to improve outputs in the STEM fields. In 2000, the nation placed last on the PISA, scoring well below the OECD mean in scientific literacy. More than half of the countries' students ranked at level one or below and less than 1 percent scored at the top level (OECD, 2011). Brazil's low PISA scores and widely acknowledged educational inequalities prompted the government to adopt a National Education Plan (2001)¹. While Brazilian students' scores remain below the OECD average, large overhauls in the Brazilian educational system has led to steady improvements in education in general and STEM fields in particular. In 2006 and 2009, the country's PISA scores in science showed improvements as Brazil had mean scores of 390 and 405 respectively. Similarly, average math

¹Since the 1930's the Brazilian government has spoken of the need for a unified plan to reorganize formal education. It was not until the 1999 World Conference on Education for All and the creation of the E-9 group where Brazil, with its high illiteracy rates and deficits in compulsory education, was asked to create a Ten-year Education for All Plan.

scores rose by 52 percent; the largest math increase on record (Bruns, Evans, & Luque, 2012). In spite of these gains, Brazil continues to trail other countries in math and science achievement.

A closer look at Brazil's PISA scores also revealed regional disparities, whereby scores in the North and Northeast regions of the country fall far behind the already low Brazilian average. In 2006, the scores in these areas were among the lowest recorded results in the Iberoamerican Pisa Group (GIP) (OECD, 2010b). The most heterogeneous area in Brazil, most of the black population is concentrated in the north and northeast parts of the country, which are cited for having poor public education and the highest illiteracy rates (Góes, 2011). "The implications for Brazil's economy and society are profound; poor students are simply not gaining the competencies required to pass college entrance exams or to secure jobs in science and technology" (Worldfund, 2013, para 2).

In 2009 Worldfund, an international organization that works with local governments and private corporations to invest resources in education, piloted its STEM Brasil² program in three public high schools in the northeast. The intensive program was intended to introduce gifted students in poverty stricken districts in Brazil "to the wonders of engineering and technology as exciting fields of exploration and learning while setting them on a clearly defined, pragmatic path to higher education and employment" (Worldfund, 2009, para 1). Since its inception, the program aimed to expand its reach, hoping to deliver STEM Brasil to 1,000 public high schools in impoverished districts throughout the nation. Moreover, the program targets the most underrepresented groups as the majority of children served are mixed race and Afro-Brazilian. It also targets gender inequalities as it seeks to enroll an equal number of female and male students.

² It is important to note that with the exception of Worldfund's program the acronym STEM is not used or well known in Brazil. The common term used in its place is *exatas*.

In addition to changes at the primary and secondary level, Brazil is making great strides at the tertiary level to educate students in STEM. Beginning in 2011, President Dilma Rousseff signed a decree to fund Brazilian university students and scholars in STEM fields. Originally known as Science Without Borders, the Scientific Mobility Program is a multi-year initiative to send more than 100,000 Brazilian STEM students abroad by 2015. Created to promote scientific research, increase international cooperation in science and technology, and to engage students in a global dialogue through international education, the scholarship program funds a full year of overseas study for students majoring in STEM. In addition to covering the cost of tuition, scholarship recipients receive room and board, book stipends, a one-time settling-in allowance of \$1300, and a \$300 monthly stipend. Throughout the course of the program the Brazilian government will fund 75,000 students while the private sector has been asked to fund an additional 26,000.

While this merit-based program is expansive, it is only intended to attract the best and brightest STEM students. Undergraduate students must first be nominated by their Brazilian university. As of fall 2013, 6,039 Brazilian undergraduate scholarship recipients were placed in 346 U.S. host institutions. Data on the fall 2012 cohort revealed that 59.6 percent of students who were selected to participate had a grade point average (GPA) of 3.5 or higher; 28.5 percent had GPAs between the 3.0-3.49; 10 percent had GPAs between 2.5 and 2.99; and 3.1 percent had GPAs below 2.0. Of the participants listed above, 71 percent of students were enrolled in engineering and computer science courses, 12 percent were in the medical sciences, and 10 percent were in the hard sciences (Monks, 2012). The government's goals and rigorous academic requirements are intended to capture the nations' best and brightest students. However, their overreliance on academic achievement and the absence of diversity from the project's goals has led to cohorts that

largely reflect the upper-class majority. Gender parity also suffered as males comprised 65 percent of students in the fall 2012 cohort--a percentage that is said to be more balanced than the first and second cohorts (Monks, 2012).

In an effort to improve diversity, the historically black colleges and universities (HBCUS) and the Ministry of Education's Federal Agency for the Support and Evaluation of Graduate Education (CAPES) signed a memorandum of understanding in April 2012 to increase participation of underrepresented groups including Afro-Brazilians, indigenous Brazilians, and women. Consequently, a special call for applications was launched for undergraduate students in Brazil to attend HBCUs in the U.S. As a result, 306 students attended HBCUs in the spring of 2013.

If the Brazilian government truly intends to compete in the global economy, they must expand STEM education to include both minorities and women. Demographic shifts in Brazil have created a condition in which the racial minority has now become a majority. Findings from the 2010 census revealed that for the first time ever non-whites make up the majority of the population in Brazil. The proportion of Brazilians who identify themselves as black or mixed race is 50.7 percent, as compared to 47.7 percent who consider themselves white. With more than half of the Brazilian population identifying themselves as black or brown, the racial diversity of the nation and the STEM pool are rapidly changing. A lack of minorities and women in STEM fields can have, "negative implications for the country's economic growth and competitiveness in the global arena" (Palmer, Maramba, Gasman, & Lloyd, 2013, p. 1).

The Brazilian government has made aggressive reforms to improve STEM education at all levels. However, in light of the regional disparities that exist and the growing black and brown population, the country must double their efforts to attract and retain minority students in STEM.

In that the next generation of students will comprise the bulk of the country's talent pool, the government and educational stakeholders cannot afford to ignore this group, as doing so may have lasting social and economic implications. "Given that minorities will make up an increasingly larger proportion of the STEM talent pool, it is essential for educators to maximize the success of these individuals if they are to use the entire talent pool of potential STEM colleges students" (Museus et al., 2011, p. 5).

Meritocracy and Affirmative Action. The idea that academic success should be the direct result of diligence and merit has been widely accepted in the educational arena. Many stakeholders in education and believers in meritocracy argue that regardless of race, gender, or socio-economic status, people are rewarded for their hard work and achievements (Museus et al., 2011). This belief in a colorblind, gender-blind, and economic-blind meritocracy ignores the fact that a student's race, gender, and socio-economic status has and continues to play a role in educational attainment. Studies have shown that systematic factors such as disparities in school funding (Adelman, 2006; Flores, 2007; Oakes, 1990), academic tracking (Bonous-Hammarth, 2006; Oakes, 1990, 1995; Oakes, Gamoran & Page, 1992; Simpson, 2001; Tyson, Lee, Borman, & Hanson, 2007), an underrepresentation of qualified teachers at primary and secondary levels (Bissell, 2000; Darling-Hammond, 2000; Fergus, 2009; Flores, 2007; Ladson-Billings, 1997; Tate, 2008), and oppositional culture (Ainsworth-Darnell & Downey, 1998; Cook & Ludwig, 1998; Kao & Tienda, 1998; Tyson, Darity, & Castellino, 2005) have disadvantaged minority and low income students. Similarly, low teacher expectations (Bissell, 2000; Collins, 1992; Fergus, 2009; Oakes, 1990; Thompson, Warren & Carter, 2004), and stereotype threat (Inzlicht & Ben-Zeev, 2000; Good, Aronson, & Harder, 1999) have been shown to negatively impact both minorities and women

majoring in STEM fields. Noting the various factors that may inhibit minority and female participation in STEM fields, Museus et al. (2011) denies the existence of meritocracy.

What many purport to be a colorblind system of hard work and proportional economic and social rewards can also be considered a system in which racism – and other forms of oppression – functions to redistribute resources to groups that already possess them (for example, affluent White populations) p. 54.

In an effort to combat the racial inequalities that have been perpetuated by a meritocratic education system, universities and educational institutions around the globe have begun to implement measures which explicitly favor members of disadvantaged groups. Policies which benefit marginalized groups in areas such as employment, education, business, and housing are widely referred to as affirmative action.

Higher education institutions use affirmative action policies to increase access for minorities. Although most people recognize the need for and benefits of increased minority enrollment, the constitutionality of affirmative action policies has been constantly challenged in the court of law. In the United States, where affirmative action has been contested on many levels, the Supreme Court has consistently argued that the use of affirmative action policies are constitutional (Museus et al., 2011). In spite of this ruling, the Court has prohibited the use of quotas and suggests that race-sensitive policies be temporary.

In contrast to higher education institutions in America, universities in Brazil have been using quotas for over a decade. González (2010) notes that within the context of higher education, the use of affirmative action has almost always pointed to the use of quotas.

The concept of affirmative action was then transformed, in the sense that it became associated with the idea of achieving equality of opportunity through the imposition of strict quotas for the access of minority members to specific areas of the labor market and to educational institutions. (p. 124)

Although these universities also faced legal challenges, the Brazilian Supreme Court ruled that the use of race-based quotas were legal and effective redress to reverse the educational and income inequalities that have existed for centuries. Following the Court's lead, President Rousseff signed The Law of Social Quotas. Described as one of the most aggressive affirmative action policies worldwide (The Economist, 2012), the law requires public universities to reserve half of their admission spots for public school graduates. To ensure that the pool of public school graduates admitted is diverse, the reserved spots must also be assigned in accordance with the racial makeup of the state.

In an effort to increase the presence of underrepresented minorities in higher education the Brazilian government has mandated the use of racial and social quotas. While preliminary data has shown significant increases in the enrollment, the enrollment and academic performance of quota students science and math disciplines remains troubling (Cunha, 2006; Velloso, 2009). This study intends to shed light on the barriers quota students majoring in STEM face and the institutional practices, policies, and programs that have been implemented to help address said issues.

Factors Affecting Minority Retention in STEM. Historically, both women and minorities have had less access to STEM disciplines. Those who have entered the field have been less successful than their majority, male peers (Astin & Astin, 1992; Bonous-Hammarth, 2000, 2006; Seymour & Hewitt, 1997). Much of the retention data on minority STEM students attributes high attrition rates to students' lack of academic preparedness (Bonous-Hammarth, 2000; Elliot, Strenta, Adair, Martier, & Scott, 1996; Grandy, 1998; Huang, Taddese, Walter, & Peng, 2000). Research has shown that students entering the university through the public school quota have an inferior education as compared to their non-quota peers (Daflon, Júnior, & Campos, 2013). Strayhorn (2013) posits that minority students' inadequate preparation is in part due to their lack

of exposure to rigorous math and science courses in high school. Since math is the foundation of nearly all STEM fields, deficiencies in math often hinder students' educational aspirations and academic success (Strayhorn, 2013).

Social variables such as unsupportive and unwelcoming university environments also deter minorities from completing degrees in STEM. Largely recognized for innovation and scholarship, STEM fields were historically run by white men and perpetuated an image of, "academic rigor and elitist intellectualism" (Amon, 2010, p. 44). These traditional and widely-accepted STEM cultures present a barrier for racial minorities and women as they perceive the field to be cold, unsupportive, fast-paced, and difficult (Amon, 2010; Astin & Astin, 1992; Bonous-Hammarth et al., 2000; Seymour & Hewitt, 1997). In a study conducted by Strayhorn (2009), minority STEM students reported that racism, prejudice, social isolation, and insensitivity impacted their ability to be successful. The prejudice and microaggressions minorities experienced on campus and in their field hindered students' willingness to seek help or support (Thiry, Lauren, & Hunter, 2011; Strayhorn, 2013). Problems such as these are further exasperated by a lack of available role models for minorities and women in STEM fields. The absence of role models fosters an environment ripe with stereotypes and social isolation, adding to the already "chilly climate" of STEM fields (Hall & Sander, 1982; Hurtado et al., 2007).

Institutional Responses to Minority Students in STEM. Universities concerned with the low number of underrepresented minorities enrolled in STEM have shifted from solely aiming to increasing access to a more holistic focus which includes student persistence. In doing so, efforts to provide support to minorities in STEM have focused on three major goals: addressing students' academic, social, and financial needs.

HEIs have implemented targeted academic supports in the hopes of boosting the academic achievement and persistence rates of underrepresented minorities in STEM. Academic intervention programs include bridge programs, tutoring, and experiential learning opportunities. Tutoring and programs like Supplemental Instruction (SI) have been cited for improving student performance in gatekeeper courses, increasing pass rates, and fostering retention in the sciences (Ramos, 2013). Likewise, bridge programs are noted for addressing academic deficiencies and helping with gatekeeper courses while experiential learning opportunities have been linked to persistence in STEM majors, bachelor's degree completion, increased academic achievement, and the pursuit of a graduate degree (Barlow & Villarejo, 2004; Hathaway, Ngada, & Gregerman, 2002; Nagda et al., 1998). Moreover, minority students who are exposed to research experiences tend to, "gain professional, cognitive, and non-cognitive benefits related to becoming a scientist" (Carter, 2011, p. 20).

In addition to dealing with academic concerns, support programs target the social barriers that minority STEM students face. A result of cultural incongruence, minorities often deal with issues such as academic and cultural isolation, stereotype threat, and discrimination (Carter, 2011). Initiatives created to address these issues include academic advising, mentoring, and the development of strong faculty-student and student-student relationships. Research has noted that factors such as faculty and peer support impact persistence rates among minority students in STEM (Gloria, Castellanos, Lopez, & Rosales, 2005; Hernandez, 2000). Though a variety of intervention programs have been implemented, few research studies have been conducted which examine the impact these programs have.

University and nation-wide funding is often earmarked with the goal of increasing minority participation in STEM. Grants such as the Scientific Mobility Program are aimed at increasing the

number of STEM students and often specifically target underrepresented minorities in STEM (Carter, 2011). As funding remains a critical issue for minorities in STEM, support programs will need to create ways to reduce students' financial concerns or provide them with the resources they need.

Purpose of the Study

The purpose of this study is to examine factors that affect the academic performance and persistence of quota students majoring in STEM fields. In doing so, this study will illuminate the academic, social, and financial obstacles STEM quota students face, as well as highlight institutional practices created to address said issues. Furthermore, this study will address critical gaps in the research on the use of affirmative action policies to increase access for minorities in STEM and the academic performance and persistence of their beneficiaries. The research questions used to guide this study are as follows:

- 1) What factors affect the academic performance and persistence of quota students in STEM fields?
- 2) To what extent does campus climate affect the academic performance of quota students in STEM fields?
- 3) What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ?
- 4) What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?

A Case for Quota Students in STEM at UFBA

This study will focus on quota students in STEM fields at a public university in Brazil. In the United States, where the bulk of research on minorities in STEM is undertaken, racial, and

ethnic minorities are among the most marginalized groups in regards to access to and completion of a higher education degree. Similarly, Brazilian universities have had a history of excluding racial and ethnic minorities from access to higher education. Prior to the implementation of affirmative action policies, only 3.2 percent of Afro-Brazilians attended university compared to 14.3 percent of whites. While a large proportion of marginalized individuals are considered black and brown, research and policy on underrepresented minorities in higher education in Brazil acknowledges a second group of students who have historically been excluded from access to public universities. Commonly referred to as public school graduates, this group includes students of any race (although the vast majority are black and brown) who graduated from a public high school.

Many of Brazil's public secondary schools, particularly those in low-income areas, are underfunded and do not adequately prepare students for the college entrance exam or *vestibular*. Traditionally, public school graduates and minority applicants perform worse on the *vestibular* than majority, private school applicants. Noting that university admissions was heavily skewed towards white, private school graduates, the universities themselves, and now the federal government, have adopted an affirmative action policy which seeks to increase the enrollment rates of both racial minorities and public school graduates.

Affirmative action seeks to promote access for members of specific social groups who have been systematically denied access and advancement (McCombs, 1989). In that the affirmative action policies of both the country and the institution that serve as the backdrop to this study identify racial minorities and public school graduates as being underrepresented and through the use of a quota policy allot a specific number of vacancies for these students, this study will follow their designation. In doing so, the focus of the study will not be limited to racial minorities (i.e.

black, brown, and indigenous students), but will include all marginalized groups who have been identified through the university's quota system. The use of this grouping is of particular importance at the Universidade Federal da Bahia (UFBA), where prior to the implementation of the quota system 61 percent of admitted students had declared themselves black or brown (Guimarães, da Costa, Almeida-Filho, & Newman, 2010). While there was already a high enrollment of Afro-Brazilians, the university acknowledged that access remained limited as the bulk of accepted black students were private school graduates who remained concentrated in courses of lower prestige (Guimarães et al., 2010). At this time, the rate of participation for public school graduates was only 38 percent and less than 20 percent of blacks were enrolled in high prestige courses such as medicine and law. Furthermore, research on access and persistence in higher education in Brazil has focused on quota students. As such, much of the country-specific literature used to inform this study focuses on quota students, while studies based in the U.S. focus on underrepresented racial and ethnic minorities.

Conceptual Framework

This study was guided by elements from Campus Climate Theory (Hurtado & Carter 1997; Hurtado et al., 1998; Kuh & Love, 2000) and Museus et al.'s (2011) Racial and Ethnic Minorities in STEM model (REM STEM). The Campus Climate Theory describes the relationship between students' perceptions of the college climate and their academic performance. The REM STEM model is more extensive, illustrating the process by which different factors, including campus climate, impact minority students' success in STEM fields.

Campus Climate. Tinto's (1987, 1993) theory of student departure is among the most cited in educational research. According to this theory, students who wish to fully integrate into the academic and social systems of the university must first sever ties with their cultures of origin

(i.e. family and high school peers). Those students who fail to do so are less likely to succeed in college as they will undoubtedly have a more difficult time adjusting to campus life. Though this theory has often been applied to the population at large, scholars have questioned if it is applicable to racial and ethnic minorities (Braxton, 2000; Hurtado & Carter, 1997; Kuh & Love, 2000; Museus & Quaye, 2009; Tierney, 1992). Recognizing the problematic nature of Tinto's theory, Museus et al. (2011) argue:

Expecting minority students, many of whom come from cultures that are very different from those that exist at PWIs, to sever ties with their cultural heritage and assimilate to the culture of their campus places an unfair burden on those students and ignores institutional responsibility to facilitate racial and ethnic minority undergraduates' adjustment and success in college. (p. 68)

Oposing views have led to the development of several alternative theories, all of which indicate that culture is a key component in the success of minority college students. Rendon, Jalomo, & Nora (2000) established the concept of bicultural socialization. According to their model, minority students can simultaneously learn how to navigate multiple cultures. Museus and Quaye (2009) extended these ideas in their intercultural framework where they emphasized the importance of collective and individual agents in building connections with minority students. Collectively, these theories argue that the manner in which minority students experience college matters.

Campus climate theory is the theoretical grounding for this study. Scholars in education have studied campus climate for over a decade (Bauer, 1998; Harper & Hurtado, 2007; Museus & Jayakumar, 2012; Kuh & Hall, 1993; Museus, 2007; Pascarella & Terenzini, 2005; Peterson & Spencer, 1990; Tierney, 1992). Research on the topic has revealed that students' perceptions of the college climate can largely impact their academic achievement and persistence (Seymour, 1995; Seymour & Hewitt, 1997). A substantial body of research has been conducted on campus cultures and racially diverse student populations (Kuh & Love, 2002; Museus & Quaye, 2009). Findings suggest that racial and ethnic minorities attending predominantly white or prestigious universities

are faced with multiple challenges. Scholars have found that a lack of cultural congruity between minority students and the campus lead to alienation, isolation, and marginalization from the campus cultures (Feagin, Vera, & Imani, 1996; González, 2002; Museus, 2007; Rendon et al., 2000).

Jayakumar and Museus (2012) describe such instances as follows:

Given that the policies and practices that permeate most institutions are based on White culture, it makes sense that students of color are more likely to experience greater distance between the cultures from which they come and the cultures of their respective campuses than their White peers. (p. 9)

Recent research has argued that campus climate theory does not do enough to, “explain how different groups might perceive, make meaning of, and experience various components of an institution’s culture in disparate ways” (Museus, Ravello, & Vega, 2012, p. 31). They contend that the deracialized nature of campus climate is aligned with past work on culture. Using studies on campus culture, race, and the role of race in higher education Museus et al. (2012) expand on the traditional cultural climate concept by defining campus racial climate. According to researchers, the campus racial climate is shaped over time by the racial majority and reflects their own values. Museus et al. (2012) suggest that this is equally important in retaining minority students.

Understanding the concept of the campus racial culture is crucial because faculty, administrators, and staff at many institutions throughout the country are disproportionately White and therefore must be conscious of the fact that students of color might perceive the same elements of their campus’ cultures in very different ways. (p. 32)

Hurtado et al. (2007) contend that racial and intergroup dynamics are relevant to the persistence and performance of minorities in STEM fields. According to researchers, a number of educational outcomes have been linked to racial dynamics including the numerical representation of minorities, interactions across race, and students’ perceptions of the racial climate (Chang, 1999; Gurin et al., 2002; Hurtado et al., 2007). Seymour and Hewitt (1997) found that ethnic isolation and perceptions of racism were factors that led minority students to switch out of math, science and

engineering majors. Likewise, Bonous-Hammarth (2006) reported that the competitive nature of STEM disciplines and a lack of institutional diversity had a negative influence on underrepresented minorities' persistence in STEM fields.

Both campus climate theory and campus racial climate theory examine the interplay of various institutional factors and the impact they have on students' perceptions. Students' perceptions of the campus have been shown to greatly influence their academic achievement and persistence rates. These variables have been incorporated in several retention models. The current study seeks to explore the factors that shape minority STEM students' perceptions of campus.

The Racial and Ethnic Minorities in STEM Model. Throughout the years, educational researchers have designed and used various models to examine the relationship between campus climate, student perceptions, and retention. Increased attention on minority student achievement has led to an interest in minority specific departure models. Nora, Barlow, and Crisp's (2005) model included factors that addressed minority, low-income, and non-traditional students. Their model examined factors like financial assistance/need, family support, campus climate, mentoring, and formal and informal interactions with faculty, that have traditionally been obstacles for underrepresented minorities. Hurtado et al. (2007) used a similar structure in their development of a conceptual framework to address first year minority STEM students' transition and adjustment to college. Hurtado et al. (2007) expanded Nora et al.'s (2005) model by adding, "an array of academic measures that may have distinct effects on academic adjustment and overall sense of belonging to the college community" (p. 848). Additionally, the model proposed by Hurtado et al. considers that minority students' psychological sense of integration is impacted by college dynamics, family and financial concerns, and academic development and performance.

Museus et al. (2011) drew from research on the K-12 and college level factors that impact minority student achievement in STEM to create a new, more holistic model. The Racial and Ethnic Minorities in STEM model was created to illustrate the process by which different factors impact minority students' success in STEM fields. This comprehensive model, which examines factors from elementary school through college completion, includes many of the same constructs found in Nora et al.'s (2005) and Hurtado et al.'s (2007) models. All three of the models examine students' pre-college ability. Understanding that minority students' pre-college ability is greatly impacted by educational discrepancies, the REM STEM model includes a K-12 construct which takes into account educational inequalities, the use of a culturally relevant curriculum, and early exposure to STEM. This first construct affects students' K-12 outcomes which includes academic preparedness.

The three models also acknowledge the importance of parental encouragement and involvement. Both Nora et al.'s (2005) model and the REM STEM model suggest that parental encouragement and involvement influences minority students at all stages. In Hurtado et al.'s (2007) model family, as external push or pull factors, are isolated from the other constructs and appear to only affect students' first year outcomes. This model ignores the large role parents play in students' college entry process and throughout their college career.

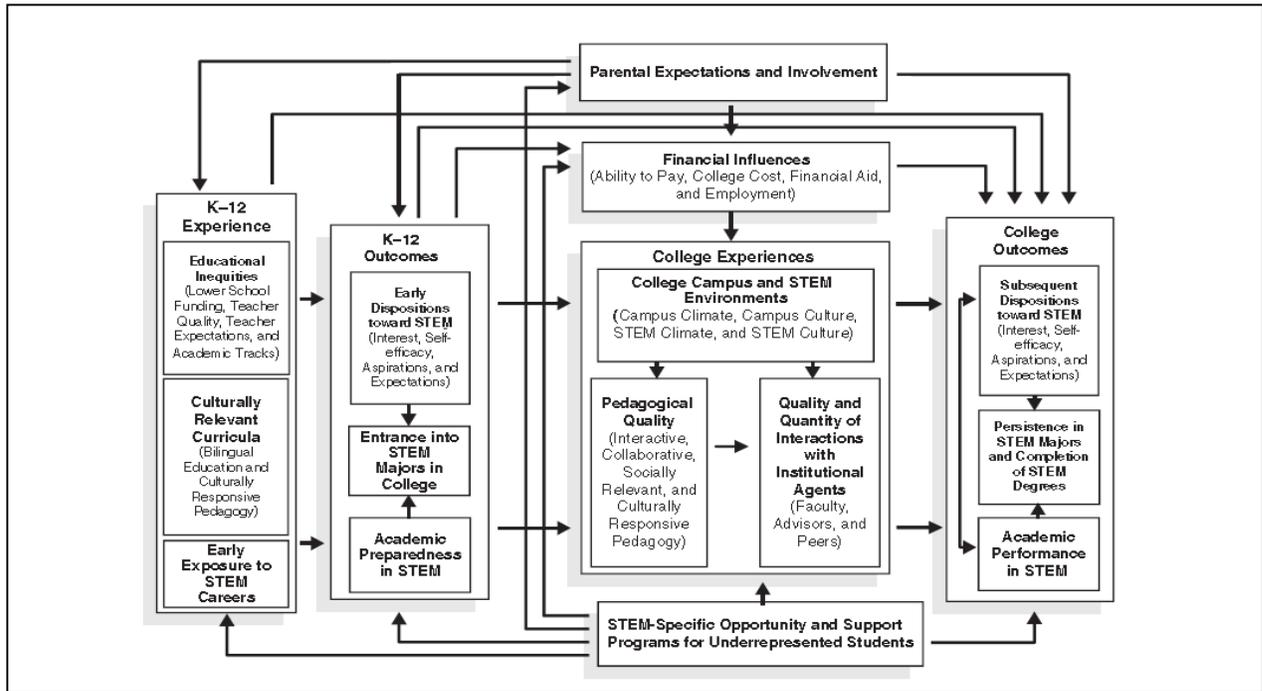
All three of the models include students' academic experiences, elements of social integration and institutional commitment, and academic development and performance. For Nora et al. (2005) each of these elements presented individual experiences students could have. Many of them influenced each other and all had an impact on student persistence. Hurtado et al.'s (2007) model further defined these experiences, grouping them as "campus structures that link the social and academic systems," or "Peer Racial/Dynamics" (p.848). The REM STEM model took this

one-step further creating a construct called college experiences. Within that construct, student experiences are separated into three fields: college campus and STEM environments, pedagogical quality, and quality and quantity of interactions with institutional agents. Moreover, the model clearly shows that this construct is influenced by students' K-12 experiences and outcomes, financial influences, parental involvement, and STEM specific opportunities. Acknowledging these additional external forces is essential as it weakens the meritocracy argument and highlights the significant role institutional factors have in minority students' academic success and persistence.

The final difference between the models revolves around financial issues. Financial concerns are absent from Nora et al.'s (2005) model and only appear to affect minority students' psychological sense of integration in Hurtado et al.'s (2007) model. In contrast, financial influences have a significant part in the REM STEM model. According to the model, parental influence, K-12 outcomes, and STEM specific opportunities and support influence student's financial needs. These financial needs then go on to impact students' college experiences and outcomes. Research on the retention of minority students indicates that this construct is key, as finances play a critical role in minority students' ability to access and persist through college.

Several models have been designed to describe the intricate relationship between institutional factors and the success and retention of minority students. While many studies include factors related to campus climate and other issues outlined in the research, the REM STEM model is the most comprehensive. Created as a result of the current literature, the model includes traditional variables such as academic preparation, family, and campus environment. However, unlike other models, Museus et al. (2011) includes constructs which address racial inequalities. Furthermore, the model explicitly shows the impact each construct has on the subsequent construct

and in many cases recognizes that factors affect more than college outcomes. In that the current study also takes note of racial inequalities and seeks to examine the relationships between the constructs listed, I used the REM STEM model to frame the current study.



Source: Museus et al., 2011, p. 88

Figure 1. *The Racial and Ethnic Minorities in STEM Model*

Research Design Overview

I conducted an ethnographic study of the socio-cultural contexts, processes, and meanings within a cultural system (Whitehead, 2005). Using observation and semi-structured interviews, I hoped to gain “explanatory insights into the reasons why people, groups, and organizations act as they do, and how conflicting social forces are resolved” (Adler & Adler, 2011, p.17). I used purposeful sampling to select a total of ten undergraduate quota students, three faculty members, two graduate students, and one administrator to participate in the study.

The conceptual lens for this study was framed by two theoretical frameworks: The Campus Climate Theory and Racial and Ethnic Minorities in STEM Model (REM STEM). The Campus

Climate theory was used to examine students' perceptions of the campus and their program. The REM STEM model was used in examining the interplay between campus climate, the obstacles quota students in STEM face, institutional supports, and the impact these factors have on student achievement and persistence. The design of this study was also informed by an extensive review of literature on the use of affirmative action policies in higher education, the factors that influence minorities' views of campus climate, the obstacles minorities in STEM face, and the shared characteristics of institutional programs designed to assist underrepresented minorities in STEM.

Significance of Study

This study was designed to generate research that will add to literature on: 1) the academic achievement and persistence of underrepresented minorities in STEM, 2) the long-term effectiveness of affirmative action policies in diversifying STEM, and 3) the impact of institutional factors and support programs on minority student performance in STEM.

To date the majority of studies that have examined student achievement and persistence in STEM have centered on the individual student and their experiences. This study examined not only the individual experiences of the student but the institutional context as well. By acknowledging that institutional factors at the university level play a part in the academic achievement and retention of minority students in STEM, this study deviates from others which solely focus on K-12 factors and largely attribute differences to underrepresented minorities' lack of academic preparation. "While we know a fair deal about reasons REM (racial and ethnic minorities) may leave STEM majors in general, we know comparatively little about the role that campus climate plays in promoting or inhibiting REM's success in STEM fields at the undergraduate level" (Strayhorn, 2013, p. 35). This study recognizes the importance of campus

climate and institutional factors at the collegiate level, as they are more apt to change than the K-12 factors that have been the traditional focus.

Anti-affirmative action legislation in the U.S. has led universities to question the use of preferential policies. These changes, coupled with voter bans on affirmative action, are likely to lead to a less diverse STEM field (Lesesne, 2013). This study adds to the debate on the use of affirmative action in college admissions as universities worldwide contend with the need for affirmative action and the legality of its use. Electing to focus on students admitted through the use of quotas at a public university in Brazil, this study adds valuable information on the academic performance and persistence of STEM students admitted under preferential policies. Unlike the U.S., where the use of a broad admissions criteria make it difficult to identify and track students who have been admitted through affirmative action policies, the use of quotas in Brazil not only made it easier for the researcher to identify program beneficiaries, but the public knowledge and treatment of this fact added another important layer to the discussion on campus climate.

Public universities in Brazil have been given four years, until 2016, to increase access by reserving up to 50 percent of their vacancies for minority and low-income (i.e. public school graduates) students. Recent research has shown that while quota students typically score lower than non-quota students do on entrance exams once admitted into the college the academic performance of quota students majoring in humanities and less competitive fields tend to be on par with non-quota students. In contrast, the academic performance of quota students majoring in STEM fields lag behind that of general admits in the same program. While there is currently an abundance of research being conducted on quota students in general, there is limited research that focuses on STEM students in particular. Moreover, few researchers have examined the impact of campus climate or other factors that affect quota student performance and persistence. Finally, by

examining quota students and differences between genders, this study will add to current research that examines women in STEM fields.

The Brazilian government has demonstrated a strong commitment to advancement in STEM through investments in programs like the Scientific Mobility Program. While this program seeks to attract over 100,000 Brazilian students and scholars in STEM fields, their use of a merit based selection criterion has limited the number of minorities and women participating. This research will shed light on the importance of incorporating quota students and women in programs designed to attract and retain students majoring in STEM.

Lastly, the focus on support services offered to STEM quota students adds a new perspective on equal outcomes. Brazilian scholars have noted that after quota students have gained admission, support through mentoring, tutoring, access to books, school supplies, transportation, food, and access to the Internet is largely absent (Aubel, 2011). The data collected in this study will bring issues surrounding the availability and types of institutional support offered to the forefront.

Key Concepts and Definitions

In order to ensure that there is little ambiguity, the following terms have been defined. While there may be variations in the meaning of these words the definitions provided below should be used as they relate to the specific context of the study.

Academic Success: Academic success is determined by UFBA on the basis of earned grade point average. Participants with grade point averages of 5.1 or better, on a 10-point scale, are considered high performing while students' whose scores fall below 5.1 are considered low performing.

Amarelo: Brazilian students who consider themselves yellow. This is a shade lighter than *pardo* on the color spectrum.

Branco: Brazilian students who consider themselves white.

Campus Climate: Campus climate is best defined as, “The collective, mutually shaping patterns of institutional history, mission, physical settings, norms, traditions, values, practices, beliefs, and assumptions that guide the behavior of individuals and groups in an institution of higher education which provide a frame of reference for interpreting the meanings of events and actions on and off campus” (Kuh & Hall, 1994, p. 2).

Cultural Congruity: The fit between an individual’s values and the values of the environment in which they operate (Gloria & Robinson Kurpius, 1996)

Exatas: Any field of science capable of quantitative expressions, accurate predictions, and rigorous methods of testing hypotheses, especially reproducible experiments involving quantifiable predictions and measurements. An example is Mathematics, Physics, Engineering, Chemistry, Statistics and Computing.

First Generation College Students: First generation students are students whose parents’ highest level of education is a high school diploma or less (Nuñez & Cuccaro-Alamin, 1998).

Indigenous: Students whose ancestors are native to Brazil.

Lower Social Class: According to UFBA, students are considered to be of low social class (*baixa renda*) when their family income is equal to or lower than five times the minimum wage.

Quota Students: Students who have been accepted through an affirmative action policy that reserves a specific number or percentage of seats aside for applicants who fall under a certain criteria. At UFBA, 45 percent of vacancies are reserved for public school graduates. Among the categories with a reserved percentage of seats, black and brown public school graduates are allotted the highest percentage (36.55 percent), followed by public school graduates of any color (6.45 percent), and public school graduates who have declared themselves Indian (2 percent). For the

purposes of this study, any public school graduate or minority student who has been accepted under the quota program will be referred to as a quota student.

Negro: All students who have identified themselves as black and brown for the purposes of applying to a university under a race-based affirmative action program.

Non-Quota students: Students who applied and were accepted into the university using the general admission criteria.

Pardo: Brazilian students of a mixed ancestry. They typically consider themselves to be brown.

Preto: Brazilian students of African ancestry that are darker in color. They are also referred to as Afro-Brazilian.

Racial Microaggression: Subtle insults (verbal, nonverbal, and/or visual) directed towards people of color, often automatically or unconsciously (Solorzano, Ceja, & Yosso, 2000).

Social Capital: Social capital refers to an individual's ability to secure benefits through familial and extra-familial networks (Simmons, 2013).

STEM fields: Science, Technology, Engineering, and Mathematics (STEM) fields are defined as academic disciplines that include biological sciences, physical sciences, mathematical sciences, computer and information sciences, engineering, and technology (NSF, 2009). This acronym is not used in Brazil. The word *exatas* is used in its place.

Underrepresented minority: For the purposes of this study, underrepresented minorities are racial and ethnic minority groups whose representation in science and engineering majors is smaller than their representation in the general population. In Brazil, black and brown students are now a racial majority. However, due to their scarce presence in the university system and in STEM disciplines for the purposes of this study they are still considered underrepresented minorities.

Upper Social Class: UFBA does not explicitly define what it means to be of upper social class. However, based on the same categories the university uses to classify students, this study defines upper social class as having a family income equivalent to 10 or more times the minimum wage.

Vestibular: Dating back to 1911, the vestibular is the entrance exam used by most universities in Brazil. Each university has their own vestibular and students' composite scores on the exam determine which departments they are able to enter.

Organization of the Study

Chapter 1 details the problem and the context associated with this study. In doing so, I examine the need for minority students in STEM, explain the debate between meritocracy and affirmative action, describe the factors that affect the retention rates of minority students in STEM, and discuss institutional responses to the low success and retention rates of minorities in STEM. Following this section, I outline my research purpose and list my research questions. In the portion titled *A Case for Quota students*, I give a detailed explanation of why quota students were the targeted sample for the study. This is followed by the conceptual framework, an overview of the research design, the significance of the study, and the key concepts and definitions.

Chapter 2 further develops the ideals touched upon in the theoretical framework through a review of current literature. Highlighting each of the salient points, the review includes an explanation of race in Brazil, a general history of affirmative action in higher education and a detailed look at how it is being used in Brazil. Literature which focuses on the specific elements of campus climate, as they relate to the access and retention of minority STEM students, is also reviewed. The chapter closes out with a review of literature on the institutional practices and models that have been used to target minority student achievement in STEM and a summation of the key findings presented in the literature.

Chapter 3 details the methodology and procedures I used to gather the data. I begin the chapter with an overview of the qualitative approaches that were used in the study. This section is followed by a description of the research site, research sample, the sampling criteria, participants' demographic backgrounds and a description of the steps that were taken to ensure the protection of human subjects. The next section describes the three modes of data collection, the process of data analysis, and efforts to maintain quality and trustworthiness. The chapter concludes with a discussion of the role of the researcher and the limitations of the study. This is followed by chapter 4, which reviews the findings from the study. Information from the interviews, observations, and document analysis are synthesized into six broad themes. Chapter 5 contains a summary of the findings and a discussion of how the findings relate to current literature and the conceptual framework. Finally, conclusions are presented as well as implications for policy, practice, future research.

Chapter Two: Literature Review

The following chapter includes a review of literature relevant to the current study. I will begin with an exploration of race in Brazil. The second section will focus on affirmative action. This part of the paper will give a historical context for its use as well as describe why and how it is being implemented in Brazil. The following section focuses on the campus characteristics, policies, and practices that impact minority student achievement in the STEM circuit. The research covered in this area can be disaggregated into four key areas: economic factors, campus climate and cultural congruence, institutional agents, and effective practices in minority STEM success.

Race in Brazil

Brazil has long prided itself on being a multi-hued “racial democracy” (Skidmore, 1972; Htun, 2004; Aubeil, 2011). In contrast to the United States and South Africa where slavery led to bi-polar racial systems and state-supported discrimination, miscegenation was largely practiced (Skidmore, 1972; Htun, 2004; Telles, 2004; Moses, 2010). A discriminatory practice in and of itself, the idea of racial mixing was encouraged by the government and aristocrats as a way to “whiten” the country. Known as the *branqueamento* movement, the large-scale mixing of European settlers with African and indigenous slaves led to a nation where skin tones were as blended and numerous as its people. Though Brazilians argue that they are nation made of one unified race, the country remains profoundly stratified by color. In 1998 the Brazilian Institute of Geography and Statistics (IBGE) reported that when left to their own devices, Brazilians labeled themselves using 143 different racial classifications. “Brazilians are color conscious, and use hundreds of terms to classify one another according to skin tone and other phenotypical traits” (Htun, 2004, p. 64).

The *branqueamento* movement is largely responsible for Brazil's numerous racial classifications as it created a racial hierarchy that placed whites at the apex and Africans at the bottom (Skidmore, 1992). By 1890 the mixed population accounted for nearly 42 percent of the country's total population (Henriques, 2001), creating indistinguishable color lines which made it virtually impossible to enforce racial endogamy (Skidmore, 1972; Skidmore, 1992; Cicalo, 2008). What resulted instead was a dual system of racial inclusion and exclusion where miscegenation encouraged racial mixing while "purification" or increased whiteness became a prerequisite for upward mobility (Telles, 2004). Skidmore (1972) describes the results of the whitening movement as follows:

Socially, the 'whitening' ideology has led Brazilians to promote 'eugenic improvement' by such government actions as the promotion of white immigration and the suppression, at intervals, of African cultural survivals. Both individually and collectively, therefore, Brazilians have sought to 'bleach' themselves in order to approach the white ideal. (p. 4)

In spite of the country's mass movement to create a whiter nation, the widely accepted view of a unified racial democracy created a hostile environment for discussions about the existence of race or the presence of racism in Brazil (Htun, 2004; Júnior, Daflon, & Campos, 2011). Though race was included on the initial census of 1872, the government omitted it as a category between 1890 and 1940. Similarly, while the National Household Survey (PNAD) recorded data on income, education, health, and housing it did not disaggregate by race until 1976. Skidmore (1992) suggests that these omissions were intentional measures to quell conversations on race. "Since there were no data, there could be no discussion of the facts of race relations" (Skidmore, 1992, p. 7).

In 1950, UNESCO commissioned a study to further understand Brazil's success at racial harmony. To the organization and government's surprise, researcher Florenstan Fernando concluded that racism was not only present, but widespread in Brazil (Telles, 2004). More than

two decades later the 1976 National Household Survey offered concrete proof that race was an independent variable in determining life outcomes; thereby suggesting the presence of systematic discrimination. Thus, while Brazil was free from Black Codes, apartheid, and blatant arguments over civil rights, the political, economic, educational, and social systems in the country upheld a type of veiled racism that kept darker Brazilians from gaining upward mobility.

The acknowledgement of racism by the Brazilian government in the 1990's marked a shift which would ultimately lead the country from racial democracy to affirmative action (Htun, 2004; Telles, 2004). "The government admitted that Brazil is racist and endorsed an extreme form of affirmative action – quotas- to address racial inequality" (Htun, 2004, p 61). As noted by Htun (2004), Brazil sought to correct historical injustices by implementing preferential policies in business, housing, and most recently education.

The History of Affirmative Action in Brazil

The first affirmative action policies in Brazil were not directed towards minorities or other historically marginalized groups but were created to protect individuals from the threat of discrimination. The 1943 Consolidation of Labors Laws (CLT) implemented quotas that required two thirds of workers in private businesses to be Brazilian; thereby protecting the nation's workers from being displaced by foreign immigrants. In 1968 a second quota law was created to benefit the sons of farmers. Law 5.465 reserved 50 percent of the seats in high school and in university agriculture and veterinary courses for the sons of farmers. Though these laws are rarely acknowledged as the first affirmative action policies, they largely represent the methods used for modern day policies.

Between the 1940s and 1960s Abidas do Nascimento and other key leaders of the Black Experimental Theatre (TEN), the Democratic Labor Party (PDT), and the Black Movement created

multiple affirmative action bills to address the inequalities Afro-Brazilians faced (Martins et al., 2004; Johnson III, 2008). bill 1.332 (1983) sought to implement quotas which would require government agencies to reserve 20 percent of their jobs for black men and 20 percent for black women. Similarly, bill 3.196 (1984) would require the country's diplomatic training school, the Instituto Rio Branco, to reserve 40 percent of its vacancies for black men and women. Though neither of these proposals passed in congress, Nascimento was one of the earliest politicians to raise the question of race-based affirmative action in Brazil.

The 1990s saw another wave of politicians who advocated for preferential policies that would favor Afro-Brazilians. In 1993, Fernandes sought to increase the number of scholarships available for black children, youth, and adults. That same year, Benedita da Silva fought to implement two quota policies. The first was a policy that would reserve 10 percent of seats in higher education to Afro-descendant and indigenous populations, while the second would increase the presence of black artists and professionals in the media to 40 percent. In spite of the overwhelming support these laws received from the Afro Brazilian Movement, not one of the proposed laws was implemented. Only in late 1990s did affirmative action policies begin to specifically target black and brown Brazilians; making them one of the last groups helped by affirmative action policies (Heringer, 2001; Aubel, 2011). Prior to that point, policies had been established to help the disabled, elderly, homosexuals, women, and individuals who had contracted HIV (Heringer, 2001).

In her study on affirmative action in Brazil, Heringer (2001) noted that between 1995 and 1999 a total of 124 affirmative action programs were implemented. Of those nearly 31 percent of were in education, while 20.2 and 19.4 percent of programs were in employment and human rights respectively (see Table 1).

Table 1. *Distribution of Affirmative Action Programs in Brazil by Field 1995-1999*

Field	Frequency	Percentage
Education	38	30.6
Employment & Income Generation	25	20.2
Human Rights & Advocacy	24	19.4
Information	12	9.7
Culture	10	8.1
Health	3	2.4
Other	2	1.6
No Information Available	2	1.6
Total	124	100

Source: Adapted from Heringer, 2001, p. 15

The proliferation of affirmative action programs was not a direct indicator of increased racial equality. As noted in Table 2, less than one third of programs implemented in 1999 were specifically designed to help black Brazilians. An additional 70 were created to fight racial discrimination and included blacks amongst other populations. Fourteen programs shared the goal of combating racial discrimination, but did so without setting any parameters for racial inclusion (Heringer, 2001). Today, the issue of race-based quotas remains a polemical issue in Brazil.

Though quotas have been used for a variety of groups and reasons, none have garnered as much attention or debate as the implementation of race-based quotas. In 2002, President Cardoso created a national affirmative action program; three ministries introduced quotas for blacks, in hiring; the National Human Rights Program endorsed racial quotas; the foreign ministry introduced a program to increase the number of black diplomats; and three states approved laws reserving 40 percent of university admission slots for Afro-Brazilians.

Table 2. *Affirmative Action Policies by Sponsoring Institution and Targeted Population, 1999*

Sponsoring Institution	# of programs targeting black Brazilians	# of programs not targeting black Brazilians	Total number of programs sponsored
Federal Government	7	5	12
State Government	0	3	3
Municipal Government	3	7	10
NGO	12	27	39
Government/NGO	5	11	16
University	6	11	17
Church	1	1	2
Political Party	4	2	6
Private Sector	1	1	2
Other		2	2
No information	1		1
Total	40	70	110

Source: Adapted from Heringer, 2001, p. 19

While affirmative action policies for women, the poor, and the handicapped have generally gone uncontested, racial quotas have ignited nation-wide debates (González, 2010). First, the use of race-based quotas required Brazilians to recognize racial distinctions and the dichotomous nature of race; where both blacks and browns would become black (Htun, 2004). This helps explain the horror felt by many people toward the idea of quotas and the emotional nature of the controversy generated by affirmative action. “It is not just social policy that is at stake, but the country’s understanding and portrayal of itself” (Htun, 2004, p. 63). Second, students who felt they were displaced because of race-based quotas questioned their legality. In August 2012, the Brazilian Supreme Court ruled that the use of race-based quotas were legal and effective redress to reverse the educational and income inequalities that has existed for centuries. Following the lead of the Supreme Court, President Rousseff signed The Law of Social Quotas. Described as one

of the most aggressive affirmative action policies worldwide (The Economist, 2012), the new law requires public universities to reserve half of their admission spots for minority and economically disadvantaged students within a time frame of four years.

Although affirmative action programs in Brazil are largely characterized by quotas, other methods have been used throughout the years. Described as weak measures, these policies stress equal opportunity as they are often defined as measures that help eliminate segregation (Beckwith & Jones, 1997). In 1993, Friar David Raimundo Santos created Educafro, an organization that offers courses to help poor and black students prepare for the college entrance exams. Additionally, Santos worked with the Catholic University in Rio de Janeiro to offer scholarships, transportation, housing, mentoring, and living expenses to his students (Jonathon III, 2008). Santos' program is credited with helping over five hundred poor and Afro-Brazilian students gain access to a prestigious university that they would not have otherwise had the opportunity to attend (Santos, 2004; Sampaio, 2004).

Programs like Santos' which organized preparatory courses for the entrance exam were widespread throughout the country (Heringer, 2001). However, similar to other affirmative action policies, the programs differed according to the groups they favored. In Rio de Janeiro, affirmative action programs targeted both the poor and blacks, while programs in Sao Paulo were driven by socio-economic factors without recognition to race.

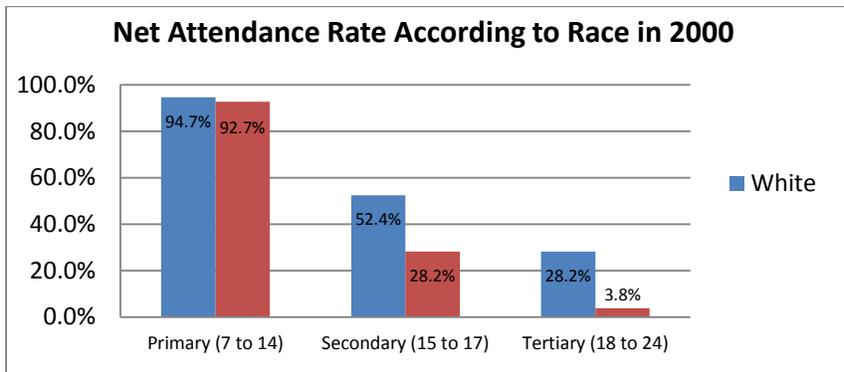
Other weak programs included community activities aimed at promoting the social and academic development of youth through tutoring and vocational activities. The vast majority of these activities were created by community organizations, religious groups, and organizations affiliated with the Black Movement (Heringer, 2001). Additionally, trade unions, NGOs, and private institutions have sponsored programs to encourage entrepreneurship amongst underserved

populations. Aligned with the guides formulated by the Ministry of Labor, these programs offer women, youth, blacks, and the disabled skills in business administration and professional qualification.

Affirmative Action in Higher Education

Although the Brazilian Constitution of 1824 stipulated that all citizens would have universal education, the black and poor were often omitted as they were not considered citizens at the time. “The political elite of the time saw no value in primary education for the underprivileged whether black or white, emancipated or slave” (Aubel, 2011, p. 25). By the time education had expanded to include all members of society inequalities were largely imbedded as part of the educational system. Wealthy students who attend private primary and secondary schools have their education subsidized by the government as they earn coveted spots in the country’s top public universities. In contrast, poor students, who are mostly black and brown, fail to qualify for admission to public universities. The subpar education minority students receive in elementary and secondary school does little to prepare them for the college entrance exams (Guimarães, 2001; Almeida-Filho, 2010; Arajuo, 2011; Aubel, 2011; Júnior et al., 2011). Consequently, higher education in Brazil has been largely composed of rich, white Brazilians. “Access to tertiary education – especially at the most prestigious universities – is skewed heavily toward upper-income families” (Rodriguez et al., 2008, 10). Prior to the implementation of affirmative action programs 97 percent of Brazilian college students were white, while 2 percent were black, and 1 percent yellow (Carvalho & Segato, 2002). The wealthiest 7 percent of the population accounted for 27 percent of college students, while the poorest 40 percent accounted for only 5 percent of college going population (Telles, 2004). In 2000, the net attendance rates for blacks enrolled in colleges represented an even lower percentage of the population at 3.8 percent (see Figure 2).

Noting these facts and other inequalities Castro, as cited in Telles (2004) refers to Brazil as “the world champion in social injustice in higher education” (p. 125).



Source: Adapted from the IGBE National Household Survey (PNAD), 2002

Figure 2. Net Attendance Rate According to Race in 2000

Affirmative Action Models and Participants

Though rarely noted, the first affirmative action programs in higher education were anti-discrimination, nongovernmental initiatives. Dating back to 1994, a Catholic priest worked with the church and other community organizations to offer courses designed to help black and disadvantaged Brazilians pass the college entrance exam (Telles, 2004). A second program named Generation XXI, was founded by Geledés, a black woman’s NGO in Sao Paulo. Funded by Boston Bank, the NGO provided financial and academic support to promising black adolescents until they were able to finish college and enter into the work force.

Considered weak affirmative action programs, anti-discrimination programs persist today. Organizations such as Educafro and the Steve Biko Institute continue to address inequalities in the educational system and the *vestibular* by offering preparatory courses for low-income and minority students. Likewise, universities are addressing issues of access by providing favored students with fee waivers, transportation vouchers, and more flexible scheduling options.

A larger, more consolidated effort by the government took place in 2005 with the creation of the University for All Act (PROUNI). A public policy that seeks to expand the postsecondary

enrollment of low-income students, PROUNI promotes the exchange of scholarships in private colleges and universities for federal tax exemptions. With over 1,200 institutions participating and an average of 120,000 new students accepted yearly, the programs increases the number of low-income and minority students to gain access to higher education. During the 2006-2007 school year, the program awarded 45,037 scholarships to Afro-Brazilians and 174 to indigenous people. In spite of this, many argue that the PROUNI scholarship is yet another example of a weak affirmative action program. The difference in quality between the highly selective public universities and the less selective private universities suggest that although PROUNI recipients gain access to higher education, their educational and economic outcomes will not compare to those students who have been accepted into the public universities. Furthermore, Algebaile (2007) suggests that the greatest increases are in colleges that offer shorter and cheaper programs than full four-year universities.

Although [PROUNI] seems to be an overarching program, the offer to increase has not been accompanied by quality. On the contrary, the increase seems to be related to colleges that offer two-year programs, mainly in the human sciences. The fact that these courses last for two years only and do not require sophisticated infrastructure allows for cheaper fees when compared to traditional courses. (p. 104)

Thus, in contrast to strong affirmative action programs which focus on creating equal results, organizations which employ these methods are primarily concerned with increasing diversity by providing students with equal opportunity.

Since the first program was initiated in 2001, affirmative action within the context of higher education has almost always pointed to the use of quotas. “The concept of affirmative action was then transformed, in the sense that it became associated with the idea of achieving equality of opportunity through the imposition of strict quotas” (González, 2010, p. 124). The first race-based quota policy was implemented at the Universidade de Brasilia (UnB). With 99 percent of teachers and 90 percent of students classified as white, the racial composition of the college was not

representative of the surrounding community (Carvalho & Segato 2002). In an effort to increase social, ethnic, and racial integration, UnB became the first federal university, and the only one in the region, to implement a race-based affirmative action program. The new quota allotted 20 percent of its seats for undergraduate admission to candidates who declared themselves as *negro* or black.

Brazilian universities have developed four variations of social inclusion programs: 1) extra points added to candidates *vestibular* scores – based on public school attendance and racial origin; 2) ethnic and racial quotas, with definition of race by a verification committee; 3) racial quotas, with self-definition parallel to social quotas, and 4) social quotas for public school students, by course, with nested ethnic and racial quotas. When examining the favored populations of the four models above, affirmative action programs can either be racially-assertive or socio-economically assertive.

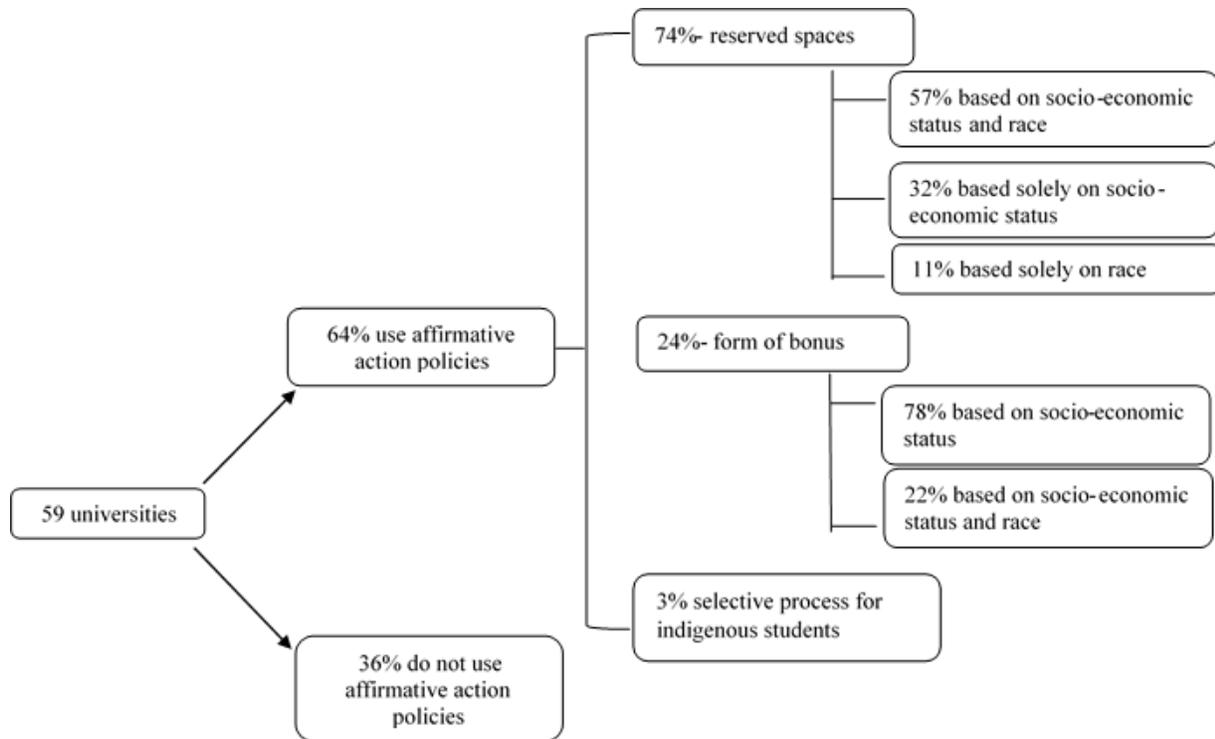
Racially assertive strategies such as the one implemented at UnB, address racial inequalities found in the university admissions system. By advancing race as the most important determinant of student acceptance, UnB suggests that racial inequalities are stronger determinants of disadvantage than socio-economic inequalities and that by targeting ethnic diversity the university will increase access for all. Johnson III (2008) posits that educational attainment is heavily skewed according to race, independent of socio-economic status. “Blacks are twice as likely to have no formal education as whites, who are four times as likely to have advanced degrees” (Johnson III, 2008, p. 216). Others argue that programs of this nature inevitably increase racial diversity, but by ignoring economic status they do not ensure that the most underrepresented students (i.e., black and brown public school graduates) benefit from said programs.

Under racially assertive programs, universities can choose which groups will be favored. In recognition of the historical injustices faced by blacks, *negros*, or students who identify as black or brown are almost always the focus of race-based policies. The other groups that have been included are indigenous students, Asian students (generally referred to as yellow), and *quilombo*³ students. Members of each of these groups have been systematically omitted from university admissions. However, due to the fact that their populations are much smaller in size, the number of vacancies reserved for these groups tend to be much smaller than the number of vacancies reserved for black students.

With socio-economically assertive models the university acknowledges the intersection of race and socioeconomic status but supports the view that students' poverty is more of an obstacle than race in university admissions (Tavolaro, 2008). *The Economist* (January, 28, 2012) noted these same ideals stating, "Brazilians have long argued that blacks are poor only because they are at the bottom of the social pyramid—in other words, that society is stratified by class, not race."

According to Sousa and Portes (2011), 64 percent of Brazil's federal universities (38 of 59) used some form of affirmative action in their selection process prior to the implementation of the law mandating quotas for disadvantaged students (see Figure 3). As demonstrated in Figure 3, 73 percent of universities implementing affirmative action reserved a specific number of vacancies for specific beneficiaries while 24 percent used a bonus-style program.

³ *Quilombo* communities were formed by runaway slaves.



Source: Adapted from Sousa and Portes, 2011, p. 524

Figure 3. *Affirmative Action Programs Implemented at Federal Universities, 2011*

In Bahia, where 75 percent of the state population and 42.6 percent of the student population at UFBA are black or brown, public school graduates are considered the most disadvantaged group. Consequently, while UFBA’s affirmative action policies want to ensure inclusion of black and brown students, they are designed to primarily target lower-income students (i.e., public school graduates). Similarly, Unicamp, which prefers to use a non-quota affirmative action policy, views socioeconomic factors as a larger hindrance to students’ ability to gain university admittance.

By assigning 30 points to the *vestibular* scores of public school graduates and an additional 10 points for black and brown students, Unicamp has found a way to address the systematic differences seen in the *vestibular* scores of low-income and minority students. By design, the *vestibular* consists of 1000 possible points, with a standardized average score of 500 points and a standard mean deviation of 100 points (Pedrosa et al., 2006).

Prompted by the outcomes of an internal study on the academic success of public school graduates, administrators at Unicamp found that the sole use of *vestibular* scores for admittance inhibited graduates from the public school system from gaining admissions. Moreover, black and brown public school graduates were faced with an even larger performance deficit in the admission exam.

Affirmative action programs in higher education have taken two main routes. Weak programs such as scholarships, vouchers, and preparatory courses increase access by creating equal opportunity. Run by NGOs, community organizations, churches, political parties, and universities, program developers determine the beneficiaries, who in most cases are poor minority students.

In contrast, strong affirmative action programs incorporate the use of quotas into the admissions process. Either racially-assertive or socio-economically assertive, universities determine whether black and minority students or low-income students will be favored. Though at least half of all programs (see Table 2) have reservation policies for the minority and low-income students, universities typically identify one group as being more favored than the others. In the event that black and minority students appear more favored (i.e. have a larger number of reserved seats or have additional points added to their *vestibular* score on the basis of race), the school has determined that when applying to a university the students' race is a greater disadvantage than their socio-economic status. Likewise, universities that use socio-economically assertive programs suggest that students' socio-economic status is a greater obstacle than race in university admissions. Understanding the importance of both factors, the Law of Social Quotas mandates that all public universities implement quotas which will reserve 50 percent of their vacancies for public school graduates. Additionally, the universities must assign these spots in accordance with the

racial makeup of the state. Thus, incoming students will be fairly distributed according to socioeconomic status and race.

Opposition to the use of Affirmative Action Policies in Higher Education

Opponents of preferential policies argue that the use of affirmative action in college admissions may contribute to poor minority retention rates in STEM fields. Referred to as the Mismatch Theory, scholars suggest that affirmative action policies allow minority students to be admitted into universities that they are academically unprepared to attend. According to the theory, students who enter the university through preferential policies have poor academic achievement, low self-efficacy, and ultimately drop out as a result of the mismatch between their academic ability and what is required by the university. Contrary to this belief, several studies have noted that attending a highly selective institution can have significant and positive effects on degree completion for minority students (Alon & Tienda, 2005; Bowen & Bok, 1998). In a study of four generations of students at the Universidade Federal da Campinas (UNICAMP), a public university in Brazil, Pedrosa, Dachs, Maia, Andrade, and Carvalho (2006) found that economically and academically disadvantaged students performed relatively better than students from a higher socioeconomic and educational strata. In a comparative analysis of the *vestibular* scores and academic performance of quota and non-quota students across the three campuses, Childs and Stromquist (2014) found that while quota students may perform slightly worse than non-quota students on the *vestibular*, once admitted, their average scores are similar to and at times higher than non-quota students. However, these findings are not always consistent for minorities in STEM. Chang, Cerna, Han, and Sáenz (2008) reported that minority STEM students at highly selective universities were significantly less likely to be retained in their majors than minorities at less selective universities. Additional scholars have corroborated these findings noting that,

“Minority students are leaving science, technology, engineering and math (STEM) disciplines in disproportionate numbers before graduating, because affirmative action may be placing students in rigorous academic settings for which they are not prepared” (Nealy, 2008, para 1). Supporters of affirmative action posit that railroading minority students into less prestigious universities or academic fields further exacerbates the problem affirmative action attempts to fix. By reassigning these students to less prestigious universities opponents are subsequently tracking students into less valued degrees and lower paying careers. Instead of assuming that minority students accepted under affirmative action policies were granted admission for reasons other than merit, Tapia, as cited in Nealy (2008) argues that, “The proper form of affirmative action is to evaluate the evaluation criteria [of admission]. It’s not that the bad students are accepted. It’s that good students are excluded” (para 10).

Preferential policies and affirmative action programs were designed to remedy past and continuous discrimination based on racial identity and gender. According to Ponterotto et al., (1990), “The ultimate goal of such programs is to enable these individuals, through educational achievement, to have greater access to socioeconomic (and concurrent social) opportunity and stability” (p. 6). Despite this goal, many have noted that while affirmative action policies help increase access they do not always ensure equal educational outcomes. Recent data has surfaced which suggests that once admitted, minority students in STEM fields contend with an additional set of obstacles, many of which negatively impact their academic achievement and persistence. For this reason, scholars argue that the recruitment of minority students must be a comprehensive, long-term, institution-wide process that responds to the specific barriers and needs of students (Thomason & Thurber, 1999).

Though quotas have widely increased access, researchers suggest that outcomes may not be as satisfactory as expected. First, there seems to be the assumption that university admission is equivalent to graduation. Carvalho (2006) has contended that quotas, in absence of support (i.e., transportation, housing, subsidized food, medical assistance, and work) do not fully equal the playing field as low income and minority students face additional financial challenges that are not concerns for their peers. Velloso (2009) adds that academic supports may be necessary as students in the hard sciences and more selective fields struggle academically. In order for universities to ensure that they are not only increasing the number of students admitted, but the number of students who persist, they must find ways to address the financial and academic needs of quotas students. Telles (2004) recognizes these same challenges stating:

Quotas represent an important first step in dealing with racial inequality at the university level, although they often do not go far enough. For example, getting black and brown students into the middle class, as should be the goal of these programs, requires programs that can keep these students in colleges; this would require the implementation of programs such as writing assistance, counseling, and financial aid, and after graduation mechanisms to help them land jobs appropriate to their education, which would help them overcome their relatively weak social capital. (253)

A second issue that must be addressed is students' field of study. Students who apply to the university under affirmative action policies disproportionately elect to enter less selective fields (Cunha, 2006; Cavalcanti et al., 2011). This could lead to an oversaturation in less selective fields, while the number of minority and low-income individuals employed in science, technology, engineering, math, and other prestigious fields remain low.

Factors Affecting Minority Student Success in STEM

Economic Factors. Economic factors have long been identified as important predictors of academic success of minorities in STEM fields. Most notably, researchers suggest that the ability to pay for college; Arbona & Novy, 1990; Astin, 1993; Green & Glasson, 2009; Kane, Beals,

Valeau, & Johnson, 2004; Maton, Hrabowski, & Schmitt, 2000), financial aid (Georges, 1999; St. John, 2002; Swail, Redd, & Perna, 2003), and hours of working (Pascarella et al., 1998; Kuh, 2007) influence minority students' success in STEM.

The cost of education is often cited as a key reason leading to racial and ethnic minorities' departure from STEM Fields. Data from Seymour and Hewitt's (1997) study revealed that insufficient financial resources was one of the main reasons that minorities majoring in STEM had higher attrition rates than whites in the same fields. Findings from a study conducted by Eagan et al. (2010) support these ideas as they reported that students with greater financial concerns had lower probabilities of completing a degree in STEM. This is in large part due to the fact that minority students are more likely to come from economically disadvantaged backgrounds than their white peers (Gándara, 2006; Garrison, 1987; Green & Glasson, 2009; Museus et al., 2011).

In Brazil, where public universities are free, many wrongfully assume that the cost of education does not affect the success of minorities and low-income students. Although tuition is covered by the state, minority and low-income students still have various financial issues to contend with (i.e., the costs of books, transportation, food, and housing). "This is especially salient in the case of minority students who are more apt to face unmet need after financial aid assistance and thus may be more likely to seek employment during college" (Tsui, 2007, p. 562). Secondly, for many of these students, the opportunity cost of attending school is high as it equates to wages forgone. "Researchers have revealed that, because of inadequate finances, many minority students in general and in STEM in particular need to have a job to compensate for their school and living expenses" (Museus et al., 2011, p. 59). For those students who decide to balance both work and school, research indicates that working off-campus, particularly for 25 hours or more is negatively associated with academic success (Museus et al., 2011; Pascarella et. al., 1998).

Campus Climate. In the late 1980s Rudolf Moos developed a social model which sought to explain the impact of organizational climates on student development. According to Moos (1986) personal and environmental factors impact students' opinions about their college environment, perceptions of coping responses, and their actual response to said environment. Data from his research further suggested that students' responses to the campus influenced their efforts to adapt to or cope with their environment. Baird (2000) expanded this idea adding the appraisal construct which suggested a link between students' perceptions of the academic and social subsystems on campus and their willingness to integrate into those subsystems. Since that time, several studies have examined the role of campus climate on student success (Cabrera, Nora, Terenzini, Pascarella, & Hagedorn, 1999; Harper & Hurtado, 2007; Museus, Nichols, & Lambert, 2008; Nora & Cabrera, 1996; and Sondgeroth & Stough, 1992). Defined by Bauer (1998) as the "current perceptions, attitudes, and expectations that define the institution and its members," aspects of campus climate are said to be frequently changing. Cole and Espinoza (2008) posit that campus climate is used to 1) determine how students interpret the college environment and 2) explain how their college experiences are related to their academic success.

Research conducted on minorities enrolled in predominantly white institutions (PWI) indicates that minority students are more likely than their white peers to report chillier and less supportive campus climates (Ancis, Sedlacek, & Mohr, 2000; Harper & Hurtado, 2007; Maramba, 2008; Museus et al., 2008, 2011; Nora & Cabrera, 1996; Rankin & Reason, 2005). According to scholars, discrimination and hostile learning environments can lead to lower levels of cultural congruity and a poor perception of the institution (Cole & Espinoza, 2013; Gloria et al., 2005). Negative perceptions of campus climate are connected with lower levels of adjustment, institutional attachment, sense of belonging, and academic success, (Hurtado & Carter, 1997; Nora

& Cabrera, 1996; Pascarella & Terenzini, 2005). Furthermore, minority students who experience chilly or hostile campus climates are more likely to feel discouraged (Fries-Britt, Younger, & Hall, 2010; Grandy, 1994; Maple & Stage 1991; Sondgeroth & Stough, 1992), and consequently have higher rates of departure from the STEM circuit (Bonous-Hammarth, 2000; Grandy, 1998; Hurtado et al., 2007).

Studies on the effects of campus climate on student success have revealed that chilly and unsupportive campuses may hinder the academic achievement of minority students in STEM fields. “URMs are more likely than their peers to perform poorly due to reasons related to campus climate and disengagement” (Eagan, Hurtado, & Change, 2010, p. 5). This is particularly true in STEM disciplines as they are cited for having departmental climates and academic expectations that differ from those found in humanities and arts (Johnson, 2007; Seymour & Hewitt, 1997). According to Seymour and Hewitt (1997), departments and faculty members in STEM disciplines uphold traditionally white male norms. They further noted that these social norms and the negative climates often found in science departments is what ultimately causes students to abandon STEM majors. While these factors are important, recent studies have pointed to a second factor, campus culture, which may also present barriers for minority students in STEM.

In contrast to campus climate, campus culture is defined by Kuh and Whitt (1998) as the “collective, mutually shaping patterns of norms, values, practices, beliefs, and assumptions that guide the behavior of individuals and groups in higher education and can provide a frame of reference within which to interpret the meaning of events and actions” (p. 12). Deeply entrenched in the fabric of the university, these ideals and beliefs are difficult, if not impossible to alter. This can create a problem for minorities coming from cultures that are very different from the normative culture on campus. Past studies have shown that minority students often experience alienation,

marginalization, and isolation from the cultures of PWIs (Davis, 1994; Fries-Britt & Turner, 2002; Green & Glasson, 2009).

Part of the alienation and marginalization minorities' experience can be attributed to the cultural stereotypes they must contend with on campus. Much of the research conducted on minority students at PWIs highlights the fact that persisting stereotypes of minorities being academically inferior can add to the pressure these students feel to succeed (Fries-Britt & Turner, 2001; Lewis, Chesler, & Forman, 2000; Museus, 2008) which can negatively impact their level of engagement and academic performance (Museus, 2008; Steele, 1999).

Cultural Congruence. Cultural congruence is described as the “fit” between the cultural community of an institution and the students it serves. Cabrera and Nora (1994) suggest that universities have two dimensions: an academic and a social dimension. “Students are alienated when they are unable to adjust or fit into either of these two dimensions,” (Cabrera & Nora, 1994, p. 388). According to Gloria and Kurpius (1996), this may be the cause leading to minority and low-income students at cultural incongruence at prestigious universities. Upon entering predominantly white or upper class universities, underrepresented minorities often come across situations that are incongruent with their values and behaviors (Cole & Espinoza, 2008). This is largely due to the fact that predominantly white universities tend to reflect white, middle and upper class, male perspectives. As such, dogma on campus may foster hostile learning situations and discrimination which ultimately leads to minority students' negative campus perceptions and low levels of cultural congruity (Gloria et al., 2005; Gloria, Hird, & Navarro, 2001). This is equally true in STEM fields where departmental cultures such as large class sizes, competitive environments, demanding workloads, and an emphasis on individual versus collective achievement are often at odds with the values held by underrepresented minorities (Seymour &

Hewitt, 1997). The cultural incongruity that results can cause underrepresented minorities in STEM to feel, “isolated, culturally alienated, and unwanted within their academic context” (Cole & Espinoza, 2008, p. 288).

Impact of Institutional Agents. Faculty members and peers have been recognized for playing a critical role in minority students’ ability to connect and integrate into the campus culture. “Probably the most significant element influencing the performance level of many students is their inability to connect to an institutional agent” (Watson, et. al., 2002, p. 78). Weidman (1989) noted that both faculty and peers largely impact the perceptions and experiences of undergraduate students in college, positing that these interactions would lead students to develop negative or positive perceptions of their college experience. Moreover, Eagan et al. (2010) noted that minority students in STEM who connect with faculty and peers through formal research opportunities reported positive academic outcomes. Findings from Pascarella and Terenzini (1991, 2005) and Allen (1986) corroborate this notion as they suggest that relationships with campus agents are the strongest predictor of college success. The following section will review literature that examines the impact of faculty and peer relationships on minority students’ perceptions of campus climate and culture.

Faculty Relationships. Current literature underscores the important role faculty play in predicting the success of minority students in STEM. “Students who foster relationships with faculty members outside of the classroom are more likely to report higher levels of college satisfaction and persist to graduation” (Cole & Espinoza, 2008, p. 286). Thus, faculty members who have provided support, helped to humanize the educational experience, and were proactive in supporting minority students have positively impacted student success. In contrast, faculty who

show subtle forms of prejudice and discrimination towards students may negatively impact minority students' experiences and outcomes.

One challenge minority students in STEM face is finding faculty role models. "Research shows that the absence of minority faculty who can function as role models for racial and ethnic minority students, faculty with insufficient preparation, and faculty who maintain low expectations for racial and ethnic minority students can hinder their success in college" (Museus et. al., 2011, 72). The presence of faculty role models gives students an example of an individual who have successfully navigated the educational system (Cole & Espinoza, 2008). Moreover, Watson et al. (2002) contend that minority students have an easier time trusting faculty members of similar racial backgrounds. "Students want faculty members who will understand their cultural uniqueness. More importantly, students want to connect with a faculty member who can empathize with the pressures minority students face on predominantly white campuses" (p. 77). The lack of same race role models will continue to be a problem as the small number of minority graduate students in STEM fields means that there will continue to be a small number of minority faculty.

The pedagogical approaches of STEM faculty are also said to be influential in student success rates. Research in this area has found that there are four pedagogy-related factors that influence the success of minorities in STEM: 1) small, interactive classes, 2) opportunities for collaborative learning, 3) a diverse and culturally responsive curriculum, and 4) a curriculum rooted in real-world problems. STEM courses have traditionally been conducted as large sized lectures. This has had an adverse effect on the experiences of minority college students (Brown, 2002; Johnson, 2007). Perna et al., (2009) found that minority students in STEM best functioned in smaller, more interactive classes. These environments allow for more collaborative learning in which students have the opportunity to work through problems together while the professor acts

as a facilitator. Cabrera, Colbeck, and Terenzini (2001) posit that collaborative work has a significant and positive influence on success as it fosters the development of professional competencies and analytical thinking. Additionally, scholars have stressed the need for faculty to create a culturally relevant curriculum that is relevant to real-world problems.

Peer Relationships. Peer groups are largely recognized as being a powerful influence on the experiences and educational outcomes of college students (Astin, 1993; Pascarella & Terenzini, 1991, 2005). Research has indicated the importance of involvement in formal and informal activities with peers, suggesting that it is positively associated with college success. Studies by Weidman (1989) and Astin (1993) note that peer groups and interactions with peers play an important role in shaping students' perceptions of their college experience. This is perhaps even truer for minority STEM students whose friend groups have been cited as providing supportive environments (Cross & Vick, 2001; Harper & Quaye, 2007; Museus, 2008). "Research has shown that peers have a profound impact on the experiences and outcomes of racial and ethnic minority college students in STEM" (Museus et al., 2011, p. 74). Interestingly, recent studies suggest that the types of relationships matter, as they can impact minority STEM students in both positive and negative ways. Cole and Espinoza (2008) found that the GPA's of Hispanic students were negatively affected when they were involved in diversity functions and studied with friends. Bonous-Hammarth (2000) attributes findings like these to the fact that minority inclusion in diversity events may interfere with students' academic work and further marginalize them from the cultures of STEM disciplines. On the other hand, when minority students engage in pre-professional clubs in STEM they are more likely to persist (Chang et al., 2008; Hurtado et al., 2007). Fries-Britt et al. (2010) report similar findings noting that minorities who study with STEM-related peers are more likely to succeed.

In that STEM fields lack a large amount of minority, faculty role models, peers can help facilitate minority success by serving as role models themselves (Bandura, 1997; Murphey, 1995; 1996). “When students observe peer role models succeed in STEM fields, they can observe that they have the potential to succeed in STEM as well” (Museus et al., 2011, p. 75). When peers share the same race, gender, or ethnic background the observer is more likely to believe that they are capable of achieving the same task.

Effective Practices in Minority STEM Student Success

In light of recent research on minorities in STEM fields, educational institutions have attempted to provide support for underrepresented students in these academic areas. Programs offer a wide variety of services including summer bridge opportunities, tutoring, mentoring, and financial support. Eagan et al. (2010) reported that, “The presence of these [support] programs make students significantly more likely to complete a STEM degree” (p. 23). This section will describe programs that have had success in improving the academic performance and retention rates of minorities in STEM. While this list is not exhaustive, it does focus on programs which can offer empirical data on their outcomes.

Research Experience. Participation in undergraduate research has been associated with enhanced undergraduate experiences (Tomovic, 1994, Lopatto, 2004), increased interest in STEM fields (Zydney, Bennett, Shahid, & Bauer, 2002), increased student persistence (Ngada, Gregerman, Jonides, von Hippel, & Lerner, 1998), increased rates of graduate education in minority students (Barlow & Villarejo, 2004; Bauer & Bennett, 2003; Eagan et al., 2010; Hathaway et al., 2002). Studies have shown that minority students in STEM benefit from having the opportunity to expand upon what they have learned outside of the classroom. “By strengthening students’ science identity, undergraduate research experiences may make students significantly

more likely to persist to degree completion in their STEM discipline” (Eagan et al., 2010, p. 6). Hackett, Croissant, and Schneider (1992) found that undergraduate research had a strong and positive influence on STEM students’ skills, job values, and life objectives. Likewise, participants in Solorzano’s (1993) study reported that the opportunity to participate in hands-on research with faculty greatly influences students’ persistence and decision to attend graduate school. Similar effects were seen in Ngada et al.’s (1998) study on undergraduate student-faculty research at the University of Michigan. Minority and female STEM students who were randomly selected to participate in undergraduate research had higher rates of retention than their peers. Walters (1997) posits that involvement in student research may also enhance students’ social integration. In joining a research team or working with a faculty member, students are more likely to develop positive relationships with faculty and peers. “Aside from building students’ knowledge and skills, research work with faculty can be beneficial by providing students with an opportunity to interact with faculty outside of the classroom and to develop a basis for a true mentor-protégé relationship” (Tsui, 2007, p. 561).

Exposure to research experiences can help minority students develop their educational and career plans. “Research with faculty may entail such professional development experiences as conference attendance, presentation of one’s work, and publication submission – all of which socializes one to a career in research while strengthening self-efficacy” (Tsui, 2007, p. 561). Paid research work and internships has the added benefit of helping minority students reduce their college expenses. Scholars have touted the benefits of student employment that is associated with the student’s program of study. Jobs unrelated to students’ academic program can detract from students’ studies and academic pursuits, while work within their field enriches student learning. Nora et al. (1996) reported similar findings as off-campus work reduced minorities’ chance of

persisting by 36 percent. In contrast, quality research work can result in long-term professional advantages.

Tutoring. Tutoring is a widely used intervention measure to enhance student performance and persistence. Similar to mentorship, approaches to tutoring can and do vary. Tutors are often upper class students, staff members, or faculty. Research on the effects of tutoring has shown varied results. According to Moust and Schmidt (1994), the majority of studies that compare the academic outcomes of students participating in tutoring programs show no differences between those who take advantage of tutoring services and those who do not.

Several researchers posit that peer led tutoring has advantages for both the student and the peer tutor. Bargh and Schul (1980) noted that in some cases tutors experienced greater academic gains than those who were tutored. Lundberg (2003) further posits that tutoring in science was the strongest predictor of understanding science material.

Bridge Programs. Ackermann (1991) recognizes bridge programs for low-income and minority students as, “an established part of the effort to recruit, retain, and graduate a population of students underrepresented in higher education” (p. 201). While varied in nature, bridge programs typically include intensive academic enrichment that is designed to help students transition and adjust to college life (Tsui, 2007). Tinto (1987) posits that support at this stage is critical as student attrition is highest between the freshman and sophomore year. Pascarella and Terenzini (2005) note that participants in bridge programs are more likely to persist into their second year of college. Data from STEM programs which specifically target underrepresented students reported that residential summer bridge programs were integral to program success (Matyas, 1991). The National Action Council for Minorities in Engineering (NACME) showed a positive relationship between minority retention and participation in a summer bridge program.

Two highly regarded intervention programs in STEM, The Meyerhoff Program and the Minority Engineering Program (MPE), also identified student participation in summer bridge programs as a key factor in their success.

As noted earlier, academic preparation may largely affect student departure. Bridge programs attempt to address educational disparities and decrease minority student departure by narrowing the preparation gap. Minority students' participation in intensive coursework helps to acclimate students to the college campus and ensure that they begin their fall coursework on equal footing.

Mentoring. Mentoring programs are prevalent at universities and are a common intervention approach targeting minority retention. Mentoring is said to address several causes of attrition and help to facilitate students' social and academic integration. Minority Stem students in Hilton, Hsia, Solorzano, & Benton's (1989) study reported that their relationships with scientists and engineers, especially those that were minorities, had a greater influence on their academics than did their relationships with parents, friends, and faculty members. Minority students have reported that having a mentor positively impacts their adjustment to college and progress towards graduate studies in the field (Lee 1999; Tsui, 2007). Additional studies have found that minority participants in mentor programs have had higher grade point averages, increased self-efficacy, more defined academic goals, and lower rates of attrition (Schwitzer & Thomas, 1998; Thile & Matt, 1995, Tsui, 2007).

Mentoring can be both formal and informal. According to research, natural or informal mentoring is said to produce better outcomes than more structured, formal mentoring programs (Davidson & Foster-Johnson, 2001; Gándara, 1999). In an attempt to capitalize on this, several intervention programs have built in elements such as cohorts and community building, which

foster informal mentoring relationships with peers and program staff. Research on programs that lack a structured mentoring component posit that minorities and female participants are less likely to find mentors. Jacobi (1991) noted that the shortage of female and minority faculty members in STEM presents another obstacle for minority and female students seeking mentorship. The lack of strong, same member, same gender mentorship can have lasting effects as minorities participating in mentor programs with female faculty or faculty of color are said to have more positive attitudes towards research (Frierson, Hargrove, & Lewis, 1994), and are more likely to pursue graduate studies (Gándara, 1999). Lee (1999) found that race or gender consistency between mentors and students was less important than having a mentor in the same career field.

Projeto Tutoria, a mentoring program at UFBA, began in 2002 and was designed to “stimulate the creation and/or continuity of projects aimed at promoting access and retention of students who have historically been underrepresented at Brazilian universities” (Barreto, p. 6). On the heels of affirmative action, this program noted the importance of not only increasing access for quota students but retaining them as well. Consequently, the goals of the program were to 1) create academic trajectories which would lead to graduation and attendance at graduate school; and 2) reduce the cultural gap that hinders students from adapting to the implicit and explicit cultural norms of the academic environment. Data from the program showed that student participants had improved academic performance, valued the supportive culture of the program, and had higher feelings of self-efficacy.

Although extremely popular, research on mentoring programs is limited. Gándara (1999) posits that data regarding the success of mentoring programs may not be conclusive as mentoring relationships can vary, leading to greater within group differences than between group differences.

Financial Support. Intervention programs geared towards minority participants often recognize the importance of providing financial support. Georges (1999) reports a positive and significant relationship was found between students' average financial aid awards and minority retention rates. A report from the U.S. Department of Education (2000) noted similar findings as receiving financial aid from school was positively linked to degree completion in science and engineering majors. In a study conducted by the U.S. General Accounting Office, an award shift of \$1,000 from scholarship aid to loan reduced the probability of graduation by 17 percent.

Due to the fact that science, engineering, and mathematics degrees often take longer to complete than other college majors, financial aid also takes on added importance in retaining students in those programs (Barton, 2003; Fenske, Porter, & DuBrock, 2000). The National Action Council for Minorities in Engineering ranks the availability of adequate financial resources as one of the top five factors that influences minority students' persistence in engineering (Landis, 1985).

Key stakeholders in higher education and affirmative action have come together to create additional resources for quota students. Understanding the financial constraints many of these students face, UFBA and other public universities have implemented several initiatives aimed at reducing students' financial burden. First, a significant number of night courses have been added, allowing more flexible schedules for students who have to work. Institutions have earmarked additional resources as more scholarships are being offered. In addition, financial support to offset the cost of living expenses, transportation, and the cost of food are available to low-income students.

Integrated Approaches. Scholars researching the academic achievement and persistence of minority students in STEM have noted that the practices listed above work best in an integrated approach. The NACME (see Matyas, 1991) reported that exemplary minority programs in STEM

address academic and attitudinal barriers. Furthermore, the report posited that among other things, successful programs should contain:

- Assistance with student matriculation (i.e., financial aid, academic advising, orientation)
- Academic support services (tutoring, study skills training)
- Linkage of students with program specific minority student organizations
- Summer program-related work experience

Programs that take integrated approaches have shown long lasting success. The Meyerhoff Program, Minority Engineering Program (MEP), and the Mathematics Workshop Program have all had empirical data to substantiate their effectiveness.

Located at the University of Maryland Baltimore County, the Meyerhoff Program was designed to address minority STEM students' needs in four key areas: (1) knowledge and skills, (2) motivation and support, (3) monitoring and advising, and (4) academic and social integration. High achieving minority students are accepted into the program that includes a summer bridge component, a four-year comprehensive merit-based scholarship, academic advising, summer research opportunities and a mentoring component. In addition, regular group meetings and a shared residence hall for freshman has been touted for helping the program develop a family-like program community. Data collected from several cohorts revealed that when compared with students who chose not to enter the program; participants earned higher grades, graduated with degrees at a higher rate, and had a higher rate of graduate school attendance (Tsui, 2007). In her study with twelve Meyerhoff scholars, Fries Britt (1998) concluded that the program fostered a family-like environment where high achieving minority students were surrounded by a large number of minority students working towards the same goal. This consequently helped students feel less marginalized and isolated.

The Minority Engineering Program was founded in 1973 and has since been replicated at more than 100 universities. MEP programs are known for having the following key components:

- Strong linkage with the engineering department on campus
- Pre-college and community college outreach
- Targeted focus on freshmen and sophomore students
- An emphasis on cooperative learning
- Learning communities
- Establishment of study centers
- Academic support services (i.e. tutoring, summer bridge, SI, academic advisement)

Data on MEP shows that program participants are retained in engineering at higher rates than non-participants. Minority participants showed even greater gains as their retention rates exceeded the overall group of engineering students (Landis, 1988). Good, Halpin and Halpin (2002) reported that the higher retention rates of African American MEP students were associated with a greater sense of connectedness to the engineering community.

Though these results are promising, Richardson (1994) posits that they are not systematic. The implementation and program effectiveness of MEP programs vary. In examining MEP programs at 20 different campuses, Morrison and Williams (1993) found that the most successful programs had strong recruitment, provided summer bridge opportunities, had high levels of faculty support, offered study centers and tutors, and received high levels of institutional funding.

The Mathematics Workshop Program was designed as an honors program that fostered group learning. In addition to placing emphasis on academic enrichment the program offers support services including counseling, monitoring of students' academic progress, and assistance with navigating the university system (Clewell, 1989). Evaluation of the program showed that participants were more likely to earn higher grades and persist in the program (Fullilove & Tresiman, 1990). Minority student participants showed greater gains, outperforming non-workshop minority, white, and Asian students. Similar models adopted by other universities have

reported higher grades among program participants, lower rates of course repetition, and greater persistence rates in STEM (Alexander, Burda, & Miller, 1997; Moreno & Muller, 1999).

Brazil Afroatitude was a nationally funded scholarship program implemented in ten universities. Each of the programs accepted 50 students who were given scholarships, research opportunities, monitoring, and the opportunity to work on science projects geared at preventing the spread of STIs and AIDS. Program participants were black students who had been accepted into the university under the quota program. Though comprehensive in nature the program had mixed results. Some students became more engaged in their work and were asked by professors to continue work on various research projects. Other students asked to withdraw from the program, suggesting that the funds were not enough to cover their needs and that they would be better off working outside of the college.

Discussion of Literature

A diverse and educated STEM pool is essential for nations wishing to compete in the global arena. Traditionally dominated by upper social-class, white men, STEM fields have been virtually inaccessible to minorities and women. Those students who have entered the field find themselves confronted with a variety of obstacles which ultimately affect their academic achievement and persistence. A review of literature on minority student achievement and persistence in STEM was conducted to gain a better understanding of factors that are critical to students' success. The literature reviewed for this study can be separated into three areas: 1) the use of affirmative action as a method of increasing access, 2) the manner in which campus climate and institutional factors affect minority STEM student success, and 3) effective practices used to combat the obstacles minority students in STEM face.

The use of affirmative action in university admissions has traditionally been researched in U.S. institutions. Despite years of study, researchers acknowledge that in these universities it is difficult to determine who has been admitted through the use of preferential policies and to track the progress of those students accordingly. The lack of available data on the academic performance and retention rates of students admitted through preferential policies in the U.S. has only helped to fuel the debate over the use of affirmative action. Opponents argue that allowing ill-prepared students to enter college creates a mismatch between the students and the university. Recognizing the importance of strong affirmative action policies and the ability to track to students admitted under such policies, this study will examine the institutional and personal experiences of students who have been admitted under the quota system in a public university in Brazil. Moreover, as studies continue to note the small presence and low success rates of underrepresented minorities in highly competitive fields such as STEM, this study seeks to understand what institutional factors affect the academic performance and persistence of quota students in STEM. Finally, the literature has shown that although strong affirmative action policies such as quotas are concerned with equal results, beyond admittance, little is done to ensure equal outcomes. By identifying the obstacles quota students in STEM face and the support services available to these students, the current study will examine the role institutional factors play in guaranteeing equal outcomes.

Recent literature has pointed to the fact that students' perceptions of campus climate and institutional agents have a direct impact on academic outcomes (see for example Farley, 2002; Gloria and Ho, 2003; Parker, 1999). While there are several studies that examine the impact of campus climate on the academic achievement and persistence of minorities in STEM, there has been no research which examines the role of campus climate on the academic achievement of quota students. This group differs from the traditional minorities researched in two ways. First,

students admitted through quotas are often openly identified as such. Tension regarding the use of affirmative action can create a campus environment in which quota students are even further isolated and discriminated against. Secondly, while studies in the U.S. tend to examine all minorities without regard to their socio-economic status, the affirmative action policies in public universities in Brazil have reservations for minority students and low-income students. Future studies on institutional factors and quota students will inevitably examine their relationship between a students' socio-economic status and their educational outcomes. This research will be increasingly significant as affirmative action policies in the U.S. shift from race-based policies to class-based alternatives.

The last section of literature reviewed focused on programs which have successfully targeted the academic, social, and financial needs of minority STEM students. While the obstacles minority STEM students face are numerous, the programs designed to combat these obstacles often isolate one or two issues to be addresses. In designing support programs for quota students in STEM, universities must take a comprehensive approach that addresses students' financial, academic, and social needs. Furthermore, many of the programs being used today lack empirical data of their results. Once implemented, institutions must find ways to collect data on the programs and student outcomes.

The growing need for a diverse pool of applicants in STEM fields has caused universities to look for new ways to attract and retain underrepresented minorities. Higher education institutions have implemented various forms of affirmative action to help increase access. Brazil - with its use of racial and social quotas has responded aggressively to the inequalities present in higher education. With three years remaining to meets its goal of 50 percent minority and low-income enrollment, universities truly interested in equal outcomes must broaden their focus to

include both the enrollment and retention of quota students. In order to reach their goal universities need to examine the impact of institutional factors on quota students' academic achievement and persistence.

Chapter Three: Methodology

This chapter will provide an in-depth description of the research methods I used to conduct this study. I will begin with a rationale for the selection of qualitative methodology for this study. This will be followed by a specific explanation of the methodological approach. Next, I will provide a rationale for and description of the site and sampling strategies. Following sections will include data collection and data analysis procedures. Finally, I will describe methods for ensuring design quality, frame the role of the researcher in the qualitative process, and describe the limitations of the study.

Research Design and Methodology

Qualitative Approach and Rationale. Studies on students' perceptions of campus climate are complex and warrant personalized explanations. In order to examine the institutional and individual contexts surrounding this issue I used the following questions to guide my study:

- 1) What factors affect the academic performance and persistence of quota students in STEM fields?
- 2) To what extent does campus climate, as measured through the academic-related experiences of quota students in STEM majors affect, their academic performance?
- 3) What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ?
- 4) What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?

Research questions in qualitative studies typically begin with words like, *how*, *why*, or *what* (Creswell, 2007; Hesse-Biber & Leavy, 2011). As outlined above, my central question asks, "What factors affect the academic performance and persistence of quota students in STEM fields?"

In addition, I explore questions which asks, “What barriers do quota students in STEM face after admission and how do faculty and student perceptions of these barriers differ? These research questions were designed to gather rich and thick data that would provide a greater understanding of the experiences of quota students in STEM fields. According to Hesse-Biber and Leavy (2011) the aim of qualitative research is to extract “the social meaning people attribute to their experiences, circumstances, and situations” (p. 4). As such, this study fits the characteristics that lend themselves to a qualitative approach (Crewsell, 2007; Patton, 2002; Yin, 2009).

Qualitative research embodies investigative methods such as ethnography, naturalistic observation, interviews, and participant observer research. These methods emphasize the importance of looking at variables in the natural setting in which they occur. Consequently, studies seeking to analyze students’ experiences and views largely rely on qualitative methods.

Ethnographic Approach. Approaches to qualitative research can be separated into three categories: (1) post-positivist, (2) interpretive, and (3) critical (Hesse-Biber & Leavy, 2011). Interpretive approaches such as ethnography focus on extracting meaning from subjective experiences and small-scale interactions. In particular, ethnographic research aims to acquire a holistic understanding of how individuals make sense of their lived reality. According to Creswell (2007), ethnographers examine the interactions between individuals and groups in natural settings in order to detect patterns such as life cycles, events, and cultural themes. “Ethnographers are researchers who ‘go inside’ the social worlds of the inhabitants of their research setting....recording the ongoing social life of its members by providing ‘thick descriptions’ of the social context and the everyday activities of people who live in these worlds” (Hesse-Biber & Leavy, 2011, p. 193). The emphasis on culture and the revelation of what occurs in that culture sets ethnography apart from other methodologies.

Ethnography allows the researcher to understand social reality from the participants' perspective. DeMarrais and LeCompte (1999) posit that ethnographers who take a critical approach to inquiry do so under the assumption that both empowered and disempowered groups coexist in the same school system. Consequently, critical ethnographers seek to uncover invisible hegemonic practices that perpetuate injustices and societal inequalities. "[Ethnography] unmasks hegemony and address[es] oppressive forces" (Crotty, 1998, p. 12). The present study of STEM quota students in a public university in Brazil seeks to understand how institutional factors impact the achievement and persistence rates of students admitted under preferential policies. Through detailed inquiries and in-depth observations, I examined the various elements of campus climate and the unique relationships that ensued. In doing so, I was able to identify empowered and disempowered groups. Observations of the interactions between the two groups helped shed light on microaggressions and other hegemonic practices that impacted quota students' academic and social growth. "Ethnography's great power lies in its depth penetration of a topic or area: it yields explanatory insights into the reasons why people, groups, and organizations act as they do, and how conflicting social forces are resolved" (Adler & Adler, 2011, p.17).

I used the ethnographic approach because it allowed me to integrate the voices of my participants while emphasizing their perceptions and experiences (Mertens, 2005). Moreover, the use of naturalistic observation provided an opportunity to explore a "range of activities that may even remain unconscious to your participants" (Hesse-Biber & Leavy, 2011, p. 197). In ethnographic studies such as these, the researcher is the key instrument in the data collection process and is responsible for describing and interpreting the observations of the group (Mertens, 2005). Aligned with these goals I collected data through observation and demonstrated reflexivity through my field notes and peer-debriefing.

Case Study Approach. Case studies provide an in-depth, holistic understanding of a problem, complex issue, or phenomenon (Creswell, 2007; Yin, 2009; Hesse-Biber & Leavy, 2011). Cases can be institutions, programs, events, or individuals in a society, and case study research typically investigates one or a few cases. The holistic nature of the case study approach makes it a preferred method in research dealing with issues of social justice. “Because the case is investigated from many different angles and pays attention to many dimensions of the issue, case study is typically able to avoid the kinds of essentialist and context-free analyses that have historically been harmful to disempowered groups” (Hesse-Biber & Leavy, 2011, p. 256). The specific context of this study focuses on the experiences of quota students majoring in STEM fields at a public university in Brazil. As opposed to examining the experiences of just one student, multiple cases were used to examine the larger phenomenon of the institutional and personal experiences of quota students in STEM (Hesse-Biber & Leavy, 2011). Thus, the experiences of each individual quota student, faculty member, and administrator served as distinct cases. Quota students majoring in STEM were selected on the basis of race, gender, classification⁴ (i.e. first semester, second semester, third semester etc.), and the type of quota under which they were admitted (i.e. black public school graduate, public school graduate, etc.). This design allowed me to examine the differential perceptions of campus climate and differing degrees of academic success among quota students. Interviews with faculty and administrators added to the research as it allowed me to incorporate their perceptions of quota student success in STEM fields and the obstacles they believed students face. I used this data to conduct within case and cross-case analysis.

⁴ Brazilian universities and students do not classify students according to their year (freshman, sophomore, junior, senior). Instead, registration status is referred to by semester (first semester, second semester, etc).

Researchers using a case study approach often use more than one method of data collection (Creswell, 2007; Hesse-Biber & Leavy, 2001; Merriam, 2009; Patton, 2002; Yin, 2009). The researchers' choice of method largely depends on the related research questions and the case. Interviews, oral history, ethnography, and document analysis are common amongst researchers conducting case studies. This study included in-depth interviews, observation, and document analysis. A description of these methods will be provided later in the chapter.

Ethnographic Case Study. A case study is not a research method. "Case study is a decision about what is to be studied, not a methodological decision" (Hesse-Biber & Leavy, 2011, p. 255). Therefore, case studies must be tied to a specific methodology. Ethnographic case studies use a combination of ethnographic interpretation and case study techniques in order to analyze and interpret the unit of study (Merriam, 1998). As opposed to typical ethnographies, ethnographic case studies explore narrower fields of interest and can be conducted over shorter periods of time. Simons (2009) posits that ethnographic case studies are "observations over time in a natural setting within a bounded system" (p.22). The purpose of which is to gain thick descriptions of the context and have a greater understanding of the case in relation to theories of culture (Simons, 2009).

An ethnographic case study was the most appropriate methodology for this research because it meets each of the following criteria:

- **Observation in a natural setting:** A naturalistic setting and observation in the field are critical to this study as I sought to understand how different factors impact quota STEM students' perceptions of campus climate, academic success, and rates of persistence. In addition to using in-depth interviews, participants were selected for close observation on the university campus. I shadowed these students in and outside of class as they proceeded through their day. Their interactions with faculty and peers added an additional layer of depth to my understanding.

- A bounded system: The cases for this research were students who were admitted under the quota system and majoring in STEM disciplines. Although the study included data from faculty and administrators, the focus of the study centered on the perceptions and lived experiences of quota students majoring in STEM.
- A close-up description of the context: Demographic information (i.e. age, gender, racial identification, etc.), students' grades, and other pertinent data was collected and used to offer an in-depth description of each student.
- Understanding of the cases in relation to theories of culture: A review of literature has revealed that pre-college experiences, campus climate, faculty-student relationships, and several other institutional factors impact minority students' success and persistence in STEM fields. I have used the information from current literature to guide my research design.

Research Site

This study took place at the Universidade Federal da Bahia (UFBA). Having approved the use of affirmative action policies in 2004, UFBA has had race and class based quotas for ten years. During that time, the university has implemented various programs to assist students admitted through the quota program. The university's long standing affirmative action policies and related institutional supports make it an ideal site for this study. Additionally, UFBA has expanded its STEM programs and was listed as a top participating university in the Scientific Mobility Program.

UFBA's mission is to promote the production of knowledge and culture, and form people with the ability to understand and transform reality. While the University states that it was, "a pioneer in enabling access through the quota policy," it acknowledges that they continue to face challenges related to the persistence of at-risk students and those who are from lower socio-economic levels (UFBA, 2013, p.8). "Despite all of the difficulties, there have been some

important advances in 2013, a significant increase in the number of grants and aid, and the expansion of resources to student assistance at UFBA,” (UFBA, 2013, p. 8).

UFBA is a middle-sized university with approximately 36,000 students and around 7,990 undergraduate vacancies yearly. Located in the state of Bahia, the area is known for having the highest concentration of blacks and the lowest levels of educational attainment (Góes, 2011). In 2004, 61 percent of students who passed the *vestibular* had already declared themselves to be black or brown (Guimarães et al., 2010). While there was already a high enrollment of Afro-Brazilians, the university acknowledged that access remained limited as the bulk of accepted black students were private school graduates and were concentrated in courses of lower prestige (Guimarães et al., 2010). Due to the fact the 2004 rate of participation for public school graduates was only 38 percent, and that less than 20 percent of blacks were enrolled in high prestige courses such as medicine and law, the university sought to implement a dual-criteria selection process, taking both socio-economic status and race into account.

The quota system at UFBA reserves 45 percent of their vacancies for public school graduates (see Table 3). Among the categories with a reserved percentage of seats, black and brown public school graduates are allotted the highest percentage (36.55 percent), followed by public school graduates of any color (6.45 percent), and public school graduates who have declared themselves Indian (2 percent). The remaining 55 percent of vacancies are open to all candidates regardless of school, ethnicity, or color. These spots are awarded on the basis of students’ *vestibular* scores, with the highest scores given admission first.

Table 3. *Category Descriptions and Percentage of Seats for the Quota System at UFBA*

Category	Description	% of seats allotted
A	Public school candidates who declare themselves black or brown	36.55
B	Public school candidates of any ethnicity	6.45
C	Private schools who declare themselves black or brown	N/A
D	Public school candidates who have declares themselves Indian descendants	2

Source: Adapted from UFBA, 2005, p. 2

In 2005, when the quota system was first implemented, UFBA had only one main campus in Salvador. The following year the Universidade Federal do Recôncavo was created, expanding the university's applicant pool with additional campuses in Barreiras, Victoria da Conquista, and later campuses in Cachoeira and Santo Antonio de Jesus. The current study was conducted at the Ondina campus in Salvador. The Ondina campus is the university's main campus and home to the majority of the STEM disciplines including the physics, chemistry, engineering, biology, and mathematics department. In addition, the main campus houses common gathering places for students including the library and two university cafeterias.

Though everyone understood the need for greater diversity at the university level, many argued that the implementation of the quota system would allow unprepared candidates to be accepted into the university. In their study on the affirmative action policies at UFBA, Santos and Queiroz (2010) noted that faculty members against the quota system argued that, "the students in the quota system will find it difficult to study in the universities because the public schools are not good" (763). Because allowances may be made for quota students in terms of their entrance exam scores, the assumption is that they are less likely to perform well once admitted into the university. Data on the 2005 cohort suggests that these assumptions may be wrong.

Data collected by UFBA suggests that quotas do not weaken the university's competitiveness. According to the university, 80.3 percent of all candidates selected for admittance in 2005 were selected by their academic performance, regardless of school origin, ethnicity, or race (UFBA, 2005). Of the 3,986 candidates selected for admission in 2005, 52.5 percent (2,104) graduated from private high schools. Out of the 1,882 public school graduates who gained admission, 1,098 had *vestibular* scores high enough to gain admission without the use of the quota system. The remaining 41 percent (784 out of 1,882) of students admitted under the quota system would not have gained admission in the absence of quotas. Therefore, the quota system remains necessary and beneficial as a significant number of candidates would be excluded in its absence.

The academic performance of admitted quota students does not confirm expectations by critics that quota students will be unable to perform well at the university level. Data collected from the 2005 cohort at UFBA indicates that once admitted into the university, quota students performed as well as or better than general admits. According to Santos and Queiroz (2010), this occurs because black students have confidence in themselves and their abilities. "Black students who enter the university through this [quota] system tend to positively affirm themselves as black as well as individuals" (Santos & Queiroz, 2010, p. 764). It is important to note that quota students' academic performance is not consistent across majors. On average, quota students majoring in humanities and arts have stronger academic performance than quota students majoring in STEM fields. In 2012, 30.8 percent of quota students enrolled at UFBA had superior academic performance⁵. Of the quota students with high academic performance, 52.8 percent majored in philosophy and human sciences whereas only 11.9 percent of quota students with superior

⁵ Superior academic performance is defined as having a grade point average of 7.7 on a scale of 1 to 10.

academic performance majored in math, physical science, and technology (Nascimento & Pereira, 2014).

With a high enrollment of black students and an increasing number of underrepresented poor students (i.e. public school graduates) being admitted, the university is an ideal location to study students admitted through racial and socio-economic quotas. Moreover, UFBA is listed as one of the top Brazilian Institutions participating in the Scientific Mobility Program. Thus, the university's continued growth in STEM fields makes a study on the success of quota students in STEM both important and relevant.

In the 2013 academic year, UFBA had an average of 34,262 students enrolled. Among them 25,546 were traditional day students and 8,716 were enrolled in the evening programs. In 2011, 41.6 percent of students admitted attended a public university. Recent data suggests that now more than 50 percent of students are admitted yearly through quotas, with preference given to minority public school students who come from families with an income equal to or less than 1.5 times the minimum salary (Bastos, 2014).

UFBA's quota system was created to ensure a more diverse and racially representative campus. While opponents of quotas argue that the university is lowering its standards, data from the first cohort shows that both the average *vestibular* scores and average grades of quota students are comparable to non-quota students. The gap in many of the math and science fields suggests that the university needs to implement some sort of support programs to help quota students in need of a stronger foundation in math and science.

Research Participants

Participant Selection. Participant selection is an important characteristic of qualitative research (Creswell, 2007; Hesse-Biber & Leavy, 2011; Yin, 2009). Researchers using qualitative

methods are often interested in selecting a purposeful sample. Though various procedures can be used, a purposeful sample requires researchers to select participants that will be most effective in answering the research questions. Snowball sampling was used with participants that may be reluctant to talk to or hard to locate. This procedure relies on the researcher's personal networks and the referrals they may provide (Hesse-Biber & Leavy, 2011). For this reason, I used relationships I have developed with faculty and students as a point of entry into the university. The faculty members and students introduced me to students and additional faculty who met the defined criteria and qualified for participation in the study. Students who agreed to participate were also asked to identify friends who might also be interested in taking part in the study. Each informant was given a recruitment flyer (see Appendix A) that they could share with potential participants. Additional flyers were posted in the halls of the physics, chemistry, and engineering buildings.

One of the most important elements of purposeful sampling is the criteria used to select participants. Criteria-based sampling requires a pre-established list of attributes that participants in the study must possess (Goetz & LeCompte, 1984). The sample population consisted of undergraduate quota students majoring in STEM fields, graduate students, STEM faculty, and support services providers in the university. For my undergraduate student participants, I focused on ten subjects who were admitted under the quota program and enrolled in one of four STEM fields at UFBA (chemistry, computer technology, mechanical engineering, and physics). Of the ten students selected, six participants were female and the remaining four were male. The racial breakdown of undergraduate student participants were as follows: 4 black (*preto*), 5 brown (*pardo*), and 1 yellow (*amarelo*). In addition to the undergraduate student participants, I conducted formal interviews with two graduate students in STEM, three faculty members, and one support

service administrator. I also conducted informal interviews with the coordinator of mechanical engineering and the coordinator of the Center for African and Asian Studies (CEAO). An explanation of the criteria used for selection is described in the subsequent section.

Selection Criteria

1. Participants must be currently enrolled at UFBA's Ondina campus and must have been admitted into the university as a quota student.

Past studies that have examined the academic success and persistence rates of minorities in STEM have focused on racial and ethnic minorities. The racial composition of the site and the unique context of higher education in Brazil have prompted the use of an alternate sample population. In an effort to examine the most marginalized and underrepresented groups, the participant pool for this study consisted of students who gained admission under the university's quota program. Aligned with the university's race-based and socio-economically based policies I sought to include students in the following categories: black students admitted under the quota policy and public school graduates admitted under the quota policy. As opposed to merely assigning students as quota students I sought to examine which particular quota they were admitted under. I did not want to assume that because of their shared identity as quota students that they shared the same experiences. Although all of the students in this study were public school graduates, they had different racial identifications which may have impacted their perceptions of campus climate and other factors that affect their academic performance and persistence.

2. Participants must be pursuing a degree in one of the campus' STEM fields.

This study was specifically tailored to students majoring in one of the STEM fields below (see Table 4). The production of STEM majors has become increasingly important as nations seek

to compete in the global arena. An increasingly diverse student pool has drawn attention to minority student performance and persistence in the hard sciences and math. Preliminary data on the academic performance of quota students has also targeted this as an area of concern. While quota students in other academic fields have been able to “catch up” and compete with their non-quota peers, the academic performance of quota students in STEM continues to lag behind. Due to snowball sampling undergraduate student participants came from one of four STEM disciplines: chemistry, computer technology, mechanical engineering, and physics.

3. Participants’ gender

As noted earlier, underrepresented minorities are often grouped together because of their shared minority status. Crenshaw (1989) posits that the same occurs with gender and race as there is a tendency to treat the two as mutually exclusive. Griffin and Reddick (2011) further this notion suggesting that the grouping of identities “misses important distinctions in how membership in multiple identity groups can affect how people are perceived and treated” (p. 3). By acknowledging students’ gender, I employed intersectional analysis, designed to distinguish the different perceptions participants have based on their multiple identities.

4. Participants’ registration classification (first semester, second semester, etc.) was considered to cover different levels of college permanence

Tinto posits (2012) that what matters is “not simply attending college, but completing a degree” (p. 1). Research has shown that institutional attrition is highest in the first year and declines with time (Tinto, 2012). For that reason many retention and student support models focus on first and second year students. In that this study’s conceptual framework is rooted in retention theories, students in the beginning stages of their degree, as well as students further along in the process were targeted for this study. Quota students in their 1st through 4th semesters will

undoubtedly have different experiences, perceptions, and needs than students who are successfully matriculating in the same fields. Having the opportunity to interview students at various points in their matriculation helped to highlight the different obstacles they faced and the different types of support that are needed as students progress through the program.

5. Faculty and administrators included in the study must be vested at the University and work in a STEM discipline.

This study sought to target faculty members who have worked at the university for ten or more years in a STEM discipline. Since the quota policy was implemented in 2005, faculty who have worked at the university prior to that time may be better able to comment on how the implementation of the policy has impacted minority enrollment in STEM fields. In addition, these faculty members may also be able to speak to smaller changes that have occurred within the department or the classroom to help ensure the academic success of quota students.

6. Support Services Administrators should be key personnel (director, assistant director, program manager, etc.) in the designated office and have access to information and documentation about the program.

Table 4. *STEM Majors at UFBA - Salvador Campus, 2013*

Chemical engineering (PF)
Chemistry (L/B)
Civil engineering (PF)
Computer engineering – night (PF)
Computer science (B)
Computers (L)
Control engineering & process automation – night (PF)
Electrical engineering (PF)
Geophysics (B)
Information systems (B)
Mathematics (L/B)
Mechanical engineering (PF)
Physics (L)
Science and technology (BI)
Statistics (B)

Note: Professional formation (PF) or training degrees take 4-6 years to complete an offer professional training in students' field of study. Bachelor's degrees (B) take between 4-6 years to complete. Students with these degrees can enter into the professional field or go on to obtain an advanced degree.

Source: UFBA SGC-SIAC/SSOA, 2013

Eighteen participants were included in this study. Formal, semi-structured interviews were conducted with 10 undergraduate STEM students, 2 graduate students in STEM disciplines, 3 STEM faculty members, and 1 program administrator. In addition, two informal interviews were conducted: one with the coordinator of mechanical engineering and a second with the Director of the Center for Afro-Oriental Studies (CEAO). The following includes detailed information about the institution itself and participant biographies in order to contribute to the comprehensive case descriptions.

Student Participants

All ten of the undergraduate participants interviewed were admitted under the public school quota. Although nine of the ten students identified themselves as black (4) or brown (5), only one student acknowledged that he was admitted under both the public school and racial quotas.

I conducted interviews with three students from each of the following majors: chemistry, physics, and mechanical engineering. I also interviewed one student who had originally majored in computer technology, but after her third semester, she transferred out of the major, choosing to pursue an interdisciplinary bachelor's degree in humanities and arts. Because she is no longer a quota student in a STEM field, I opted to conduct only the first interview with her.

There were a total of six female and four male undergraduate students interviewed (see Table 5). Students ranged in age from 17 to 23 and their matriculation status ranged from the 3rd to 8th semester.

Table 5. Undergraduate Participant Demographics

Participant	Name	Gender	Age	Race	Major	Year Entered	Matriculation Status
1	Akacia	Female	17	Preto	Chemistry	2013	3 rd Semester
2	Rosa	Female	23	Preto	Chemistry	2013	3 rd Semester
3	Leandro	Male	23	Pardo	Chemistry	2013	3 rd Semester
4	Paula	Female	18	Pardo	Computer Technology	2012	4 th Semester
5	Alex	Male	23	Pardo	Mechanical Engineering	2011	6 th Semester
6	Beatriz	Female	21	Pardo	Mechanical Engineering	2011	6 th Semester
7	Etienne	Male	23	Amarelo	Mechanical Engineering	2011	8 th Semester
8	Luan	Male	21	Pardo	Physics	2011	8 th Semester
9	Ruth	Female	22	Preto	Physics	2011	5 th Semester
10	Cecilia	Female	20	Preto	Physics	2011	8 th Semester

Note. Students' matriculation status is dependent upon the number of classes they successfully pass.

Chemistry

Akacia. Akacia is from the island of Itaparica, Bahia, just across the water from Salvador. She is 17 years old, preto, and entered the university in 2013 through the public school quota. A chemistry major, Akacia attributes her initial interest in the field to her high school courses where she found herself taking a liking to math and science. After doing some independent research, Akacia settled on chemistry because she decided she likes to analyze formulas and was interested in the type of work chemists do.

Akacia attended the Colégio Estadual Democrático Jutahy Magalhães. Compared to other public high schools in Bahia, her school had a “good structure.” What was missing was quality and well trained teachers. Akacia described how a shortage of teachers meant that she had teachers certified in one subjects teaching classes in another.

In Akacia's opinion, the use of quotas are a fair and just way to deal with inequities between the public and private school system. She remarked that quotas are necessary in order to give public school students a real chance at entering the public university system.

Rosa. Rosa is from Salvador, Bahia. Age 23, she is *preto*, and entered the university in 2013 under the public school quota. Rosa graduated from the Colégio Estadual Luis Pinto de Carvalho public high school. There, she had a professor who sparked her initial interest in Chemistry. Rosa suggests that due to the lucrative job market for engineering she had actually considered chemical engineering first. However, Rosa decided that it was more importante to do what she loved, which was "pure chemistry," than to choose a major based on the money she could make.

When asked her thoughts about the quota system Rosa also suggested that it was an important tool to help give poor students access to public universities. She noted that it was impossible, almost inhumane, to compare the education public school students received to that of private school students. According to Rosa, private school students are exposed to every subject needed to enter the university whereas public school students receive only a portion of those same courses.

Leandro. Leandro is from Salvador, Bahia. He is 23, *pardo*, and entered the university in 2013 under the public school and racial quota. Leandro graduated from the Colégio da Polícia Militar, which has a reputation for being one of the best public schools in the state. Leandro suggests that the school's reputation is much better than the actual level of education they provide. In spite of diminishing standards, Leandro recalled having good chemistry professors and said it was one of the subjects he performed better in. Leandro's encouragement from his professors and early success in the field led him to select chemistry as his major.

When asked his thoughts about the quota system, Leandro suggested that the use of quotas has advantages and disadvantages. The advantage of the affirmative action policy was that it allowed students, like him, who didn't have a privileged education, gain admittance into the public university. At the same time, Leandro cites the government's unwillingness to fix the secondary public education system as a major disadvantage.

Computer Technology

Paula. Paula is from Salvador, Bahia. She is 18, *pardo*, and entered the university in 2012. Paula attended Colégio Estadual Thales de Azevedo public high school, which she recognized as being one of the best public schools in Bahia. In spite of being one of the leading public schools, Paula notes that the school still had many weaknesses. Like several other students, Paula noted that the teachers, specifically in mathematics, were not well qualified.

Paula began majoring in computer technology but after her third semester transferred to the interdisciplinary bachelors program in humanities. Paula's decision to major in computer technology stemmed from a strong interest in mechanical engineering. She felt that mechanical engineering was interesting as it included various areas and subjects. Undecided about what area to study, Paula simply picked a major when taking the *vestibular* and passed. Paula says she liked the program but left because she was having difficulty adapting to the level of work required in the math and science classes.

Paula has mixed feeling about the use of quotas. She recognized that private school students have a natural advantage when it comes to college entrance exams, but notes that the use of quotas does not work to improve public education. She further commented that while the public school quotas are fair because they help address deficiencies inherent in the public school system, racial quotas are unfair as everyone has the same capacity independent of skin color.

Mechanical Engineering

Alex. Alex is from Salvador, Bahia. Age 23, he considers himself *pardo*, and entered the university in 2011 under the public school quota. Alex attended Augustine Alfredo public high school, which is not a highly ranked public school in the area. In spite of this fact, Alex noted that the teachers always encouraged and supported the students. He recalled being drawn to engineering because of the broad number of areas it covers and the positive job outlook associated with a degree in engineering.

When asked about the use of the quota system Alex commented that the quotas are a great opportunity to give access to students. He recognized that students graduating from public schools do not have the foundation needed to enter the university. In spite of being in favor of quotas, Alex noted that giving students access does not solve the problem of poor basic education. Consequently Alex does not think the quotas will have a long-term, positive effect on basic public education.

Beatriz. Beatriz is from Camaçari, Bahia. She is 21, *pardo*, and entered the university in 2011. Beatriz attended the Escola Tecnica Federal, which is largely recognized as one of the best public schools in the state. She credits the school for sparking her interest in engineering. Prior to entering high school Beatriz had intended on majoring in business or accounting. After being exposed to engineering courses and labs she quickly changed her mind.

When asked her opinion about the quota system Beatriz commented that the system is beneficial but has a few flaws. First, the use of quotas gives access to students who normally would not have a chance to enter a public university. Although Beatriz has benefitted from the implementation of quotas she questioned how much the quotas were really working to change things. According to Beatriz, a significant number of students entering the university through the quota system are coming from a few selective public schools.

Etienne. Etienne is from Salvador, Bahia. Age 23, he is the only student who does not identify himself as *preto* or *pardo*. Although his complexion is nearly identical to Paula, Etienne considers himself *amarelo*. This distinction suggests that he is not dark enough to consider himself brown, but his features are not fair enough to be considered white. Etienne entered the university in 2011 under the public school quota. Etienne attended the Colégio Estadual Thales de Azeveno, which according to him, is typically ranked in the top three public schools in Bahia. In spite of continuously being ranked one of the top schools in the state, Etienne acknowledged that the academics at the school had been slowly declining. According to Etienne, this decline was largely due to a poorly structured curriculum and a lack of qualified teachers. Similar to other students he reported having teachers who were not certified in the subjects they taught.

Etienne's interest in mechanical engineering stemmed from a long-standing interest in math and science. He recalled being a young child and questioning how different machines worked. From a very young age, Etienne had aspired to be a scientist.

When asked his views on the use of quotas, Etienne suggests that they are needed but acknowledges that they are in no way perfect. He agrees with the use of quotas because of the inequities between public and private education. At the same time, Etienne recognizes that some private schools are just as bad as the public schools. Students attending these private schools pay for their education thinking they are getting better quality when they are not. Because the quota favors public school students, the students attending the poor quality private schools are at a disadvantage. While the system is unfair to students who attend poor quality private schools, Etienne suggests that there simply is not enough room to accept all of the applicants and without the quota system almost no poor students would be admitted.

Physics

Luan. Born in São Paulo, Luan's family moved to Xique Xique, Bahia when he was three and to Salvador when he was 13 years old. Luan is currently 21 and considers himself *pardo*. He entered the university in 2011 through the public school quota. Having graduated from Raphael Serravele high school in Pituba, one of the best public high schools in the state, Luan felt that his high school teachers were knowledgeable of the subjects they taught.

Luan asserted that he always had a deep interest in science. From a young age, he was curious and excited about the environment. When Luan entered high school he was exposed to different types of science courses and realized he wanted to learn even more. By his third year, he had a professor who felt really taught well. Being in that class fueled his passion to study physics. When asked about his perceptions of the quota system Luan suggested that the system has many defects, but that quotas are needed because without them public school students have little chance of entering the university.

Ruth. Ruth was born and raised in Salvador Bahia. She is 22, *preta*, and entered the university in 2011 through the public school quota. Ruth graduated from high school in 2009. At the time, her high school, Mario Augusto Teixeria da Freitas was one of the best high schools in the state. Ruth suggested that she had a good high school but because of teacher strikes, her schooling was greatly interrupted. Consequently, there were many gaps in her education.

At first, Ruth was hesitant about exploring a career in science. She enjoyed the subject, but because of her poor performance in her high school math classes she thought it was unrealistic to pursue a degree in STEM. A physics teacher in her third year of high school encouraged Ruth to follow her passion and let her know that she could be successful in STEM. According to Ruth, it was because of his encouragement that she decided to major in physics.

When asked her thoughts about the quota system, Ruth responded that although the use of quotas reduces the number of private school students admitted to universities it also helps poor public school students enter the university with a bit more dignity.

Cecilia. Cecilia is from Salvador, Bahia. She is 20 years old, *preta*, and entered the university in 2011 through the public school quota. Although Cecilia went to private elementary and middle schools, she attended the public high school Mario Augusto Teixeria da Freitas. Cecilia also noted that this was one of the better high schools in the state. One of the things that made the school competitive was the fact that unlike many of the other public schools, the teachers at Teixeria da Freitas were trained in the areas they taught. Cecilia noted that in many public schools teachers trained in one subject would be required to teach classes outside of their area of expertise.

From the moment she was first introduced to the subject, Cecilia has always loved physics. She enjoyed examining things that happen in nature and manipulating numbers. Now that Cecilia has entered the field, she realizes that what she really wants to do is teach.

In Cecilia's opinion, quotas are needed to assist low-income students in gaining access to public universities. She described a huge disparity between private and public education. One in which public school students are not prepared at all to enter the university. Cecilia goes on to say that as a result of their poor public education at the primary and secondary level, many poor students are forced to look for private colleges with more relaxed admissions processes.

Graduate Students, Faculty, and Staff Participants

Junior. Junior is 28, *pardo*, and is from Lauro de Freitas. Currently a doctoral student in chemistry, Junior first entered the university in the second semester of 2006 under the public school quota. Junior graduated from Colégio Estadual Bartolomeu de Gusmão public high school, which

was the only public high school his town had at the time. As the only public high school in the area, it was relatively large and well organized. Complete with sports teams and a laboratory, Junior described it as a very good school. Upon completing high school, Junior recalled that he was not interested in taking the *vestibular* and applying to the university. At his mother's insistence, he took a prep course but did not pass the *vestibular* the first time he took it. The following year he enrolled in a prep course offered by an NGO in his hometown and passed the *vestibular*, gaining admittance to the university.

Junior became interested in chemistry only after graduating from high school. Although his high school had math and science facilities, it was not until he took the second prep course when he met a chemistry professor that he identified with. Because of the relationship they developed and the teacher's encouragement, Junior selected chemistry as a major. Similar to others, Junior considered changing his major to chemical engineering or mining engineering but once his classes began he knew that chemistry was the right field for him.

Having entered the university only one year after the quotas were initiated at UFBA, Junior sees them as much needed. According to Junior, quotas are an attempt to recover the damage from the public schools. He noted that in the past the public school system was quite good but now only students with no money and no other option end up there. Recognizing the disparity between the level of education in the public and private school, Junior suggests that the very presence of the quota system has helped to motivate students who once thought it was impossible to enter a public university.

After graduating with his undergraduate degree, Junior continued at the university and entered the Master's degree program in chemistry. In 2013, he defended his Masters and is now in his third semester as a doctoral student.

Raphael. Raphael entered UFBA in the first semester of 2009 and graduated with a bachelor's degree in computer technology in 2012. A *branco*, private school graduate, Raphael did not enter the university under the quota program but rather as a general admit. He is currently pursuing an advanced degree in computer engineering and teaches undergraduate math courses at the university.

As an undergraduate student, Raphael served as a monitor and initiated his own basic math course that was free for students during the semester break. Raphael recalls seeing a need for supplementary math instruction. He started the course to help students with the *vestibular* but soon found that public school students, both outside and inside of UFBA began attending the class. Raphael suggested that this course and others like it are a necessity as public school students come with huge gaps in basic math.

Professor Cassio. Professor Cassio has worked at UFBA since 2010, but has worked in the university system for a total of seven years. During his tenure at the university, he has primarily worked as a professor and researcher. A faculty member in the physics department, he is *branco*, young, and actively involved with students.

Professor Cassio stated that his opinion of the use of quotas has shifted over the years. In the beginning, he was concerned the quota system would not ease discrimination. Now, he agrees that affirmative action is important but is worried that these actions will become permanent policies as opposed to temporary solutions. According to him, the government must address the real issue, which is the poor quality of primary and secondary public education.

Professor Sergio. Professor Sergio is *preto* and has worked at UFBA for thirty-two years. During this time, he has served as the deputy director of the chemistry institute, the deputy department chair, and has served as the coordinator of the graduate program on three occasions.

Professor Sergio currently teaches classes and mentors graduate students in the chemistry department.

Professor Sergio has mixed feelings about the use of the quota system. He stated that quotas were beneficial in the sense that they give access. However, Sergio noted that the bad thing about the use of quotas is that in some form there will always be discrimination against the students who entered under the quota system. He described how being a quota student is almost always associated with being black, poor, or from a lower social class.

Professor Dirceum. Professor Dirceum is *branco* and has worked at the university for seventeen years. In that time he has served as a faculty member in the chemistry department, the director of chemistry, and the vice president of the office of student assistance. Having worked closely with the office of affirmative action, Professor Dirceum sees the quotas as much needed. While they have already helped to increase access he suggests that further supports are needed to ensure positive student outcomes.

Protection of Human Subjects

I developed my procedures for data collection and analysis in accordance with the guidelines established by the University of Maryland's Institutional Review Board (IRB). As described in the guidelines I explained the goal and purpose of my study to all participants and made them aware of the fact that they could opt out at any point during the study. Students and faculty selected to participate in the study were given a written consent form (see Appendices B-E). At this point participants were informed that the study had only minimal risks and at no point were they required to answer questions that made them feel uncomfortable. Information regarding the students' rights and role in the study was provided in their native language.

The present study included individual interviews and participant observation. Interviews were audiotaped with the participant's consent and conducted in a location that was comfortable for the participant. All information provided in the interview will be kept confidential. The interviews were recorded using a digital recording device. The interviews were then be placed in a password-protected folder on my personal computer. In addition, each participant was allowed to create a pseudonym of their choosing or had one assigned for them.

Data Collection

This study used a demographic questionnaire, in-depth interviews, participant observation, and document analysis as modes of data collection.

Demographic Questionnaire. At the start of each interview session, I asked participants to complete a brief demographic survey. Using questionnaires from similar studies as my base, I captured basic information about the student's age, race, and secondary education (Appendix F-G).

In-depth Interviews. Interviews are often used as a method for generating data related to a research problem (Roulston, 2010). A preferred method when trying to understand peoples' experiences (Silverman, 2005), data from interviews can assist the researcher in understanding the complexity of the phenomenon under investigation. I conducted semi-structured interviews in order to explore minority STEM students' perceptions about campus climate and institutional factors that may affect their academic achievement and persistence. The use of semi-structured interviews allowed me to investigate individual students' perceptions and experiences while using a consistent framework (Miles & Huberman, 1994). Moreover, this style afforded me the flexibility to omit, add, or alter interview questions as needed. By allowing the interviewees

responses to guide the direction of the interview, I was better able to grasp how participants make meaning of the experiences they describe (Merriam, 1998).

Undergraduate student participants were interviewed twice. The first set of interviews lasted between 19 and 110 minutes in length, with the average interview lasting 40 minutes. Interviews with students began by having the subjects recall their secondary education and college going experiences. Students were asked questions like, “Think back to the high school you attended. Can you tell me a little bit about the school and how well you feel it prepared you to enter college?”, “When and how did you decide you wanted to major in (say specific subject area)?” and “Under what quota program did you enter the university?” This introductory section was followed by questions related to how students experienced the campus and the various obstacles quota students face as they pursue their degree. Questions from these categories include, “How are quota students viewed and treated on campus?” “What barriers or obstacles do you think quota students face in completing their degree?” and “What types of programs or services does the university have to help quota students with their academic needs?”

The second set of student interviews were shorter in duration averaging 25 minutes each. These follow-up interviews asked students to describe the climate within their major and inside of the classroom. These questions examined students’ relationship with faculty and peers as well as the need for and presence of support services on campus. Sample questions included, “Which students participate most in class?” “How would you describe your relationship with teachers,” and “How would you describe the feeling of community within your major?”

Faculty, administrators, and graduate students were interviewed only once, with interviews lasting approximately 35 minutes each. After describing their position and history of work at the university, faculty and administrators were asked to give their general thoughts about the quota

program and quota students. This was followed by a line of questioning related to campus climate. Questions from this section included, “In what ways does the university make quota students feel like they belong here?” and “Why might quota students have a difficult time fitting in?” These questions were followed by questions that examined faculty/administrators perceptions about the barriers quota students face and the services available to them. Sample questions included, “What do you think is the biggest challenge quota students face?” and “what institutional supports are available to help quota students with these challenges?”

Two graduate students were included in the study. One student had successfully matriculated through the chemistry department as a quota student and was now pursuing a PhD at the university. He was asked similar questions as the undergraduate participants but as also asked a modified line of questioning that included items such as, “What factors helped you graduate?” and “What difficulties did you encounter after graduation?”

The second graduate student was interviewed because of his role in the creation of a free remedial math course offered to students at the university. Due to the fact the student had not entered the university under the quota system, the questions he was asked were directly related to the program he created and the students it served. Sample questions included, “Talk about the basic math course you created. Why did you start this program?” “What type of students typically attended the class?” The complete set of interview protocols and guides can be found in Appendices H through O.

Participant Observation. Participant observation was the second method for data collection in this study. Using data gathered from the semi-structured interviews, I asked permission to shadow two of the participants while they were on campus. These observations took place while students were on campus and were designed to capture the students’ “typical day.”

The observations lasted up to five hours and followed students in both academic and non-academic settings on campus.

I elected to follow students who voiced opposing views and experiences during the interviews. The first student I observed was Etienne, an older male student enrolled in mechanical engineering who was in approaching the end of his academic career. He was the only student participant who did not consider himself brown or black, and expressed feeling discriminated against in the field during his first few semesters. The second student, Akacia, was the youngest and was only in her third semester at the college. A chemistry major, she considers herself black and is the only student I interviewed who has yet had to repeat a class. By observing these students on the campus setting, I was able to better explore the ways in which their experiences were similar and different from the other students interviewed. Furthermore, observing students with different demographic backgrounds helped me understand how the intersectionality of their age, gender, race, and socio-economic status affected their perceptions of the campus climate.

I used a variety of field notes while collecting my data. In the formal classroom setting, I used thick descriptions to capture the design and structure of the class, as well as the faculty to student and peer-to-peer interactions. Hesse-Biber and Leavy (2011) note the importance of sensory observations and recording exact words and phrases as “something you thought was unimportant may in fact be crucial once you fit some of the pieces together” (p. 216). In addition, theoretical notes and observer comments as personal reflections were used (see Appendix P).

Using the literature and interviews as my guide, I paid close attention to students’ actions, discussions, and expressions as they helped to highlight students’ feelings about the campus, faculty, and their programs. In addition, I sought to examine the interactions between students and faculty, and students and their peers. In watching these interactions, or lack thereof, I was able to

gain useful data about the role faculty and peers have in quota student performance and persistence. Furthermore, observing faculty members' and peer reactions to quota students helped me determine how others' feel about them and how these feelings can create a warm or chilly environment for students.

Data Analysis. According to Merriam (1998), data analysis should be ongoing during the research process as it allows the researcher to condense large amounts of information into a more manageable format. I first used the conceptual frameworks discussed earlier in this chapter to help provide a structure for the questions and data analysis. Using the literature as my guide, I used pattern matching to compare an empirical pattern with a predicted one. In addition, I used cross-case synthesis to establish a pattern amongst themes that were not present in the framework. This technique allowed me to treat each case as a separate study, comparing them for similarities and emerging themes.

I used a digital recorder to collect the data from each interview. As interviews were initially conducted in Portuguese, my interpreter transcribed each interview verbatim, for a total of 202 transcribed pages. Interviews were transcribed within a week of the initial interview. After reviewing and translating the interviews, member checks were conducted in which participants were given the opportunity to review the transcript themselves. Clarifying and probing questions were asked during the second interview.

Constant Comparative Analysis Process. Merriam (1998) posits that coding occurs at two levels. The first includes identifying notations that helps the researcher access the interviews, field notes, and related documents, whereas the second level consists of interpretive constructs related to the analysis. Data analysis is commonly referred to as “the process of making sense out of the data” (Merriam, 1998, p. 178). Using a constant comparative analysis design, I began by

conducting multiple reads of the interview transcriptions and organized the data into meaningful categories. Beginning with the first interview, I started the analysis by identifying noteworthy responses and categorizing them into salient themes. I then compared the transcript from the second interview, extracting responses that fit into those same themes and identified additional themes that were not present in the first, but were equally important as they corresponded with the main research themes. I continued this process until all of the transcripts were compared and a master list was created reflecting recurring patterns and regularities (Miriam, 1998). After creating a master list of responses, general themes such as, “Pre-College Experiences and Outcomes” were further disaggregated into more specific categories including, “Educational Inequalities,” “Inadequate Preparation to Enter the University,” and “Early Interest and Exposure to STEM.” Using both my conceptual framework and research questions throughout the analysis process, the most salient themes from participant interviews were: Pre-College Experiences, Parental Expectations and Involvement, Campus Climate and STEM Classroom Environment, Barriers to Graduation, College Outcomes, and Institutional Responses.

Convergent and Divergent Thematic Analysis. Although data was collected and coded on the basis of convergence, I examined divergent ideas, beliefs, and perceptions found in the data as well. Participants’ multiple identities and the complexity of the phenomenon being studied, make an examination of the convergent and divergent themes a critical component of the research design and the interpretation of the results. As opposed to assuming that quota students’ shared identity implies that they have similar experiences, an analysis of divergent themes stressed the importance of understanding how students’ experience vary according to race, gender, classification, or socio-economic status.

Cross Case Analysis. In order to bring breadth and depth of understanding I used multiple cases within a single institution. Therefore, the institutional and personal experience of being a quota student in a STEM field was traced through the in-depth study of ten quota students in STEM fields. Yin (1994) suggests that the use of multiple cases can strengthen the external validity of results. “The evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as being more robust” (Yin, 2003, p. 46). Aligned with purposeful sampling, cases must be selected so that they (a) predict similar results or (b) predict contrasting results. Because I was interested in both the convergent and divergent perspectives quota STEM students have about the campus climate and factors that affect their success, the use of a multiple collective case study design with a cross-analysis was a logical methodological approach (Creswell, 2007; Yin, 2003; Yin, 2009).

Data Quality

All research is concerned with producing valid and reliable data. Miriam (1998) posits that this is increasingly important for scholars in education as “the applied nature of educational inquiry makes it imperative that researchers and others have confidence in the conduct of investigation and in the results of any particular study” (p. 199). Yin (2003) argues that data quality should not be limited to simplified standards of validity and reliability but rather include tests for construct validity, internal validity, external validity, and reliability. The following section will describe the various tactics I employed to increase the credibility and trustworthiness of my data.

Construct validity refers to the degree to which a test measures what it claims to be measuring. The “subjective” nature of case studies often makes it problematic for researchers to address issues with construct validity. Yin (1994) proposes three remedies to address this issue: using multiple sources of evidence, establishing a chain of evidence, and allowing key informants

to review a draft of the case study. Yin (1994, 2003) documents six sources of evidence: documentation, archival records, interviews, direct observation, participant-observation, and physical artifacts. The current study used three of the six modes. Documentation was used to view institutional data on support services offered to students. In addition, I used data the monitoring program at UFBA and high school rankings to support students' reflections about the high schools they attended and the quality of education within these schools. Collectively, these documents were used to add further insight or corroborate the data collected through one of the other modes (Yin, 2003). In addition to documentation, I used the interviews with students, faculty, and administrators to better understand participants' views on campus climate and how various factors impact student success. Yin (2003) holds that interviews are an essential source for case studies because they allow events to be reported and interpreted through the eyes of well-informed respondents. Finally, direct observations of participants were conducted. These observations added new dimensions for understanding the context and the phenomenon being studied. Hesse-Biber and Leavy (2011) contend that the use of multiple sources fosters greater triangulation. By looking for convergence in multiple sources, I enhanced the validity of the research results (Hesse-Biber & Leavy, 2011; Mertens, 2005).

Internal validity is more commonly tested in experimental and quasi-experimental studies in which the researcher is trying to determine whether one event led to another (Yin, 2003). In the context of case studies, internal validity is often extended to the broader problem of making inferences. "A case study involves an inference every time an event cannot be directly observed. An investigator will 'infer' that a particular event resulted from some earlier occurrence," (Yin, 2003, p. 36). According to Yin (2003) viable tactics include pattern matching, explanation

building, addressing rival explanations, and using logic models. I used pattern matching to help ensure better internal validity of the study.

Pattern matching compares an empirically-based pattern with a predicted one (Trochim, 1989). An extensive review of literature on the use of affirmative action policies, campus climate, minority student achievement in STEM, and types of institutional support services has been used to inform this study. I used the information from the literature review to cross reference against the data retrieved from documents, interviews, and observations. “If patterns coincide, the results can help a case study to strengthen its internal validity” (Yin, 2003, p. 116).

External validity is the extent to which the findings from one study can be generalized and applied to another (Mertens, 2005; Yin, 1994, 2004). Yin (2003) argues that as opposed to survey research which relies on statistical generalizations, case study research relies on analytical generalizations. Replication logic and multiple-case design are used to increase external validity. The design of this study called for interviews with multiple students sharing similar demographic backgrounds. This use of multiple cases allowed for cross-case analysis. Similar or corroborating data from the various cases provided strong support for the external validity of the study (Yin, 2003).

Researchers argue that in order to be useful, data collection instruments must be consistent (Mertens, 2005). As such, the goal of reliability is to minimize the errors and biases present in a study (Yin, 2003). According to Yin (2003), the best way to ensure reliability is to operationalize as many steps as possible. In addition to including a detailed description of the methodology and steps in data collection, I also conducted member checks and engaged in peer debriefing. After I transcribed the interviews and assigned codes to important themes, participants and other key stake holders were invited to read the documents and offer their opinions and points of clarification.

This process helped to confirm the accuracy of the transcription and suggested themes (Glesne, 1999; Lincoln & Guba, 1986). Likewise, peer debriefing allowed me to get unbiased feedback and insight from a graduate student who was unaffiliated with my research.

Role of the Researcher and Reflexivity

In qualitative research the investigator is the primary instrument for gathering and analyzing data (Merriam, 1998). In order to challenge issues of subjectivity and bias, researchers must be reflective in their work. Reflexivity requires the researcher to be conscious of the manner in which their background (i.e. gender, race, age, level of educational attainment etc.) and experiences influence their collection and understanding of the data (Krefting, 1999; Lincoln & Guba, 1985). In the following section, I will describe how my personal experiences led to my interest in the study and how these experiences and my role as the researcher may impact the study.

In 2009, I was working as the director of the Predominantly Black Institutions (PBI) grant at a college in Brooklyn, NY. As part of my role, I directed and led a summer study abroad program to Salvador, Bahia. Partnering with the Center for Black and Asian Studies (CEAO) at UFBA, I was pleased that 16 students would be able to attend classes in one of the most culturally rich and diverse areas in Brazil. While the vast majority of people we encountered on the streets and in the area we resided in were clear descendants of African slaves, the number of black and brown faces diminished significantly when we stepped on campus. This led me to question why, in an area that is predominantly black, were so few minorities present in the university system. The research I conducted as a result of my initial inquiry fueled my interest in studying higher education in Brazil.

As a black woman who has worked in education for over a decade, I have a strong interest in issues of access. My interest in issues surrounding educational inequalities and past experiences

working with academic and social programs used to support minority students fueled my interest to undertake the current study.

Limitations

One of the inherent limitations in case study research is the fact that the findings are not generalizable (Merriam, 2009). As such, I do not suggest that the experiences and perceptions of the ten cases sampled accurately reflect the entire pool of STEM quota students, but rather offer an in-depth understanding of the unique context, concepts, and processes found in these cases (Creswell, 2007; La Rossa, 2005). It is equally important to note that none of the cases represented night students or students admitted into the BI program. Consequently, I acknowledge that the sample may not accurately represent students in these programs as their profiles differ from traditional daytime students (Claro et al., 2014). Finally, the fact that there were no first semester students interviewed may also be considered a limitation. Research shows that the first year of college is critical to student success and that student attrition is highest between the first and second year. Therefore, students in their first semester may have had vastly different views about the campus climate, STEM climate, and the obstacles they have encountered while at the university.

In qualitative research having in-group status may be an advantage (Creswell, 2007). When participants view the researcher as an outsider they may be less trusting. This can negatively impact data collection as participants may be more guarded about sharing their true experiences and perceptions. My identity as a black, female, graduate student helped me build rapport with participants. Furthermore, my physical appearance and familiarity with the area, the university, and the culture led many of the participants to initially assume that I was from Bahia or at the very least that my parents were Bahianos. Prior to conducting my study, I had already been to Bahia about six times. This, along with the aforementioned factors immediately gave me in-group status.

“When the researcher is perceived as a ‘community insider’ it is more likely that people would readily reveal information that they would not have disclosed to outsiders,” (Filep, 2009, pg. 63).

I often began my interviews speaking about the similar challenges black and low-income students in STEM faced in America. In addition, I let participants know that the Supreme Court in America ruled the use of quotas illegal. I explained that this attributed to my interest in gaining a better understanding of how the system in Brazil worked. Many students identified as Afro-Brazilian or black and as such, viewed us as having a shared racial identity. This in part, increased their willingness to open up to me. Additionally, some participants viewed me as a near peer, as I am a black student who has successfully matriculated through the university system. Similarly, female participants were willing to give me their honest opinions on the basis of our shared gender.

While my status as a black female graduate student allowed some participants to feel closer to me, there were times when participants thought I could not understand or relate to their struggles because I was an American. Although some participants were aware of the racial inequalities that exist in the American educational system and the on-going fight for increased access for minorities in higher education, they did not view me as having had a similar experience. This is in large part due to the fact that the public schools in America are thought to be of a much better standard than the public primary and secondary schools in Brazil.

A second issue I had to contend with as an outsider was not being fluent in the participants’ native language. Portuguese is the native language in Brazil. Though there are some, particularly at the university level, who speak English, the vast majority of participants in this study had limited English proficiency. For this reason, all interviews were conducted in Portuguese. Since I am not a native speaker, I used the assistance of an interpreter. This had two implications on the study. First, the participants had to engage with a second person, whose identity may have also impacted

the study. The interpreter I chose was an Afro-Brazilian woman from Bahia who was not a student at the university but had close ties to the school. Having graduated from a public school in Bahia, her primary and secondary educational experiences were similar to that of the participants. As my interpreter completed high school more than a decade before the quota was established, she was unable to gain admission to a federal university. In spite of this, her racial background, youthful appearance, and educational experience gave her in-group status.

Another issue I have to acknowledge is that even with the use of an interpreter there remained a chance that certain nuances may have been lost in translation. When students spoke of their high schools and the neighborhoods in which they lived there was certain contextual knowledge that I did not have. While my interpreter knew right away the reputations their schools and neighborhoods had, I did not. If I had more information about the schools and neighborhoods I may have been better prepared to ask follow-up questions. Finally, some students used slang terms that I were unfamiliar to me. This at times slowed or altered my understanding of what was said.

Chapter Four: Pre-College Experiences of STEM Quota Students

The purpose of this study was to examine quota students' perceptions of the factors that affect their academic performance and persistence in STEM disciplines. As such, this study explored the impact of campus characteristics, policies, and practices on quota student. I interviewed ten undergraduate quota students majoring in STEM fields, two graduate students, three faculty members, and one administrator. The study was guided by the following questions:

- 1) What factors affect the academic performance and persistence of quota students in STEM fields?
- 2) To what extent does campus climate affect the academic performance of quota students in STEM fields?
- 3) What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ?
- 4) What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?

Findings from the interviews are directly related to the theoretical framework and have been grouped into four broad themes: Pre-College Experiences of STEM Quota Students, The College Experience of STEM Quota Students, College Outcomes, and Barriers to Graduation and Institutional Responses. These themes were further broken down into sub-themes that reflected students' experiences and were described as greatly affecting student performance and persistence.

When speaking about their pre-college experiences, students' conversations centered around four central issues: Educational Inequities, Inadequate Preparation to Enter the University, Early Interest and Exposure to STEM, and Students' Perceptions of Parental Involvement.

Educational Inequities

All of the undergraduate students interviewed graduated from a public high school. While public schools overall are thought to be of lower quality, several of the students alluded to the fact that there is hierarchy amongst public schools where some are notably better than others. Nine of the ten students stated that they attended a “good” public school and several suggested that their high school was among the top ranked public high schools in the state (see Table 6 and Table 7).

The government uses two main indicators to decipher the quality of education in Brazilian high schools - the Basic Education Development Index (IDEB) and the High School National Exam (ENEM). The IDEB is the principal quality indicator for basic education in Brazil. Used to rank elementary, middle, and high schools, the index was created in 2007 in response to the Education For All Goals created at the World Education Forum (Dakar, 2000). In an effort to reach these goals, the Brazilian government has stipulated that by 2021, national schools must reach an average score of 6.0⁶ on a scale of 0 to 10⁷. In 2013, high schools in Bahia received an average score of 3.4, with private schools outperforming public and municipal schools with average scores of 5.4, 3.2, and 3.1 respectively. As seen in Table 6 below, five of the eight high schools students attended had average IDEB scores above the state’s public school average. This suggests that students’ schools are amongst the better performing public schools in Bahia. In spite of their rankings among public schools, their scores were still lower than the average scores for the state schools and private high schools.

⁶ An international comparison between the PISA and Saeb was conducted to determine what level of proficiency was needed in order for Brazil to meet the national average scores of developed countries (OECD members); thereby positioning themselves among the countries with the world’s best education systems.

⁷ The IDEB is calculated from data on school approval, which is obtained yearly from the school census, and students’ average performance on the INEP assessments (Saeb).

Beatriz, Leandro, and Ruth all noted the prestige of the military and federal public high schools. In a class by themselves, the quality of education in these public schools is on par with that of private schools. The 2013 IDEB scores substantiate this fact as both the Colégio da Polícia Militar Unidade Dendezeiros, and the Escola Técnica Federal (IFBA) have average scores almost identical to or higher than that of private schools in the state. Furthermore, in 2013 the highest IDEB score in the state (7.2), belonged to one of the military schools. Thus, federal public high schools are acknowledged for being of much higher quality when compared to the mediocre education offered at state and municipal public high schools.

Institutional data revealed that in 2011, 15.5 percent of quota students admitted to UFBA graduated from a federal technical high school while 81.1 and 3.4 percent graduated from state and municipal public schools respectively. Moreover, Nascimento and Pereira (2014) reported that the majority of quota students admitted into UFBA’s medicine, law, and psychology majors graduated from federal public high schools.

Table 6. *Average IDEB Scores of Students’ High Schools, 2013*

Student	High School Name	Average Score
Leandro	Colégio da Polícia Militar Unidade Dendezeiros	5.3
Alex	Colégio Estadual Alfredo Agostinho de Deus	3.0
Rosa	Colégio Estadual Luiz Pinto de Carvalho	2.5
Cecilia & Ruth	Colégio Estadual Mário Augusto Teixeira de Freitas	5.0
Etienne & Paula	Colégio Estadual Thales de Azevedo	5.0
Beatriz	Escola Técnica Federal (IFBA)	6.1
Luan	Raphael Serravalle	3.3
Akacia	Colégio Estadual Democrático Jutahy Magalhães	2.2

Source: National Institute of Educational Studies, 2013

The second indicator I used to gauge the academic ranking of students’ schools was the 2013 ENEM. The ENEM is a non-mandatory, standardized exam that evaluates high school students’ academic performance in Portuguese, history, geography, math, physics, chemistry, and

biology. Aligned with the national high school curriculum, the exam has been used since 2009⁸ as an admission test for universities.

Results from the 2013 ENEM mirror that of the IDEB. The average composite score for the state of Bahia was 527, with averages of 475 and 564 for public and private schools, respectively. As demonstrated in Table 7, both the military and federal technical school had composite scores above the state average. Moreover, students' composite scores at the military school (552) were in close range to that of the private schools, while average scores at the technical school (594) surpassed those at private schools.

Table 7. Average ENEM Scores of Students' High Schools, 2013

Student	High School Name	2013 ENEM Average Scores					
		Language	Writing	Math	Social Science	Natural Science	Composite Score
Leandro	Colégio da Polícia Militar Unidade Dendezeiros	615	567	549	541	490	552
Alex	Colégio Estadual Alfredo Agostinho de Deus*	466	446	441	492	439	457
Rosa	Colégio Estadual Luiz Pinto de Carvalho*	482	468	486	526	449	482
Cecilia & Ruth	Colégio Estadual Mário Augusto Teixeira de Freitas	490	523	488	511	455	493
Etienne & Paula	Colégio Estadual Thales de Azevedo	518	546	521	546	477	522
Beatriz	Escola Técnica Federal (IFBA)	561	683	593	599	532	594
Luan	Raphael Serravalle	484	521	503	505	460	495
Akacia	Colégio Estadual Democrático Jutahy Magalhães	471	502	470	496	454	479
2013 National Averages		609	660	689	647	568	635

Note. * Indicates data reported for 2012.

Source: Adapted from the National Institute of Educational Studies (2013)

Having taught at the federal technical high school (IFBA), Professor Sergio described the school as having a rich academic environment that prepared students to enter the university and STEM fields. “We treated the students the same way we do here. There are times when I use the same tests [I used at IFBA] because the students there are excellent.” According to Sergio, the rigorous math and science curriculum offered at the technical and military schools gives public school students an edge in college admissions. He suggested that a large number of quota students admitted into fields like chemistry, physics, and engineering graduated from the military and

⁸ In an effort to address inequalities inherent with the vestibular entrance exams, the federal government has pushed universities to incorporate the ENEM as part of their admissions process. The popularity of the exam continues to grow as more than 8.7 million students registered to take the exam in 2014.

technical schools. Beatriz, along with other students agreed, noting that the bulk of students admitted through the public school quota matriculated from one of these prestigious schools. “Now it’s like this with the quotas. You realize that here at the university most students either come from the school I came from [IFBA] or from the military school.”

Although five out of the eight high schools attended by students had IDEB scores higher than the state’s public school average (see Table 6) and seven of the eight schools had composite ENEM scores higher than the state’s public school average (see Table 7), all of the students described being at a disadvantage for having attended a public high school. Even Beatriz and Leandro, who attended some of the best public schools in the state, suggested that there was a large disparity between the education they received and that of their private school peers. Akacia echoed these sentiments stating, “There’s no way a public school student can compete with a private school student.” To students like Rosa, the academic differences between the public and private system are so staggering it is absurd to compare the two.

There is no way to compare the education a person from public school gets to a person from private school. I think it’s inhumane to do such a thing. They [private school students] saw every possible subject and we didn’t see virtually anything.

It is widely accepted that the public school system in Brazil faces fundamental challenges. Public school attendees receive an education that is inferior to that of private school students. Though quotas have helped increase the number of public school graduates and minority students admitted into public universities, quota students remain aware of the educational inequities inherent in the system. Consequently, participants in this study stressed that the quota system be used as it was intended; as a temporary fix rather than a long-term solution. Luan best summarized a sentiment expressed by students and faculty stating:

Quotas were emergency measures, but I think the government would have to invest in basic education, especially for blacks, the poor, and people who are unable to study in private

school. Then they can come to the university with a good foundation and the power to compete equally.

Students frequently spoke about the poor basic education they received having attended public schools. Even students who attended top ranking schools, recognized that the education they received was inferior to that of private school students. On multiple occasions students remarked that the differences between the public and private system were so vast it was almost, “inhumane” to hold the two to the same standard.

Recognizing the use of quotas as a path to redress the disparities between the public and private system, both students and faculty alluded to the fact that while the use of quotas may have paved the way for more public school graduates to get admitted into the university, it did little to solve the actual problem; poor basic education.

Inadequate Preparation to Enter the University

Students and faculty often spoke about the disparities between private and public education. Results from the 2013 ENEM reveal an 89 point differential between the average composite scores of private school students and public schools students, with private school students outperforming their public school peers. Because of educational inequities, students reported feeling inadequately prepared to enter the university. They cited low quality teachers and a limited curriculum as two main factors that negatively affected their preparation to enter the university.

Eight of the ten students complained that their high schools did not have “good” teachers. The majority of these students stated that their teachers were not trained in the areas they taught. “We did not have teachers who were qualified to teach us. I mostly had classes in math and I had a lot of difficulty.” Rosa, along with other students, noted that it was common to have uncertified instructors teaching math and science classes. Akacia described her experience saying, “The

school I went to had a teacher shortage, mainly in the areas of science and math. I never had a chemistry teacher. The teachers who taught chemistry were biologists.” Both students and faculty members suggested that this was a common practice at public schools. Professionals who were certified in subjects like physics and chemistry were either teaching in the university or had found more lucrative jobs in the field. Outraged by the fact that public schools would allow and at times encourage instructors to teach subjects in which they were not certified, students like Cecilia questioned the ethics of such practices.

Many teachers are not trained in the area that they teach. I have friends who have said that they had their high school art teacher teaching physics and the physical education teacher teaching chemistry. How can you do that? How do you prepare students like that?

In 1996, the Law of Guidelines and Foundation for Education (LDB) set basic requirements for teacher certification. The National Institute of Educational Studies (INEP) classifies teaching credentials in five distinct categories where highly qualified teachers are defined as, “Teachers with a higher education degree in the same discipline that they teach or a bachelor’s degree in the same discipline with a complementary education course completed” (INEP, 2014, p. 5). According to 2013 data, 59.4 percent of high school teachers in Brazil are highly qualified. When analyzing various education indicators, researchers noted a positive correlation between the percentage of highly qualified teachers and students’ scores on the ENEM. Quota students in this study alluded to the fact that teacher quality and student performance were positively correlated. Students who attended schools with better teachers felt better prepared to enter the university system. As demonstrated by Tables 6, 7, and 8, the schools with the top IDEB and ENEM scores also had the highest percentage of qualified teachers.

Table 8. *Percentage of Highly Qualified Teachers Employed at Students' High Schools, 2013*

Student	High School Name	Percentage of highly qualified teachers
Leandro	Colégio da Polícia Militar Unidade Dendezeiros	39.8
Alex	Colégio Estadual Alfredo Agostinho de Deus	NA
Rosa	Colégio Estadual Luiz Pinto de Carvalho	NA
Cecilia & Ruth	Colégio Estadual Mário Augusto Teixeira de Freitas	11.9
Etienne & Paula	Colégio Estadual Thales de Azevedo	75.7
Beatriz	Escola Técnica Federal (IFBA)	60.5
Luan	Raphael Serravalle	32.4
Akacia	Colégio Estadual Democrático Jutahy Magalhães	42.1

Note. NA indicate that data was unavailable for these schools

Source: INEP, 2014.

In addition to having unqualified teachers, students reported that a limited curriculum and course offerings negatively affected their ability to prepare for the university. Rosa recalled the impact of missing key courses. “In math I didn’t get any trigonometry and did not see many other things in math. I couldn’t complete the *vestibular* without knowing these things.”

Nearly all of the students measured their preparation to enter the university in terms of their ability to pass the *vestibular* or entrance exam. In the current study, eight of the ten students interviewed had to take a prep course in order to prepare for the entrance exam. Half of those students had to take the *vestibular* multiple times before they were able to pass and successfully gain admission into the university (see Table 9).

Students cited their poor public schooling as a reason why they were inadequately prepared for the university’s entrance exam. Luan, one of only two students who did not take a prep course, remarked:

In order for you to enter a Brazilian university today you need to have a strong basic foundation in order to pass the *vestibular* and the public schools do not prepare students for this. You have to go up against people who are being aggressively trained to enter the university... it’s inhumane.

Table 9. *Student Participation in Prep Courses (cursinhos)*

Major	Student	Type of Prep Course	Duration of Prep Course	Number of Attempts before Successfully Passing the vestibular
Chemistry	Akacia	Public	1 year	1
	Leandro	Private	1 year	1
	Rosa	Public	1 year	3
Computer Technology	Paula	NA	NA	3
Mechanical Engineering	Alex	Private	1 year	1
	Beatriz	Private	1 year	1
	Etienne	Both	1 year each	2
Physics	Cecilia	Private	6 months	2
	Luan	NA	NA	1
	Ruth	Private	1 year	2

Luan recalled checking out books from the library and studying independently to fill in the gaps he knew he had. Although Etienne enrolled in two prep courses, he also commented on the importance of self-study.

At the same time that I took the private prep class I studied things on my own that I did not have in public school, because there are things they didn't give for example I didn't have trigonometry. How can I do engineering without trigonometry?

The other students largely attributed their acceptance at the university to their attendance in the prep course. Rosa's experience mirrored that of other students as she found that the prep courses helped to fill in the gaps. "It was voluntary but we had classes every day, on the weekends and on holidays. We had to be really dedicated but it helped a lot because I learned things I never saw in school."

For half of the students, enrollment in a prep course did not guarantee admission. Some students felt that the prep courses they took were of poor quality. Ruth expressed this sentiment, but acknowledged that the course still helped her improve in the subjects and skills she missed in high school. "I took a prep course which was not very good because I did not have good financial conditions. But it improved what I hadn't learned in high school." Ruth, along with several other students, pointed out that the quality of the prep course was often related to the cost of the course.

Thus, students from low-income families found themselves enrolled in subpar prep courses that ultimately left them at a greater disadvantage.

Students like Cecilia realized after taking the exam a first time, that entrance exam contained several subjects of which she had never been exposed. Having attended private school for elementary and middle school, Cecilia thought of herself as a strong student. Upon graduating from high school, she took the entrance exam and failed. After seeing what was on the test, she registered for a prep course that would help give her the foundation she was missing.

I took the vestibular when I graduated from high school and I failed. So the following year I took a prep course. It's intensive because it begins in the middle of the year and goes until the end of the year. It's only to give you a base.

Paula also struggled to pass the entrance exam. While she never enrolled in a prep course she noticed that there seemed to be a disconnect between the content that was taught in high school and information that was needed in order to pass the exam. "They [my high school teachers] would teach what they thought was important but in reality, it was not that important. When we got to the university we realized that they did not teach us what we needed to know."

Students reported that the subpar education they received in the public school system did little to prepare them for college entrance exams and their matriculation into the university. The majority of students stated that their high school lacked qualified teachers and strong math and science curricula. As a result, students found themselves enrolling in prep courses that provided the foundation they often missed in high school.

Early Interest and Exposure to STEM

Early interest and exposure to STEM fields is a key component to minority student success in STEM. In the Brazilian university system, each major has a select number of vacancies and its own set of requirements in regards to the entrance exam. Consequently, students must select their

major during the application process. Although three students attributed their initial interest in STEM to a long-standing interest in science, all of the students credited their decision to major in a STEM field to an experience they had in the public school system.

Cecilia's interest in physics began when she was young. Having skipped a grade in elementary school, she was first exposed to physics at the age of 12. She immediately liked the subject and has had a continued interest in physics. Both Akacia and Leandro reported having similar experiences. In high school, Akacia excelled in science and math areas. After researching some of the different fields that interested her, she settled on chemistry.

In high school, I was very fond of exact subjects: mathematics and chemistry. I thought about doing chemical engineering but when I googled it I saw that the course actually had only a little chemistry so I opted for chemistry.

Leandro and Beatiz also suggested that their early academic success in math and science sparked their interest in pursuing a degree in STEM. Leandro described chemistry as one of the courses in which he performed best.

My interest in chemistry is very great. I love chemistry and I decided to make it my major because I have an affinity, or at least I thought I had an affinity for it when I was in high school because it was one of the subjects I did better in.

For many of the students, early successes in math and science courses paired with exposure to subjects in these areas sparked students' interest in pursuing a degree in STEM. For other students, teachers and mentors played an active role in their decision to enter STEM. Luan attributed his interest in wanting to study physics to a teacher he had during his junior year in high school.

I always had a great interest in science. I was always curious about how nature evolves. This always excited me and when I was in high school I had a professor who helped me understand things, one who taught really well. From his teaching I wanted to study more and more and when I was in my third year I decided physics was what I wanted to study and research.

Similarly, Ruth's interest in physics began when she was a young girl. She always had an interest in why things worked like, "how the press of a button could light a lamp." However, her fear of math, coupled with a number of poor instructors, made Ruth doubt her ability to study physics or be a scientist. In her junior year of high school, Ruth had a teacher who helped change her mind.

In my third year of high school, I had a professor named Jair who introduced us to a world we had never seen. It was because of his encouragement that I decided I was going to study physics. The most interesting thing is that 90 percent of the class decided to go to college because of his encouragement.

While Alex and Rosa also recognized school for sparking their interest in their respective fields, the two suggested that the prospective job market largely influenced their choice of major. Alex credited his interest in mechanical engineering to the fact that he has always liked technology. As he advanced in school, Alex found engineering particularly interesting because of it included various areas. "It was engineering that really caught my attention because it's a very broad area and has multiple job markets for its professionals." Rosa's interest in chemistry first began in school. Once introduced to the subject, she realized she really liked it and considered pursuing it as career.

At first my biggest doubt in choosing a profession was based on money. I thought maybe I would earn more in chemical engineering instead of chemistry but then I saw that it [money] is not the most important thing. The most important thing is to do what you really you like. So I chose chemistry.

For underrepresented minorities, early interest and exposure to STEM fields can be a critical component of students' success. Students commented that their early interest in STEM was primarily due to early academic success in science and math courses, supportive teachers and mentors, and the prospective job market. According to students, these factors positively influenced their decision to major in a STEM field.

Students' Perceptions of Parental Involvement

When speaking about their parents' expectations and involvement, students' responses were separated into two sub themes: first generation students' lack of social capital and college encouragement.

First Generation Students' Lack of Social Capital. According to institutional data, 78.9 percent of quota students at UFBA are considered first generation compared to only 37 percent of non-quota students (Nascimento and Pereira, 2014). Data from the 2005, 2009, and 2012 cohorts revealed that nearly half of all quota students' mothers and more than half of their fathers have less than a high school diploma (see Table 10). In contrast, more than half of non-quota students' parents have at least attended college and 40 percent have earned a college degree.

Six of the ten undergraduate students interviewed were first generation college students (see Table 11). These students often spoke of the challenges they encountered upon entering college and facing the unknown. The first in their families to attend college, several students reported not receiving help from parents or other family members because they were not knowledgeable about the college going process. Cecilia described feeling this way saying:

I had no idea what to expect here. I think this a problem for most people from a lower social class. They don't have much information about university, or an academic curriculum or things like this. When we [quota students] arrive here we are totally unprepared, not just in scientific knowledge but in social knowledge like how to behave in different situations we may encounter in our major...it's very complicated.

Ruth expounded on this idea, suggesting that her lack of social capital was a challenge she would have to overcome.

For me the level of knowledge is the biggest obstacle. When you enter the university you still have a vision of high school and how you were treated which is totally different from the university. But with time you adapt, find a rhythm, and understand how the system works and what is your routine.

Table 10. *Educational Attainment of Parents of Quota and Non-Quota Students in Percentages, 2005, 2009, 2012*

Level of Educational Attainment		2005		2009		2012	
		Quota	Non-Quota	Quota	Non-Quota	Quota	Non-Quota
Less than a high school diploma	Mother	48.2	14.1	47.0	13.1	43.4	13.6
	Father	50.9	17.9	53.5	15.2	52.1	17.7
High school diploma	Mother	40.4	36.9	37.5	32.2	39.4	31.0
	Father	32.8	30.1	30.1	30.5	32.9	28.5
Some college	Mother	3.7	8.7	4.9	9.0	4.6	8.7
	Father	3.9	10.4	3.8	12.1	3.8	11.1
College degree	Mother	7.3	39.9	9.6	44.8	11.7	46.2
	Father	9.4	40.1	7.4	40.1	7.2	39.4
Not reported	Mother	0.3	0.5	1.0	0.9	0.9	0.5
	Father	3.0	1.5	5.2	2.0	4.1	3.3

Note. Percentage of parents reported in the Less than a high school diploma category includes parents who never went to school, did not complete primary school, completed primary school, did not complete secondary school, completed secondary school, and attended but did not graduate from high school.

Source: Nascimento and Pereira, 2014, p. 6.

Several of the first generation students reported feeling lost or drifting through campus. Etienne captured this sentiment stating, "You're not guided towards anything so you're just discovering things as you go along and sometimes you discover things too late." He further remarked that there were many occasions when his peers seemed to be informed about things of which he was ignorant. "When I came in here I didn't know that I would have to have English and I didn't know it was a requirement or pre-requisite in my field. A person who has money comes in here speaking English fluently."

Quota students who were the first in their families to go to college reported being negatively affected by their lack of social capital. Unfamiliar with the college going process, students described feeling "lost" or "on their own." Two of the six first generation students suggested that this made them feel as if they were going through the process alone. They recalled feeling as if no one in their family understood the challenges they faced. Rosa, like many others, said that these feelings often made her question her decision to attend the university. "You really are sometimes just thinking, 'My God this place is not for me.'"

Table 11. *Family Participation in College*

Major	Student	First Generation Status	Family members who attended college
Chemistry	Luan	No	Luan's father attended a private college and is a music therapist.
	Ruth	No	Ruth's brother went to a private college first. After Ruth entered, her mother decided to go to college as well.
	Cecilia	Yes	
Mechanical Engineering	Alex	No	Alex's sister entered first.
	Beatriz	Yes	Beatriz entered and then her sister went on to college.
	Etienne	Yes	Etienne and his two sisters entered at the same time.
Physics	Akacia	Yes	Akacia is the first in her immediate family but she did have a cousin who entered earlier.
	Leandro	No	Leandro has a brother who entered college and majored in computer science.
	Rosa	Yes	
Computer Technology	Paula	Yes	Both of Paula's parents entered college in the same year Paula entered, but they are enrolled in a private college.

As seen in Table 11, four of the six first generation students entered college alongside other family members. While these students also felt as if they had no one to guide them, they expressed comfort in the fact that others in their family could relate to the challenges they faced. Etienne reported sharing stories with his sisters about their experiences on campus and within their majors. He stated that knowing that other people were having similar experiences helped ease his transition and made him feel less alone.

First generation students reported being at a disadvantage because they did not have the same social capital as students whose parents had entered college. Moreover, first time college goers noted how difficult it was to adjust to the campus environment and described feeling lost as they were forced to learn the expectations and norms of the university on their own.

College Encouragement. First generation students noted that their parents wanted them to enter college but did not always support their choice of major. According to students, their parents were nervous that they may not be able to complete the rigorous work associated with STEM majors. The first in her immediate family to attend college, Akacia found herself having

to defend her choice to study chemistry as her parents were concerned the major may be too difficult for her to complete.

I was discouraged by my parents. They would say, 'It takes a lot of courage to study chemistry because it's complicated.' It's a hard course because it involves a lot of chemistry, a lot of math, and lot of things I didn't see in high school.

Students who were not the first to attend college expressed varying levels of support from family and friends. Ruth, whose brother attended a private college, recalled having her parents question her decision to study physics. According to Ruth, her parents were concerned that as a physics major she would have a difficult time entering the job market. They felt that the nation did not value science and as a result she would only be able to find lucrative work outside of the country.

They [my family] asked me where I was going to live because science is totally devalued in Brazil. You need to go outside of the country. And to go into physics I did not want to be a teacher. Here in Brazil that doesn't really exists. So I was really discouraged by my parents, family, and friends.

Ruth went on to describe how her friends questioned her ability to successfully complete the course. "They told me, 'you're not going to finish, you won't be able to handle the pressure of the course.'

Having a brother who majored in computer science, Leandro felt that he was neither encouraged nor discouraged by his family. They simply warned that chemistry was a difficult major and how he responded to the work would determine if he persisted or dropped out of the major. "I was told when you enter UFBA or when you get into the chemistry course you're going to really get hit hard and this will decide whether you continue or give up."

Whether parents agreed with students choice of major or not, all of students stated that their families offered financial and emotion support. All of the students lived at home with their parents

and relied on them to help with the purchase of books or money for transportation. Etienne described the support of family as being essential for quota students.

Normally, the quota students are students from humbler families and so they don't have much family support. I think this is one of the main barriers because if a student doesn't have support, or someone who can help him stay here, he has to leave work to go forward.

First generation quota students majoring in STEM reported having parents who encouraged and pushed them to attend college but simultaneously discouraged them from pursuing a degree in STEM. Aware of the academic rigors of STEM disciplines many of the students' parents worried that they would not be successful in the major. Others were concerned that upon graduating it would be hard to find work. In spite of their parents' concerns students continued to pursue their interest in STEM. Once enrolled, many of the students felt that their parents' financial and emotional support helped them to persist at the university and in their major.

Chapter Five: The College Experience of STEM Quota Students

Conversations with students about their college experience led to discussions about their perceptions of the global campus climate and the STEM environment. Students' identity as a quota student, racial identity, gender identity, and their relationships with institutional agents all played a part in how they perceived the campus and STEM climates.

Global Campus Climate

Students suggested that their experiences on campus largely affected their academic achievement and persistence. As such, students identified five variables that influenced their perceptions of the campus climate: their identity as quota students, their racial identity, gender identity, relationships with faculty, and pedagogical quality.

Identity as a quota student. Historically, research on underrepresented minorities in STEM fields has focused on students' racial identity or gender. Students admitted through quota programs have traditionally belonged to marginalized groups that are easily identifiable and stereotyped (i.e. race or gender). Thus, a student's identity as a quota student or underrepresented minority and the marginalization and discrimination that may occur as a result of it, often plays a key role in how they experience the campus climate. While UFBA's quota policy targets students who identify themselves as black and brown, the greater priority is for low-income students (i.e. public school graduates).

Faculty and students alike suggested that quota students at UFBA are only identified as such for admissions and scholarship purposes. Outside of the offices that deal with the aforementioned areas, no one is able to identify which students were admitted under the quota program. When asked about the number of quota students enrolled in his classes Professor Cassio responded, "I have no idea because we are not aware of who the quota students are. There is no

differentiation in the registration number of quota and non-quota students.” Faculty participants described how being unaware of students’ status as a quota student made it easy to treat students uniformly. Students like Cecilia and Etienne noted that faculty’s expectations of students were the same regardless of whether the student had entered under the quota program. Cecilia sensed that this was in large part due to the fact that faculty had no way of deciphering who had entered the university through the quota program. “If the professors have this information it does not show. I think they have no idea who came by quotas and who didn’t.” Etienne further commented that his status as a quota student seemed insignificant to faculty. “Teachers never differentiated. They never came to class and asked, ‘who is a quota student?’ I never felt treated differently.”

Students repeatedly suggested that they are not openly labeled as quota students on UFBA’s campus. Due to this fact, nearly all of the students reported that they did not feel discriminated against on campus. Paula described the environment at UFBA as inclusive stating, “I don’t think there’s discrimination here because I don’t think people have a way of knowing who is a quota student and who isn’t. During class we are all the same.” Beatriz agreed stating, “Here there isn’t a way to really be discriminated against because you don’t walk around with a sign that says, ‘I’m a quota student’.”

As opposed to feeling discriminated against, several students spoke of how welcomed they felt on campus. Luan described this saying, “I feel validated all over campus. I’ve never noticed any segregation here on the Ondina campus.” Alex expressed having a similar feeling while being on campus. “I think the UFBA campus has a very, very, pleasant environment for students. Students feel welcome. Everyone talks to everyone.” Faculty members like Professor Cassio also suggested that the campus provided a harmonious environment for students. “There isn’t a

sentiment about being a quota student or not. There are many different cultures, a rich environment, and I have never seen any problems.”

While on campus, I noticed the same welcoming environment and discretion when it came to the identity of quota students. Though a few students were easily able to identify friends in their program who entered through quotas, when I asked if they could recommend quota students to participate in my study, most of them randomly called classmates to ask if they had entered through the quota system.

I recall having a particularly difficult time identifying quota students in the chemistry department. One student had volunteered but when she realized I was interested in speaking only with students admitted under the quota she no longer qualified, as she attended a private high school. She then suggested two friends who she thought may be quota students but they also were not. After explaining my study to a graduate student in the program she said to me, “UFBA does not have quotas. You should do your study at UNEB. They have the quota system there but not here.” To my surprise, neither she nor her colleagues were aware of the fact that UFBA had a quota policy that had been in place for nearly ten years. Upon receiving more information about the program, the student attributed her ignorance to the fact that she had entered the university prior to the implementation of the quota program. I found it interesting that as undergraduates they were not active participants in the discussions and debates surrounding the implementation of affirmative action.

Students’ identity as both quota students and underrepresented minorities played a significant role in how they perceived the campus climate. For the vast majority, their status as quota students did not detract from their overall impressions of the global campus climate. On the contrary, quota students described the campus as a welcoming place and reported having a strong

sense of belonging. According to students, this was in large part due to the fact that there is no way to identify which students were admitted via quotas.

The STEM Environment

Although the global campus climate seemed favorable to quota students in STEM further discussion with students and observation of the campus revealed that while quota students are not easily identifiable nor socially isolated, within their fields, several students were faced with discrimination, mostly in the form of micro-aggressions.

In 2004, the proposal to implement race-based quotas at UFBA sparked an online debate in which faculty members opposing the use of quotas posted several arguments against the use of affirmative action including the fact that, “merit is the mark of access to the system of higher education; and the students in the quota system will find it difficult to study in the universities because the public schools are not good” (Santos & Queiroz, 2010, p. 763). Though race and socio-economically based quotas have been in effect for nearly a decade, the sentiment that quota students are not able to compete academically with their non-quota peers remains a concern for some faculty and students. Luan recalled hearing these types of sentiments expressed in his field. “When I entered it was the third year after the entry of quotas and some teachers still felt and claimed that when students enter through quotas they have difficulties.” He went on to say that the segregation on campus is not based on race but rather social class. According to Luan, there are still many people who believe that quota students are academically inferior to their non-quota peers.

I think here people do not feel like there is much racial segregation...or at least its not noticeable. What weighs the same here is social status. We notice that when a person is from a public school. Then you will hear people say, ‘So and so does not have a base.’

Although these sentiments were rarely expressed overtly, many of the students felt that they were being looked down upon because they were quota students. They acknowledged that quotas were needed because without them, the subpar education they received in the public school system limited their chance of passing the *vestibular* and gaining admittance into the university. At the same time, students wanted faculty and peers to understand that although quota students may lack a strong foundation in some subjects, it does not mean that they do not have the capacity to perform well in class. Rosa recalled how students and faculty seemed to have lowered expectations of quota students. She noted that even today, her professors and peers appear to be shocked when a quota student gets a high score on a test or answers a question in class.

I think that generally there is some kind of prejudice. Because you are a quota student people think you don't have the capacity to be here, that you only entered because of the quotas and if it wasn't for them you wouldn't be here at all because you don't have the ability. And if a quota student gets a good grade, 'Oh God, there's no way because you don't have the capacity to be here.'

I myself got to see how easy it was for people to believe and propel the myth of quota students' inferior academic abilities. In an effort to help me secure students to interview, Professor Sergio suggested I speak with one student who he was sure had entered through the quota program. When I explained my research to the student and asked if she would be willing to be interviewed she agreed but told me that she had attended a private high school. Upon relating this information to Professor Sergio, he was extremely surprised "Really? She's such a poor student. Her grades are really bad," he said shaking his head in disbelief. Although the student was also black, it was apparent to me that Professor Sergio believed her to be a quota student because of her poor academic performance.

Several students suggested that stereotypes about quota students' poor academic performance often led to a type of de facto segregation with the private school students separating

themselves from the public school graduates. While students recalled that it was not obvious at first who had graduated from a public school and who had entered through the quota system, many students matriculated together from the same high schools. Consequently, it was not long before students began to realize who had attended private school and who had attended public school. As a result of being shunned by the private school students, Etienne remarked that most of his initial friends were quota students.

When I first came in the people who were not quota students were angry at the quota students and so in a certain way they excluded themselves. The group who came from private schools had a certain preconception about those who came through the quota system and they stayed in their own group and didn't open it for us. It was really difficult for me at first and so practically almost all of my friends were people who entered under the quota system.

Many of the quota students described having a similar experience within their major. Outside of STEM they easily made friends from various backgrounds. However, in the classes within their major students found themselves closest with the peers they identified with or who were also experiencing difficulty in the course. More times than not, that meant that the quota students had become friends with other students who had entered the university under the same circumstances.

Within their specific majors, students felt that being a quota student was often accompanied by stereotypes of lower levels of academic ability. Consequently, students' academic performance was used as an indicator of their status as quota student, whereby poor performing students were thought to have been accepted via the quota program. In STEM disciplines this caused friction amongst peers and led to de facto segregation with the quota and non-quota students forming homogenous groups of friends.

Racial Identity. Although students reported that they never experienced racial discrimination on the campus at large, several students noted that their racial identity became an

important factor within their field of study. Luan, the same student who suggested that race was not a big issue in terms of the general campus climate, described it taking on more significance within STEM disciplines. “It’s interesting here in the exact courses where I have more contact with people. You’ll notice that there is some racial segregation in the courses. In engineering for example, it is dominated by White people. It’s very sad.” Ruth reported similar findings noting, “In science, the majority of people are White and have conditions, and they unintentionally discriminate.” In spite of being a minority in STEM, Ruth acknowledged that students’ racial identity did not limit their opportunities as a student. “I haven’t seen a distinction for being black in relation to opportunities. You just have to be interested because there are a lot of opportunities here.”

When speaking about their race students, particularly in those in physics, spoke about the dearth of same race faculty members. Cecilia remarked, “There are very few blacks here, at least in the places that I frequent. I see very few including the teachers. There are lots of teachers who fit the stereotypical old, bearded guy, and most are White.” Cecilia, along with Luan and Ruth, reported having had only one black professor in physics. Ruth described enjoying in his class because she felt she could relate to him on several levels. “He also came from the northeastern interior and went through difficulties but now he has a PhD. He is the type of person that inspires you.” Students in chemistry also noted the importance of having same race faculty to serve as role models. They commented that the presence of faculty members or graduate students who were black and brown showed them that it was possible to succeed in the field.

Cecilia was the only student who commented on the importance of having dialogues about race for black students. According to Cecilia, the absence of discussions about race did not equate to creating an environment where Afro-Brazilians felt valued. “My perception about negritude is

that they don't have it here [in STEM]. I have a friend who is a master's student in sociology and I talk a lot with her and go places where they talk about negritude." Cecilia goes on to say that while discussions about race and blackness are prevalent in the humanities and arts majors, they are largely absent from the STEM fields.

I think I'm the first person who wears a head wrap here in this [physics] department. I don't see people, not even the black students, with this posture of being black, defending the idea of blackness, of respect. They take a very pacifist position – very on the fence in relation to this.

Professor Santos, director of the Center for African and Oriental Studies (CEAO) at UFBA, agreed with Cecilia's assessment. While the center offers students at UFBA numerous opportunities to engage in activities like CEAURO, a program that educates students on topics related to racial and gender equality, most of the participants come from the social sciences. Professor Santos suggested that more students and faculty from humanities and arts participate because there is an overlap between the curriculum in their courses and the topics covered by the programs. According to him, students majoring in sociology, psychology, and anthropology express a greater interest in issues of race, gender, and social equality than students in STEM fields. Although there are STEM students like Cecilia, who want to engage in conversations about these topics, Santos' reasoning helps explain why none of the students I interviewed knew about the existence of CEAO or the Office for Students of Color.

According to students, the "chilly" environment within STEM fields was further compounded by their racial identity. Much less diverse than the campus at large, students reported a diminished sense of belonging as the majority of students and faculty in STEM fields were white. Though some students experienced feeling isolated or as if they did not belong, students noted that their race did not limit the number or type of opportunities that were available.

Only one student expressed the fact that the concept of race is largely absent from the dialogue in STEM fields. Faculty members supported this notion, stating that discussions about race and other social issues are much more prevalent in the humanities and arts as the curriculum in these majors supports such topics of discussion.

Gender Identity. Five of the six female students spoke positively of their gender in regards to their reception in STEM disciplines. Several of the women reported feeling proud to be a woman in STEM. Because there are so few women in her major, Cecilia said she feels as if she stands out for positive reasons.

I feel different but I feel special. It's a good situation because people admire you being a woman in the realm of science. To be a woman in physics is practically like being a goddess. People look at you and say, 'Damn you're a woman doing physics. That's extraordinary.' Historically, there have been few women in physics. I don't know what happens with women that they aren't involved in math and science.

Both Paula and Rosa shared similar feelings. Paula felt as if women in the field were recognized for their diligence. "Women are very well recognized in the major, mostly because they stand out. The majority of women stand out for showing effort, dedication, and organization which the boys do not have." Rosa described how difficult it is for women to enter her field and as such stated that she was proud to be among the few majoring in chemistry. "For me it's an honor. A few years ago it was very difficult to be a woman in an exact major so I feel honored to have the privilege of being one of few."

Beatriz, a student in mechanical engineering, thought that the situation for women in her field is constantly improving. "Before it was uncomfortable because you spend so much time with boys and sometimes in their conversations you actually end up being treated as one of the boys. When I entered there were only four women out of fifty students." She went on to say that in spite of the hardships and difficulties the female students in engineering may have faced, they have all

persisted. “All of the women stayed. Two are now travelling with Scientific Mobility Program, one just returned, but all of us have continued firm and strong.”

While a majority of the female students felt that their gender positively affected their view of campus, the two female students from the physics department held slightly different views. According to Cecilia, the preferential treatment given to women in her field is not uniform. “Some professors give preference and more attention to the White women [in class]. I think black women are a very small percentage here so I have already felt different in relation to how some professors treat us.” Ruth, who is also a black female in the physics department, shared similar experiences with her colleague. “I notice that some professors treat me different because I am a woman and I am black, and other people do not.”

Though the number of female students varied depending on the major, all of the students noted a strong presence of female faculty members. While I did not have the opportunity to interview any female faculty members, all of the classes I observed were taught by women. For many of the students the presence of female faculty members provided additional support and proof that women can be successful in STEM disciplines. Ruth summed up these very sentiments saying, “I like the fact that they have female teachers here. It helps a lot. Everyday it’s hard to handle that in a room you have 40 men and 2 women.”

Ruth was the only female student who had overwhelmingly negative experiences being a woman in STEM. A traditionally male-dominated field, Ruth experienced sexist encounters in class.

It’s complicated because this is a course that is mostly made up of men. For example, one teacher said that if some of the girls in the class were ‘cute’ he would give everyone in the class a good grade. This was a horror and things like this are difficult to deal with.

Experiences such as these made Ruth feel as if she and the other women were not being taken seriously on account of their gender. She also described situations in which professors gave female students easier assignments. Ruth felt that this “preferential treatment” was really an insult. In her eyes, it was as if the faculty did not think women had the same capacity as men.

Nearly all of the female students noted that their gender positively impacted their perception of the STEM climate. Within each of their majors, women were thought to be exceptional for pursuing a degree in STEM. As such, they reported often feeling praised and valued within their respective areas.

Despite the fact that women were often commended for selecting a STEM major, some felt that it was challenging to work in a male dominated field. Students reported either being treated like one of the boys or being given preferential treatment on account of their gender. Overall, the female students acknowledged that their situation continues to improve as more and more women enter the field.

Interactions with Institutional Agents. Relationships with faculty played a significant part in students’ ability to feel connected to the university and their major. Students reported that having faculty members who were open and dedicated to seeing students succeed positively affected their ability to perform in class. Etienne stated that these attributes set some faculty members apart from others.

You have some teachers who aren't dedicated to anything. On the contrary, they don't study, don't read the books they use in class, and there are others that are dedicated and preoccupied with sharing the content with the students. They are really learning and they are preoccupied with giving us real life experiences.

Like Etienne, the other students found themselves closest to faculty members who were open and whose primary concern was to ensure that their students were learning. In addition, students noted that they responded best to faculty members who saw them as individuals with

different talents and needs. Rosa claimed that she liked being in the chemistry department because the majority of her professors made themselves available to students.

They [the faculty] are really interested in teaching students and see the weaknesses that the students have and they see that each student is different. Some have more difficulty and others less difficulty. They seek through their teaching that everyone learns, not just those who already know a lot but those who also don't know much.

In several cases, students reported that having a professor multiple times helped them to develop a relationship. Etienne described how his relationship with a professor helped open doors to additional opportunities. "I have a professor here in the department that I have had for two or three subjects so she really knows me. She referred me to a conference and to participate in the Organization of Congress. I am close with her." Yasmin, recognized that with "good" professors these relationships don't diminish once you leave that professor's class. "We have some professors who are always willing to help. Even if you were a student in the past they are always open to help you." Ruth also recalled having strong times with two faculty members who taught her on multiple occasions. She added that although she had failed the classes these teachers taught, they had a way of caring about the students that made the class feel more like a family. "They kind of became like our father and mother inside here [class]. [The class] became like a family because of the way they treat people. They are so sweet and they really care about us." Ruth went on to say that one of the professors even scolded students in the manner a mother would. "Look the teacher Zuque is like a mom. If we don't study she will pull our ear and ask, 'why didn't you study?'"

Many students stated that their strongest bonds were with faculty members in their department. Akacia described a culture in the chemistry department in which the faculty know and care about their students. According to her, this is different from the professors she has had from other departments.

There are some professors who are close and others who are not so close [to students]. Here in chemistry, normally the professors are close because they are already here at the institute and are available to answer questions anytime or you can schedule a time to meet with them. The calculus professors are far away and it's a bit worse because they are from another department. Even in the classroom the chemistry teachers know all of their students by name and they know who each student is. In math, they don't know our names. For example, my Calculus B teacher probably doesn't know my name.

When observing classes I noticed that the courses students took within their department were smaller in size than the core math courses or labs. There were 42 students in the Calculus B class I observed, 17 students in the Fundamental Chemistry class, and 10 students in the Physical Metallurgy Class. The intimate nature of the two science classes appeared to make it easy for the faculty members to connect with students. In both of these classes, it was evident that the professors were taking attendance by simply surveying the room. The only time they called a student's name was if they did not immediately see that student present. In contrast, the math teacher sent around an attendance sheet, asking students to sign their name. Another telling factor about the student teacher relationships was the fact that the students took the time to introduce me to the professors teaching the classes in their major. On some occasions, we even met with the faculty member prior to class to discuss the details of my study and to ask permission to attend the class. None of these arrangements were made with the professor of the math class. Akacia said it was unnecessary because, "the teacher does not know who is in the class anyway."

Students who were involved in research reported having close relationships with the faculty members who served as their research advisors. Two students in particular suggested that these faculty members played a significant role in helping them to feel welcome and valued in their field. Both Cecilia and Ruth had a negative view of the faculty in the Physics department but had forged strong ties with their research advisors.

The only faculty member on campus with whom Cecilia felt particularly close was the coordinator of the PIBID, a research program in which she participates. When speaking of the coordinator Cecilia said:

She is extremely open. When we have some difficulty, when we're missing something or part of the program she looks for us and asks if we're having some type of personal problem. She's close to us and I like my relationship with her.

Cecilia went on to say that part of what makes the coordinator different from the other faculty members is the fact that she deals with the students on a human level. "She talks with us as equals. She makes it clear to people, especially in our program, that she's not there as a superior. She's there to work with all of us, because she is also learning from us."

Ruth's description of a faculty mentor mirrored that of Cecilia's. She shared how he took the time to get to know all of his students, regardless of their race or social class. Ruth said that it was easy to build relationships with faculty members like her mentor who were supportive of students.

What is good is the support of the professor. An example of this is my mentor, not only because he embraced the quota students, but because he does not care if you are White or black. He treats everyone as if he is their father and gives them support. He even helps buy books if you need them. I've seen some students saying that they were able to graduate because of his support.

Aside from the professors who worked with them on their research teams, students noted that they did not have faculty members who discussed their academic progress with them or served as academic advisors. Upon further investigation I found out that when students enter the university they are given the curriculum requirements for their major. This document outlines the core courses students are required to take as well as the approved electives for each semester. If students have a question about a course or want to take additional courses they have to meet with

the department chair. According to students, when they had questions regarding the sequences of courses or registration they generally asked their peers.

While the majority of students described having rather harmonious relationships with faculty members in their departments, Cecilia and Ruth's overall view of faculty in the physics department was characterized as unsupportive and distant. Cecilia described the distance between the faculty and students as a norm in her department. "Within the major there is a hierarchy. A professor with a PhD is a god, other professors are demigods, and the students are slaves." Consequently, she described the physics department as an environment where there is little interaction between students and teachers.

Teachers here are very distant. Their world is upstairs and when you go there they are in their own little section. Only a few teachers interact with students. They don't mix unless a student has a question and even a few teachers are not open to answering questions.

Even Luan, who reported having countless positive interactions with faculty, acknowledged that there is a hierarchy in the department. According to him, many of the professors with PhD's separate themselves from others. "There is a huge hierarchy. They [faculty with doctorate degrees] feel as if people should know who they are." He went on to describe how students and other faculty members feel as if they can't sit and have coffee with these professors. Although he does not share the same views as Ruth and Cecilia he recognizes how this type of hierarchy could make students feel as if faculty as a whole are unapproachable.

Both Ruth and Cecilia also felt that their negative perceptions of faculty members in the physics department was largely due to the fact that there was little to no accountability on the part of the faculty. Cecilia described having professors who seemed to be above the law. "The teachers here basically do what they want and they are not afraid of opposition from other teachers." Ruth went on to add that students are powerless when it comes to bad teaching. "When we complain

about a professor with influence or status, the complaint simply gets lost and disappears because you're a student." Cecilia described several situations in which she felt mistreated by faculty. Although she felt the faculty members were wrong in their actions, Cecilia said she felt powerless to react. She suggested that it was better to tread carefully, as students inevitably have faculty members for more than one class.

Physics has a large deficit of teachers, so a teacher may teach three or four different subjects. So if you have a disagreement with a teacher in one subject, you will likely have that teacher again in another subject.

Students described their interactions with faculty as being either supportive or unsupportive. The majority of students felt supported by faculty who were open to help students, knew their students individually, and were dedicated to seeing them succeed. Some students commented that having faculty members on more than one occasion helped them to build relationships while others attributed their positive relationships with faculty to their joint research endeavors. Students who felt unsupported by faculty reported having faculty members who were distant and had little accountability.

Pedagogical Quality. Students reported that their academic successes and failures were largely dependent upon the teacher and the content. According to students, the majority of STEM courses are taught in a lecture format and require little to no student interaction. Luan best summarized the group's feelings stating:

In class, the work is very individual. You can take a course without ever speaking to anyone. It's like this. You enter the classroom and don't say hello to the professor or anyone. The professor delivers the content and then you leave.

This was certainly the case in the calculus class I observed. When we entered the room the professor was at the board copying down her notes for the class. Twenty minutes into class she finished writing her notes on the board and finally addressed the class for the first time by telling

the students to, "Copy the notes quickly." The professor waited another five minutes for students to finish copying from the board and then began the lesson by telling the students the topic they would be covering.

Beginning on the left side of the board she reviewed the notes for case 1 quickly, and never stopped to check for understanding. In fact, after completing the first case and demonstrating the rule with an example, she commented that students should not be confused because what they were learning was, "easy." Without asking students if they have gotten all of the notes, she erased the first quadrant of the board and went on to the second case.

The class continued in this manner as the teacher went over two additional rules. Without even breaking or giving some sort of cue that a transition was about to occur, the teacher ended class by telling students that she was handing back their tests. To everyone's surprise, she dismissed the class only 35 minutes after it had started and nearly a full hour and a half earlier than it was supposed to end.

Overall, the students in the calculus class seemed to express the same hopelessness and frustration with the teacher and the manner in which the content was taught as the quota students in my study. While the students seated in the first two rows were copiously writing notes, the other students were either engaged in side conversations, sleeping, or playing on their phones. Ruth noted that this was very similar to the manner in which her analytical geometry class was run. "He [the professor] came to class and copied everything very quickly on the board. Before you could get it in your notebook he was erasing it and writing the next set of notes."

The same can be said of classes in the physics department. Cecilia remarked that this style of teaching was the norm. She went on to say that even faculty who were well versed in the subjects they taught spent most of the class dictating from their notes.

We have a professor here who is super old but everyone praises him because he knows a lot. He knows a little bit about every part of physics. The teachers themselves ta ether questions to him. But his class is dictated. He read and you copy for the entire class.

This practice and pace of note taking appears to be very common as I observed the same drill in classes that were more student-centered. In the mechanical engineering class I observed one student decided to use his cell phone to take photos of the board instead of copying the notes in a notebook. I later learned that he would post the photos on Facebook so other students in the class could copy the notes they may have missed.

According to students, the structure of the classes in STEM is very teacher centered. During the entire length of the calculus class I attended the teacher did not ask one single question to students and there was no class participation. Furthermore, when a student raised his hand to ask a question, the professor went to the student's desk and answered him privately, without sharing the question nor the answer with the larger group.

Several students stated that they were least successful in lecture style courses. Heavy in theoretical content, students described these classes as boring and felt the method of instruction was not conducive to learning. They complained that the lectures focused too much on theory and that professors did not demonstrate how to apply the concepts to real life. As most of their classes are run in this manner, Beatriz recalled how difficult it was to avoid classes such as these.

It's in these classes when the time does not pass. You are sitting there and you don't understand anything. The professor does not know how to pass the content and they are not teaching in a way that you can understand and so you are very preoccupied. There is a lot of that [kind of teaching] here.

When asked about the classes they were most successful in, students noted that they experienced the most success in classes that were in their major, less theoretical, and more student centered. Students agreed that their grades were higher in classes where they could be active participants. They described these classes as ones in which students were encouraged to work

together to apply what they were learning to “real life” problems. For some students, having classes where they learned topics directly related to their major helped motivate them to study.

Cecilia was the only student who preferred classes outside of her major. Unlike Etienne, Leandro and others who despised courses in humanities, Cecilia reported being most successful in her education courses. According to Cecilia, nearly everything they study in physics is theoretical. In contrast, her education courses are built around class discussions where the teachers and students work collectively to find solutions to problems. Cecilia also noted that her education classes encouraged group work, as tests in those classes were often in the form of group presentations or papers.

While many of the students named courses within their major as being the ones they had the greatest success in, students commented that their performance had little to do with the actual content and more to do with the professor and their style of teaching. Etienne and others recalled feeling motivated by good teachers. “If the teacher is good, you like the class and it gives you the incentive to study more. Ruth went into further detail describing the professor in her most successful course as follows:

The teacher was a partner with us. He was one of the few teachers I had who in addition to making the subject interesting, he was interested in knowing how we learned things. He would ask us if we were understanding and welcomed us to ask questions. He worked with us. He did a lot of exercises in class.

Several of the students found it useful to complete exercises and group work in class. When teachers asked them to solve problems in class it gave them the opportunity to see if they understood the concepts and to have a model students could use when they had problem sets to complete at home. Moreover, students felt more confident making mistakes in class where the teacher or their peers could help explain the error. Students like Beatriz reported learning best when she could sit next to someone in class who could, “take away her doubts.”

Outside of the work students did in labs, which occurred in all three of the majors, mechanical engineering was the only major where students reported being asked to work in groups in class. All of the students in this major reported having the opportunity in class to work in groups. In the class I observed, the professor gave the students sample problems to solve. While the professor did not demand that the students work together, she also did not discourage them from working in groups. Etienne reported that many teachers will allow students to work together and that some even require students to complete a group project. Alex agreed, stating that in one of his classes the professor had students work together on projects in SPSS. Conversely, students in chemistry and physics stated that the only opportunity they really have in their major to work in groups is if they are on a research team.

Pedagogical quality played an important role in quota students' academic success. Students reported that the academic content, the professor, and their style of teaching all affected students' ability to be successful in class. Classes that were solely based on theory and taught in a lecture format turned students off while classes that offered real life examples and interactive group work seemed to boost students' engagement and subsequently their improve their academic performance.

Chapter Six: College Outcomes

Students spoke at length about their academic performance and persistence. For the vast majority of students, their academic performance was best characterized by the number of times they had to repeat a class. According to students repetition was intimately linked to students' ability to persist at the university and in STEM majors.

Academic Performance

Institutional data suggests that the repetition of courses is used as an indication of students' academic performance whereby repeating a single course four times or repeating all courses in any given semester is an indication of academic failure. On multiple occasions, students commented on how their educational experiences in high school, lack of social capital, and poor relationships with faculty adversely affected their ability to succeed once enrolled in college. Similarly, all of the quota students interviewed spoke of the academic challenges they encountered, particularly during the first year in math and science courses.

All of the students in this study described themselves as having had excellent grades in high school. Used to being top performers, students reported being shocked by the grades they earned when they entered college. Many believed that passing the entrance exam proved that they had the basic foundation necessary to be successful in college. However, upon entering the university, students realized that being able to pass the entrance exam was in no way equivalent to passing class. Looking back on the first year, Luan described how surprised he was by his final grades.

When I entered the university I failed all of my classes from the first semester. This was very shocking because when I was in high school I was a good student and I got good grades. I completed all of my work directly and when I got here I had horrible grades. It was a shock.

While the students expected the courses to be difficult, none of them were prepared for what they would encounter. Students repeatedly stated that their poor grades were a direct result of being unprepared academically to enter the university. Students said that their high schools failed to give them the foundation they needed to be successful in class. Cecilia, as well as others described feeling completely lost in class.

I had tremendous difficulty when I came here. The things that the professor was talking about, it was like he was speaking Japanese. I was like, ‘What? What is this?’ I didn’t know what he was talking about and neither did many of my classmates.

Students suggested that experiences such as these were unique to STEM fields. According to them, quota students in humanities and arts could enter the university and easily learn the things they were not exposed to in high school. In contrast, STEM classes are often sequential and require you to have a strong base in math and science. Consequently, it is much more difficult for quota students to “catch up.” Ruth summarized how many of the quota students felt saying:

If you have deficits in areas like math, you will suffer even more in areas like physics. The level of knowledge you have is important in the case of quota students, because if you did not have a good high school you will really suffer. I can say this because I have repeated many subjects here when I started and it was a disaster. I was crying everywhere because I thought I would never make it.

Students noted similar experiences as all of them spoke of the hardships they faced in their core math courses. All four of the majors in this study required students to take calculus A in their first semester. Students like Etienne reported being at a huge disadvantage because he had not had trigonometry or pre-calculus in high school.

The biggest challenge was to compensate for the classes that I didn't have like calculus and trigonometry for example. I had to take the textbook from high school and study because I didn't know it. You can't simply walk into calculus A and understand it and go on to calculus B and C without knowing the basics.

When asked which classes presented students with the most difficulty, nine of the ten students reported having difficulty with a fundamental math or science course (see Table 12). Because students did not take the pre-requisites to these classes in high school, they did not have a strong base and consequently struggled to successfully complete the course. On average, quota students repeated three courses between their first and fourth semesters. As courses like calculus A, analytical geometry, and physics 1 were gateway courses for many of the students it slowed their matriculation as these classes were pre-requisites for next series of courses. This was most evident with Alex, Beatriz, and Ruth as they were two and three semesters behind the other quota students who entered in their same semester (see Table 5).

In particular, students spoke of the difficult nature of the initial calculus courses (see Table 13). Seven of the nine students failed the class at least one time, while six students failed analytical geometry and four failed physics 1. Even Akacia, the only student who has yet to repeat a class, named calculus as her most difficult course. Able to pass the course on the first attempt, she still described the content as being hard to decipher. "There are a lot of times when the teacher speaks and I wonder what is this? Sometimes I do not understand."

While several students named calculus as their most challenging course, students like Paula and Rosa described calculus as only one of many difficult courses. "All of my math classes [are challenging]. It is always going to be math. Surely, this weakness is a result of my high school. I completely contribute it to this."

Cecilia also struggled in her math and early physics courses. However, unlike other students who blamed their poor public school education, Cecilia attributed her difficulties to poor teaching at the university level.

The classes I like least are mathematics and theoretical physics...the math classes are a terror. Few of the math professors know how to explain to us how these [theories] are

applied in reality. The teachers come in class and talk to us about the theory but they don't tell us how we will use things in real life. This is horrible, complicated and I don't like it.

Table 12. *Type and Number of Courses Repeated*

Major	Student	Course	First Semester Attempted	Number of Times Attempted Before Passing
Physics	Luan	Calculus A	First Semester	One Time
		Analytical Geometry	First Semester	Two Times
		Physics 1	First Semester	One Time
		Calculus C	Third Semester	One Time
	Cecilia	Physics 1	First Semester	Two Times
		Calculus A	First Semester	Two Times
		Analytical Geometry	First Semester	Three Times
		Physics 2	Second Semester	Three Times
	Ruth	Calculus A	First Semester	One Time
		Analytical Geometry	First Semester	One Time
		Physics 1	First Semester	One Time
		Physics 2	Third Semester	Three Times
		Calculus C	Third Semester	One Time
Mechanical Engineering	Alex	Calculus A	First Semester	One Time
		Analytical Geometry	First Semester	One Time
	Beatriz	Calculus C	Third Semester	One Time
		Physics 1	Third Semester	One Time
		Statistics	Third Semester	One Time
		Mechanical Engineering 1	Fourth Semester	One Time
	Etienne	Elements of Mechanics	Seventh Semester	One Time
		Vibration Control	Seventh Semester	One Time
Chemistry	Leandro	Calculus A	First Semester	Three Times
		Analytical Geometry	Second Semester	Two Times
		Fundamental Chemistry	Second Semester	Two Times
	Rosa	Calculus A	First Semester	Three Times
	Mario*	Analytical Geometry	First Semester	One Time
		Physics 2	Second Semester	One Time
		Physics 3	Fourth Semester	One Time
Electromagnetism		Fourth Semester	One Time	
Computer Technology	Paula	Calculus A	First Semester	Three Times
		Technological Science	First Semester	Three Times

Note. Although Mario is now a graduate student the data provided his from his undergraduate experience as a quota student at UFBA

Table 13. *Frequency of Courses Repeated by Student Participants*

Course	Number of students who repeated the course one or more times
Calculus A	7
Analytical Geometry	6
Physics 1	4
Calculus C	3
Physics 2	3
Electromagnetism	1
Elements of Mechanics	1
Fundamental Chemistry	1
Mechanical Engineering 1	1
Physics 3	1
Statistics	1
Technological Science	1
Vibration Control	1

Quota students majoring in STEM fields struggled academically in their core math and science courses. As a result, students found themselves repeating gateway courses multiple times. Students stated that their failure to pass their first and second semester math classes was primarily a result of the poor education they received in public school. Many of the students never had trigonometry or pre-calculus classes that served as the foundation for the calculus A class that was a requirement for all STEM majors.

Persistence in STEM

Students stated that there was a correlation between the difficult nature of initial math and science courses and low retention rates in their majors. University regulations state that students are permitted to repeat a course a maximum of three times. If the student does not pass the course on the fourth attempt, he/she will be withdrawn from the university. Should the student wish to continue their studies they must sit for the entrance exam again and compete with all other candidates to be readmitted into the university. Students suggested that it is common for quota

students to have to repeat a course. In spite of the fact that repetition is a recognized norm, both students and faculty stated that failing a class can have damaging effects on a student.

Having had to repeat calculus A three times, Rosa suggested that quota students are in constant fear of failing a class because they run the risk of losing the spot they fought so hard to obtain. Professor Cassio also acknowledged this as a serious issue as repeated failures may lead to lowered self-esteem. “I think what also differentiates them [quota students] is low self-esteem. These students find that they cannot persist. Perhaps this is one of the strongest reasons for them to leave.” Paula, the one student who did change majors, stated that she left because she could not deal with the rigorous math and science courses. After failing both calculus A and technological science three times she decided she would rather switch majors than fail out of the university.

I left the program in science and technology because I’m not accustomed to doing calculus. I really like math and physics but because I was not used to doing this type of work and because of the deficiencies of in my high school, I could not adapt to doing the work on a college level.

The University has acknowledged that the unfavorable socio-economic condition of quota students puts them at greater risk for experiencing academic delays and having an interrupted academic career (UFBA 2012). Furthermore, institutional data highlights the significant challenges students in STEM fields face⁹. In August 2014, UFBA published a study that analyzed retention¹⁰ at the university by academic major. According to the authors of the study, students were seen as being retained if they failed at least two of the required courses within their major. When a student is retained, they are forced to repeat all of the courses required by the curriculum

⁹ Data was not available for the physics or mechanical engineering majors.

¹⁰ In the context of this study, retention is not used in the traditional manner in which HEI’s in America use the term. Instead, the word retention is indicative of the number of students who were held back and forced to repeat a class or semester.

for the given semester. Ruth acknowledged that this had happened to her as she was now in her fifth semester taking classes from the third semester curriculum.

While the data did not distinguish between quota and non-quota students, it showed that a large number of students were being held back because of their performance in core math and science classes. Among chemistry majors, researchers found that of 150 students who had been held back in Fundamental Chemistry, 110 failed due to low grades, 10 did not sign-up to take the final, 20 did not show for the final exam, and another 10 dropped out of the course. Several students recalled similar situations in their classes as they spoke about the large number of students who dropped out of their fundamental math classes or abandoned the major. Leandro described this phenomenon as follows:

Calculus and physics begin with forty and fifty people but after the first test there are only twenty, and then there are fifteen, and after the second test there are only ten [students remaining]. And now that we are at the last test there are only five or six students. In the chemistry major it is the same. In the first half there are twenty or thirty. Second semester there are fifteen or ten and when we go to graduate there will be four or five. It is always like this.

All of the students recalled similar experiences. At the beginning of the semester, their classes are full of students. With each test and each failing grade, more and more students drop-out. Mario, a doctoral student in chemistry, cited academic difficulty as the main reason students do not persist.

The year I entered in 2006, I think there were 80 students who entered with me and about 15 have graduated. In fact, there are people who entered with me that have not graduated yet. A lot of students dropped out. Most give up and others change majors.

Though it is obvious that quota students face academic challenges, many spoke about the need to persevere. Students acknowledged that they have worked too hard for the opportunity to enter college to simply give up. Rosa recalled the tremendous effort she put forth in order to get into the university.

I know how hard it is to get into UFBA. It is very difficult. I forced myself to try to get in three times and it's more difficult now... As a quota student in my course it is more difficult to keep pace with the course so I try more.

Other students cite their strong support systems as the main reason they refuse to quit. Both Mario and Etienne commented that their mothers are the driving force behind their continued persistence. When asked what factors helped him to graduate, Mario responded that it was his mother and later his wife. When he found himself struggling in his courses, the two of them encouraged him to continue. He also noted that when he was awarded a research scholarship he experienced less of a financial strain and was able to more easily focus on his classes.

Ruth attributed her perseverance to faculty members who encouraged her along the way. "Thank God we did not give up. Three or four teachers told us – 'you will not quit this major. We will help you.' So do not give up in moments of difficulty."

In spite of recognizing the fact that low income students may be at an academic disadvantage, the university has not implemented the necessary mechanisms to help students deal with their weak skills. When the students were asked what strategies they employed to help themselves to persist, they spoke of the importance of learning how to study and having a close circle of peers. Many of the students described feeling academically lost when they entered the university. This was in large part due to the fact that the students did not know how to study or prepare for class. Ruth captured the groups' sentiments, stating that only after a few semesters did she finally understand how to study for class.

I have matured in college. When you enter in the first semester things are different than in the middle [of your college career]. You begin to understand how you learn. If I only read [the text book] I'm not learning. I understand that I have to do the exercises and when I first entered here I did not know that. I didn't know how to study. It was all new to me. The fact that I am successful in these classes is because I have had more time here [at the university].

Students who were further along in their academic career said that with time they adjusted to the college environment. Their improved study habits led to a better understanding of content and improved grades.

Nearly all of the students reported going to their friends when they needed academic assistance. Students in each of the three majors said that they first asked their friends for help when they had questions about the content. These students recalled feeling like they learned better from their friends than they did the professor. Consequently, students reported scheduling as many classes as possible with their helper friends.

Interestingly, many of the students reported relying on one specific student within in the major. In chemistry, both Rosa and Leandro names Akacia as the person they went to when they needed assistance. Although Akacia is also mentioned studying with her peers she reported being more likely to go to faculty if she needed academic help. Similarly, Beatriz and Etienne named Alex as the person they went to for help, while he reported going to faculty when he needed an academic question answered. The students in physics did not name a specific student but said they go to their colleagues for help. Luan described students' willingness to help one another. "Generally [I go to] my colleagues. We all solicit help. It is very cool. Everyone talks and explains things. I rarely go to a professor."

After the first and second semester students described getting into the rhythm of school. They have a better understanding of how they need to study to be successful in class and have learned to rely on each other when they have trouble understanding the content. In many ways the quota students created their own learning communities with students in their cohort. They purposefully take classes together and schedule times after class to collectively study the material.

Paula was the one student who did not persist in a STEM major. Discouraged by her performance in the core math and science courses Paula decided to change her major to humanities. Although Paula stayed in the major for three semesters she had not learned how to fully comprehend the material and did not seem to have the same support system as the quota students in the other majors. Though Paula was the only quota student in this study who did not persist in a STEM field, her story is not at all uncommon.

The chair of the mechanical engineering department, professor Jurandir, stated that quota students' tendency to switch from STEM majors to humanities is not unusual. Like Paula, he attributed this switch to the students' inability to pass the initial math and science courses. He expressed frustration with the fact that faculty and administrators do not know the students are considering dropping out until they come to have the paperwork signed. At that point, it is almost impossible to get them to stay. Professor Sergio suggested that many of the quota students who leave a STEM major do not drop out altogether. Instead, they choose to stay at the university and enroll in a major they perceive to be less challenging. Although Paula changed majors she has still persisted at the university. Paula described herself as being resilient and suggested that this is a common trait among quota students. According to her, quota students work hard because they are looking to prove that they belong at the university. "I think quota students are more successful because they strive more to show their value."

Currently, there is no institutional data available that reports on the persistence rates of quota students in general or those in STEM fields. In their study on social inclusion at UFBA, Guimarães et al. (2010) reported that there were no differences between quota and non-quota students in regards to course continuity and dropout rates. In spite of the fact that little data is available regarding quota and non-quota students' rates of evasion, Guimarães et al. (2010) suggest

that the quota students' similar performance to non-quota students is a result of the university's strong institutional supports.

For all cohorts, there are no differences between beneficiaries and nonbeneficiaries in the indicators with regard to course continuity, rates of conclusion and transfer, and dismissals and drop outs. Evidently these indicators are underestimated due to underreporting and late registration related to academic procedures. Nevertheless, it is clear that the variation in the indicators consistently occurs in equal measure for both groups being compared - beneficiaries and non-beneficiaries..... the findings of the present analysis can only attest to the positive impact of drop-out prevention strategies directed at the groups of students benefited by Affirmative Action policies (grants, increase in student accommodation, *Programa Permanecer*, etc.) that we have put in place at UFBA, within the context of REUNI, and which have proved to be efficient despite limits and omissions. (p. 12)

Participants in this study noted that quota students in STEM often struggled through their first year. Having attended public schools, they were unprepared for many of the gatekeeper courses they encountered. Consequently, nearly all of the students found themselves repeating an introductory math and/or science course. Both faculty and students commented that the need to repeat courses often fueled students' low self-esteem and created an environment in which students were bound to drop out. Students who persisted relied on two strategies to get them through: establishing good study skills and a strong network of friends. Those students who did persist did so because they felt they had worked too hard to get into the university to give up their spot.

Chapter Seven: Barriers to Graduation and Institutional Responses

Quota students described many variables that were barriers or obstacles as they worked to pursue their degree. The following section outlines these barriers as well as institutional responses to common issues quota students face.

Barriers to Graduation

Underrepresented minorities in STEM fields face several barriers in route to graduation. These barriers were a recurring theme in this study. Table 14 describes the barriers students themselves faced and their perceptions of the barriers they feel all quota students face. To date, the greatest obstacles for students in this study are the academic difficulties they face and their ability to adapt to the university. As mentioned in the earlier section, at least a third of the students said that they failed nearly all of their courses during the first or second semester. While their private school peers seemed to easily understand the content, quota students reported feeling as if the material had been written in a foreign language. Lacking a strong academic base and an understanding of how to study, students described themselves as having to “run” just to keep up with the pace of his courses.

When asked what obstacles in general quota students face, students listed four major obstacles: the lack of an academic base, lack of sufficient finances, lack of social capital, and lack of family support (see Table 14). Six of nine students suggested that the largest obstacle quota students face is the fact that their attendance at public high schools leaves them ill prepared academically. Four students spoke of the impact financial hardships can have on student persistence while one student spoke of the negative impact a lack of social capital and family support can have on student persistence.

Table 14. *Students' Perceptions of Barriers They Face*

Major	Student	Barriers encountered since entering the university	Barriers quota students face in route to graduation?
Chemistry	Luan	adapting to university	lack of academic base
	Ruth	lack of finances	lack of academic base
	Cecilia	poor relationships with faculty	lack of cultural capital
Computer Technology	Paula	academic difficulty	lack of finances
Mechanical Engineering	Alex	adapting to the university	lack of family/ financial support
	Beatriz	schedule for classes	lack of academic base
	Etienne	academic difficulty	lack of finances
Physics	Akacia	academic difficulty	lack of academic base
	Leandro	academic difficulty	lack of academic base
	Rosa	adapting to the university	lack of academic base / finances

Lack of an Academic Base. More than half of the students in this study cited their lack of a strong academic base as the largest obstacle they faced after entering the university. Quota students repeatedly acknowledged the fact that much of the material they saw in their first semester college courses was new, whereas it was simply a review for their private school peers. Ruth, described the negative impact attending a public school had on her academic preparation.

It's a challenge [being in a STEM field], being a quota student from a public school, we need to study more. This is different from what we see in federal public schools, because they have studied morning, evening, and night. When they come here they just repeat what they already did in high school. Quota students find it even more difficult because they come with deficiencies from the public school. You really need to spend all day and night studying. You have to learn a lot and you have to sacrifice to do it.

Several students shared similar feelings. Once again, they noted that the teachers do not differentiate between the quota and non-quota students. Consequently, there is an assumption that all students have entered with the same knowledge and are therefore held to the same standard. Mario remembered how difficult it was for him when he first entered the university. The students who attended private schools came in having been exposed to subjects he had not yet seen.

When you get out of high school there is a lot you don't know when you enter the university. When you enter, those who went to private school and public school are treated the same way. There are so many subjects that I had not seen so I had to study hard.

Although students realized how difficult it is for a student who has not been exposed to high levels of math to enter a calculus class and immediately understand the concepts, the faculty members act as if this not an unreasonable request. According to students, many of the faculty members expect students to come to class with a certain level of knowledge. Since faculty do not differentiate between private and public school students, the students are all expected to know certain “basic information.” Leandro recalled a class where the teacher chided students who did not understand the material. To her, the information was something the students should have remembered from high school, but the material was new to Leandro and other quota students.

When you get to chemistry, you have other problems because some things are similar to what you learned in high school but not really like before. If we had the basics or a decent education then we wouldn't have much trouble at this point. The teacher says things like, 'this is basic, this is from high school, if you do not know this you can't do anything. You need to study more is all.'

When observing the Fundamental Organic Chemistry 4 class I was able to see an interaction similar to the one Leandro described above. The teacher had been speaking to the class about different elements and their configurations when one student asked how they were supposed to know where to draw the bonds and electrons on the model. The teacher explained to the class that the placements were based on mathematical calculations and that they should remember this from high school. The same student acknowledged her answer but repeated his question, “But how do we know the difference? What do we look for?” At this point, other students chimed in stating that they were confused as well. The students had been attentively watching the demonstration but they did not understand how they were supposed to “magically” know what electrons were orbiting what element and when. After yet another student asked, the teacher explained that there are three

ways to decide where the electrons go. After modeling with the element Pepidina, the class was clearly frustrated and one student commented aloud that he still does not understand. The teacher then responded, “OK. If you don’t get it, you’re going to get it now. Let’s try another one.” The students demonstrated body language that suggested that they were increasingly frustrated and exhausted of asking the same question. It seemed like they kept getting theory when they wanted a solid set of steps that would help them solve these types of problems.

While walking off campus the male student who first asked the teacher to clarify where to put the electrons voiced his frustration again to Akacia and Rosa. He spoke about how the instructor never answered the question and then made him feel like he should have already known how to do this type of work. The student continued, speaking about the difference between the knowledge he entered the university with and what the teachers expected him to know. “It’s like we’re down here,” he demonstrated by reaching his arm down to the ground, “but the teacher expects us to be all the way up to stars.” He then said he wanted to see what was going to be on the test, because if he does not know how to solve these types of problems now, he will not know how to do it on the test.

Having experienced situations like these many times, Akacia, noted the academic deficit quota students had and the diligence required to keep pace. “Once we get into college there are a lot of things we’ve never seen and so we have to run to catch up and learn the things that the other students already know.” Students who were exposed to some of the topics covered in class still found fault with their high school education. Rosa recalled feeling like everything she had learned in high school was useless. Upon entering the university, Rosa, and many of the other quota students felt as if everything they had learned was wrong.

When I analyze my major [I realize] it is very difficult, very, very, very, difficult. Everything that you learned in high school has to be deleted in a certain form here. The

professors will tell you, ‘No, that is wrong.’ and so you have to prepare to learn things all over again and its very complicated.

Many of the students felt that their public school education left them ill prepared to face the academic rigors of their major. Thought to be the biggest obstacle students face after entering the university, students often said that faculty assumed, or at the very least acted, as if all students were coming in with the same knowledge base.

Lack of finances. The public universities in Brazil do not charge tuition fees. In spite of this, there are still a number of cost associated with attending the university. Since the majority of students admitted under the quota system are low income, they not only have problems dealing with the costs associated with being a student, but with the opportunity costs of going to college.

Students who spoke about the financial challenges they faced in completing their degree often talked about the additional costs and fees students have to pay. Items such as transportation, food, books, and laboratory materials are necessities for all students, but quickly become burdens for those who cannot afford to pay for them. Paula described how a lack of money can be a huge burden for quota students. “To stay here at the university you need money...It’s a really complicated issue because generally the people who enter through quotas don’t have financial conditions.”

Ruth stated on several occasions that money, or a lack thereof, is one of the greatest obstacles she faces. A recipient of one of the university’s many *bolsas*, or scholarships, she reported barely having enough to make ends meet.

Staying here is the biggest difficulty. Working in the CNPq (Science initiation) I get R\$ 400 per month, which is too little to survive and that’s for transportation, food, shoes, clothes, and events in my major that require travel and books. Physics is very expensive.

Etienne shared Ruth’s perspective, adding that students’ lack of funds plays a significant role in student departure. “Many times they [students] fail to come to the college because they

don't have money for transportation, or they don't come because they have to work so they take fewer classes and take longer to matriculate. They lack aid and they lack support.” Etienne went on to describe how difficult things were when he first started at the university. “I had this experience because I had no money to even get a snack. I spent the entire day without eating anything and I was just going to eat at two or three-o-clock in the afternoon when I got home.” Several of the students suggested that experiences like Etienne’s are common.

For many students the cost of attending college is not limited to the fees and materials they need to purchase. It is also calculated from the amount of money they are losing by not working. Several students spoke of the opportunity cost quota students face when attending college. Ruth noted that the need to work often meant that quota students took fewer classes and a longer time to graduate. “Many students are taking only one or two courses so they can work because they need to survive and pay bills.” Students often suggested that quota students have additional duties in the family that makes working an attractive alternative. Mario noted that several of the quota students who dropped out of his cohort did so for this very reason. “Sometimes we have the opportunity to work outside of college and when you weigh things out for some work is better than studying because it can help the family.”

Although public universities in Brazil are free from tuition, quota students still encounter financial difficulties. Students reported that the cost of daily necessities such as food, books, and transportation made the cost of attending college higher than many could afford. Even those students who received financial aid in the form of research scholarships and food and transportation subsidies reported that the amount they received was insufficient to cover their costs. Finally, several students described having to choose between work and school. While all of

the students in this study chose to stay at the university, they noted that several quota students took reduced course loads or dropped out in order to work.

Lack of Social Capital and Family Support. Students spoke about the importance of social capital and family support when discussing their pre-college experiences. Not surprisingly, these two topics came up a second time when students began to discuss the obstacles they faced in route to graduation. Many of the students were the first in their families to attend college. Consequently, they felt that their parents' limited educational experiences negatively affected their ability to successfully navigate the college going process. Students like Cecilia, reported feeling lost when she entered the university. "Our [quota students] parents usually have little education and as a result we have no idea what to expect here." Etienne went on to describe how coming from a lower class family often meant a student had less access to critical information and educational opportunities.

It's difficult for a quota student to compete with a person who has financial conditions. Their parents know influential people so they just talk to one of their friends and say, 'my son is in his fifth semester.' I've seen it. People who are much worse students than I am and barely competent who easily get an internship while I struggle.

Students reported on several occasions that their parents' level of education presented yet another obstacle. For first generation students whose parents had no knowledge of the university system, it meant having to navigate the entire process on their own. These students reported having to learn things along the way. Similarly, low-income students stated that their families did not have professional ties that could help them gain coveted internships, pay for study abroad, or open doors for additional opportunities.

Institutional Responses

The expansion of allotted admission vacancies in 2003 and the implementation of affirmative action in 2005 created a significant increase in the demand for material, social, and

academic supports. Prior to 2003, 5,400 students at UFBA were public school graduates from low-income families. Of that number only 1,087 were beneficiaries of one of the university’s student assistance programs. In addition, the Ministry of Education sponsored eight programs, which funded a total of 250 scholarships designed to improve student success and persistence. Due to the fact that the number of students served by assistance programs was far below the actual number of students in need, in 2007, UFBA outlined seven goals related to institutional support (see Table 15). Consequently, new programs were initiated with the goal of, “improving student retention and promoting the success of poor students,” (UFBA, 2012, p. 35).

Table 15. *UFBA Goals for Institutional Supports, 2007*

I	Until 2012, gradually expand academic and social supports by at least 200%, to students from a low socio-economic status
II	Reserve 50% of vacancies in all student assistance programs for quota students and 50% for non-quota students from a low socio-economic status.
III	Expand, reequip, and restructure the Medical Center at UFBA
IV	Complete construction of the residential student complex at Avenida Garibaldi
V	Expand the meal plan program with progressive financing and scholarships yearly
VI	Implement a meal plan program for the UFBA campuses at Barriers and Victoria
VII	Increase the number of permanence scholarships, the extent of funding resources, diversifying the relevant programs

Source: UFBA, 2012, p. 37.

According to institutional data, the university has met all of the aforementioned goals. In 2012, more than 5,000 low-income students were beneficiaries of the university’s various scholarships, especially those set aside for housing, food, transportation, childcare, and the purchase of educational materials. In addition, over 750 scholarships were offered to students involved in projects in the areas of education, research, and extension. Since that time, the number of scholarships has continued to grow. While the data did not specifically state what percentage of

scholarships recipients were low-income or quota students, both faculty and students acknowledged that the bulk of university funding is reserved for low-income students.

Goals IV through VII were also met during the expansion. The residential hall at Garibaldi has been completed and currently serves as a model for future builds. The number of meal plans and permanence scholarships have been expanded at the main Ondina campus and at Barriers and Victoria.

While UFBA has successfully met its goal to create supports to help assist quota students, students and faculty primarily spoke about two types of supports: financial and academic supports. All of the students in this study acknowledged the importance of having access to both financial and academic support. Professor Cassio described how essential these supports are stating, “We have to give access with support. Only then will we have the qualified professionals with the training Brazil hopes for.”

Financial Supports. During the 2013 academic year, UFBA funded over 15,000 scholarships and grants (see Table 17). Of that number, 1,266 were specifically designated for undergraduate students. With the exception of the research and monitoring scholarships that are based on teachers’ recommendation, many of the other scholarships are earmarked for low-income students.

The students in this study cited the research scholarships (PIBID, PIBIC, CNPq, and CAPES), transportation vouchers, meal vouchers, and the residence halls as the institutional supports most widely used by quota students (see Table 16). As seen in the table below, when asked about institutional supports available to quota students all ten students named the university’s meal plan and research scholarships. While none of the students in this student are recipients of the university’s meal vouchers, nine out of ten students reported having either the

PIBID or PIBIC research scholarships. More than half of the students recognized support in the form of housing and transportation aid, while four students spoke about the university’s retention program (*Programa Permanecer*) and the Xerox vouchers they offer to students.

Table 16. *Types of Student Support Identified and Used by Quota Students*

Type of Institutional Support	Number of Students Who Identified This Type of Support	Number of Students Who Use This Type of Support
Meal Plan	10	0
Undergraduate Research Scholarships (PIBID/PIBIC)	10	9
Housing Aid	8	0
Transportation Aid	6	1
Retention Program	4	0
Xerox Subsidy	4	4
Monitoring	3	0
Health Assistance	0	0

While there is no data indicating how many beneficiaries of institutional support are quota students, students and faculty infer that a larger number of quota students receive the various supports offered by the university. Since 50 percent of student assistance aid must be reserved for quota students and 50 percent for students from low socio-economic backgrounds, it is within reason to infer that a large number of housing, food, and transportation aid beneficiaries are also quota students. Cecilia drew a similar conclusion stating, “I have never heard of anything [scholarships] specifically for quota students, but I believe that many quota students are low-income and in order to get these scholarships you have to be a student from a low-income household. I think that covers most quota students.” Professor Cassio agreed noting that quota students were well aware of the financial supports offered by the university. “I don’t think that any scholarship goes unawarded. That which the university has is well absorbed by students.”

Table 17. *UFBA Scholarships and Financial Aid, 2013*

Name/Type of Scholarship	Number of Recipients
Dean of Undergraduate Studies – PROGRAD	1266
Tutorial education program-PET	180
Monitoring program	500
Institutional program teaching Incentive Scholarships-PIBID	586
Dean of Extension-PROEXT	249
Curriculum action in community and society- ACCS	87
Institutional scholarship program initiation into extension-PIBIEX	100
PROEXT project	62
Dean of Research and Innovation-Creation PROPCI	9,975
Institutional program of scientific initiation scholarships PIBIC	1599
Prog. Scientific initiation Fellowship institutional Junior – PIBIC JR.	33
Scientific initiation of Institutional Research Programs/UFBA	168
Institutional scholarship program Technological Initiation-PIBIT	66
Institutional program Russell-Wood/UFBA 1	1
Young talent program scholarships-BJT/CAPES	68
Science without frontiers program grants-CsF (CNPq and CAPES)	686
Special scholarship program of Monitoring/UFBA-PROFICI (English, French, Spanish, German and Italian)	80
Participation in the PROFICI aid/UFBA (2)	5936
Awards Public aid/UFBA and reward Inventors/UFBA	22
Other aid/UFBA (3)	1316
Office of the Dean of Affirmative Action and Student Assistance-PROAE	3839
Retention Program	750
Housing aid	908
Meal plan	1103
Transport aid	658
Health assistance	420
Total	15,329

Note. Source: UFBA, 2014

In the current study, nine students were awarded research scholarships, four stated that they used the Xerox subsidy, and one was a beneficiary of the university's transportation scholarship.

When asked about their use of other supports offered by the university students often commented

that they were ineligible due to their families' socio-economic status, used an alternative support (i.e. Beatriz used free transportation provided by her prefecture), or they never thought to apply.

All of the students had mixed feelings about their research scholarships. Research scholarships award students a monthly stipend of R\$400, which is less than 150 dollars. Students in this study realize that the university is making an effort to help students financially, but comment that the money they receive is too little to cover their actual costs. Ruth expressed the sentiments shared by many students in the group stating:

Working in the CNPq (Science initiation) I get R\$ 400 per month which is too little to survive and that's for transportation, food, shoes, clothes, and events in my major that require travel and books and physics is very expensive. Staying here is the biggest challenge.

Students reported feeling the same way about the transportation and meal vouchers. First, there are too few scholarships offered to help all of the students who need assistance. Secondly, scholarship recipients feel that amount they receive is not sufficient to cover students' costs. For example, over 80 percent of the students who receive free meals on campus are students housed in one of the university's three residence halls. All other students pay subsidized rates for meals.

Of the different financial supports I observed, the housing assistance was by far the most impressive. The university opened its residence halls to offer housing for students whose homes are several hours away. The university's three dormitories collectively offer housing to over 900 students. Although none of the students I interviewed lived in university housing, I had the opportunity to visit the newest facility and meet with student residents.

A ten-minute walk from the Ondina campus, the residence hall I visited was the newest, the closest to campus, and the model that will be used for future builds. A renovated apartment building, the dorm holds 197 students. Although the dorm is mixed gender, each apartment houses four students of the same gender. Students who live in the residence halls are permitted to stay

year round and pay absolutely no fees for their room or board. In fact, the residents have nearly everything provided for them. The apartments come fully furnished with four beds, living room furniture, a TV, a computer and desk, bed linens, kitchen appliances, and other necessities like soap, deodorant, and toilet paper are supplied on a monthly basis. In addition, there is a computer lab located on the first floor, 24-hour security, and the building is staffed with workers who wash the students' clothes and clean the building.

The university offers financial support to students in the form of various scholarships and aid. At least half of all student aid is reserved for quota students and low-income students. Quota students appear to be knowledgeable of most of the university's offerings but the majority of students in this study are only beneficiaries of the research scholarships. Students reported being grateful for the opportunity to receive funding but acknowledged that the stipend is too low to cover their basic needs. Furthermore, they remarked that in regards to the meal plan, housing, and transportation scholarships that the number of students in need far exceeds the amount of available aid.

Academic Support. Student and faculty participants suggested that academic supports were largely absent from the university. When asked what types of academic supports were available Akacia said, "Here at UFBA there is a lot of financial support, but support to help the difficulty students have in class, no we do not have that here." Luan among others, agreed stating, "Unfortunately, we don't have that [academic support] here." The one exception students spoke of was the monitoring program.

Founded in 2012, the program was created to give faculty and students additional support in the classroom. Students who have successfully passed a course can be recruited by teachers to serve as a monitor for that class or a similar course. In order to serve as a monitor, students must

pass an exam demonstrating that they have knowledge of the content. Once selected, their duties include attending class, assisting faculty members with research, and helping struggling students with course material. In exchange for their work, monitors receive a monthly stipend of R\$400. During the 2013 school year, 500 students were funded to work as monitors¹¹.

Several of the students felt that the monitoring program was a greater benefit to faculty than students. Akacia called the program superficial suggesting that no real learning takes place. “If you have a difficult question and you go to the monitor they will help you answer the question. There is nothing else. That’s it.” She, along with other students stated that the monitors were really in class to help grade papers and work jointly with the faculty on their research projects.

Many students suggested that while monitors were supposed to be available to help struggling students, they had not received any training on how to tutor and had limited availability. Rosa described being frustrated at the monitor’s inability to help her understand the concepts being taught in class. “I went for analytical geometry but I think that monitors are not very prepared to help and in a certain form it hinders us because we go there to get help and eventually they will answer the question but it doesn't matter if you understood or not.” An interview with the director of the program revealed that monitors do not in receive any type of training.

Formal training, I would have to say no. It is at the discretion of each professor. Each professor has a criterion for what is needed to be a monitor in their class. And then there are the guidelines for the program. They do not state that the monitor has to receive any training, only that they have taken the course.

Even when students risk going to untrained monitors, there are additional factors that may make it hard for them to get the help they need. Data on the 2014 monitors at UFBA revealed a

¹¹ There are two types of monitors at UFBA: volunatry and montiors who receive funding. Both types of monitors must meet the same requirements. Volunteer monitors typically work with professors or in departments who did receive sufficient funding to finance their position. Several students spoke of volunteering in the hopes of getting a paid position later in the year.

total of 155 monitors serving science and math classes. As shown in Table 18, several of the challenging courses students took have monitors assigned to them. Physics 1, a core course for many of the science majors, had monitors in 14 classes for the current school year. Other challenging courses like calculus A and analytical geometry were allotted four and five monitors respectively. Although the director of the program noted that it is common to have a high number of monitors in difficult math and science courses, she acknowledged that the placement of monitors is not driven by a needs assessment or student data, but based on the departments and faculty members who petition to have monitors in their classes.

Table 18. *Number of Monitors Serving Core Math and Science Courses, 2014*

Course	Number of Monitors
Physics 1	12
Analytical Geometry	5
Physics 3	5
Calculus A	4
Physics 2	4
Calculus C	2
Statistics	1
Technological Science	1
Electromagnetism	0
Elements of Mechanics	0
Fundamental Chemistry	0
Mechanical Engineering 1	0
Vibration Control	0

In spite of the heavy presence of monitors in courses like physics 1 and analytical geometry, several of the students reported that scheduling conflicts made it nearly impossible to meet with monitors. Students themselves, the monitors' availability to meet with students is limited by their own class and research schedules. Beatriz recalled being unable to get help from a monitor as her availability never matched up with the monitors. "They [monitors] are selected by teachers and can spend up to 12 hours during the week working with students but your schedule has to match

up with the monitors in order to get help.” With no training and limited availability, quota students often described how difficult it was to get the academic support they needed.

In light of these findings, students and faculty stated that the university needed to invest in more and better functioning academic supports. Students noted that the current program with the monitors could be improved by ensuring that monitors were trained, increasing scheduling availability, and collecting data on the students who use the system.

Although students did not describe their undergraduate research experiences as an experience that provided academic support, academic support, their comments alluded to the fact that their participation in research helped improve their academic performance and willingness to persist in STEM. Managed by the office of Affirmative Action, Education, and Diversity at UFBA, the undergraduate research scholarships are part of the *Programa Permanecer*, which was created to improve the academic outcomes of students from low socio-economic backgrounds. Along with PIBID and PIBIC, faculty members must first submit a project to the university for funding. Once the project has been funded, the faculty member can then enlist students to work on the project. These selected students are subsequently awarded a research scholarship. The type of work varies by project but can include lab work, field research, or teaching practicums. In spite of the varied manner in which research scholarships are defined, Etienne insists that they are all academic in nature. “All of these research fellowships were created to include the student in academic activities. Some focus on the fact that the student will be a teacher in the future while others prepare them to be researchers in their field.”

Students had varied opinions about how easy it was to get a research scholarship. While the scholarship itself only has the requirement that the beneficiary be from a low socio-economic status, students reported that their academic performance played a significant role. In each of the

three departments students noted that professors often invited students with high performance to be on their research teams. This was the case with Akacia, who was offered a research scholarship after her first semester at the university. Other students reported having to approach faculty members and ask to be on their team. Cecilia, along with others spoke about the difficult and intimidating nature of this process. She pointed out that students, especially those early on in their college career, are not knowledgeable of all of the faculty members or their projects.

There aren't announcements nor do you professors come in class and say, 'People I'm working on this topic if someone wants to help me.' And if they do say something, they usually only say it to the students who stand out in class. When a student excels in class they pull them over to the corner and asks if they want to help but they don't open the opportunity to all students.

Other students also recognized that they had to take the initiative to approach faculty members but suggested that it was only a matter of asking. "To be on a research team you only need to search for a professor." Etienne made this remark but added that only professors with PhD's were awarded research projects. This reinforces Cecilia's comments about how challenging finding a research team can be for students unfamiliar with the faculty and their areas of expertise. According to some students, many faculty members are awarded scholarships that exceed the number of students they have on their research teams. Students suggests that this is due to the fact that they do not get enough students to fill the vacancies on their research teams. Etienne remarked that this problem could be eliminated if faculty members advertised their projects by speaking about them in class and posting them on bulletin boards.

Although all of the students felt that faculty should play a larger role in advertising research opportunities, Leandro and Rosa acknowledged that for now the onus of finding a research team rests on the students. They further remarked, that since scholarships are limited students must be persistent if they want to get a spot on a research team. Both Leandro and Rosa volunteered with

a professor in the hopes of getting a research scholarship. After volunteering for one semester another professor had seen their diligence and invited both students to be on her research team. Leandro suggests that volunteering is a good way for students with less than stellar academic performance to get on a research team. Through volunteering he was able to establish better relationships with faculty and prove his ability to conduct research.

Students stated that their work on research teams was beneficial in two ways. First, working on the research teams helped students connect the concepts they were learning in class. The research that required lab work allowed students to get hands on experience in their field, while teaching practicums made students more knowledgeable of the content as they would be required to teach it to middle and high school students.

The second major benefit of joint research was it improved faculty-student relationships. As noted earlier in the paper, the vast majority of students said they were closest with their research advisors. Students reported having the opportunity to develop relationships with these faculty members on a personal level. Furthermore, since the research groups were relatively small, faculty could more easily see students' academic abilities.

In spite of the monitoring program and academic advantages tied to undergraduate research, nearly all of the participants suggested that the university implement some sort of support that would help improve students' foundation in basic math. Cecilia, Rosa, and Professor Cassio recommended that UFBA create a course that would be offered to quota students prior to the start of the semester. Similar to bridge programs in the U.S., they see this course as a way to better prepare students for the gateway courses they take during their first and second semesters. Other students felt that by offering quota students the opportunity to take basic math classes the

university would be leveling the playing field so that all students could begin their core classes with the same basic knowledge.

After matriculating through difficult math courses himself, Raphael, a graduate student at UFBA, teamed up with some friends to offer a free remedial math course to students during the semester break. Initially, the course was designed to help high school students prepare for the *vestibular*. However, word spread and more and more public school students who had already been admitted into the university started to attend. Raphael said that he decided early on that the content for the study group would follow the basic math curriculum. He recalled going through a high school math textbook, highlighting the information students needed to know in order to have a strong base for calculus A. “I figured I would give support to the undergraduate students. The greatest difficulty they had was with basic math.” According to Raphael, public school students in all majors struggle when they have to take math. Further examination of students ENEM scores (see Table 7), suggests that this may be a problem area as math and natural science scores are typically lower than their scores in language, writing, and social science.

Student turn-out revealed a need for such courses. According to Raphael, courses were held every Saturday from 8:00am until 5:00pm. In the beginning, they had nearly 45 students who showed up every Saturday. The number of students who consistently came diminished over time. Although they only offered the course on one occasion, Raphael and the students he helped felt that the time and effort they put into the course helped to make a change “We were very well received. But since then no one has done anything like it.”

Participants in the study felt that much more needed to be done to support students academically. Currently, UFBA’s academic supports are limited to the monitoring program. Although the program employs 500 students and serves 155 STEM classes, students suggested

that the program is useless. In addition to not being trained, students complained that scheduling conflicts made it difficult to schedule an appointment to meet with a monitor. Raphael, a graduate student at the university, offered a basic math class during the semester break that students and faculty believe should be replicated. This would give public school students the foundation they need in math prior to starting their classes.

The academic supports offered by the university are limited to the monitoring program and student participation in research. Students described monitors as being of little use as they have limited time and capability to tutor struggling students. Those students who did work with monitors suggested that the service did not really help as they remained confused about how to solve the problems independently.

While students did not acknowledge participation in research as an academic support, the positive impact it had on their understanding of course material suggests that it can be a mode of support. Students who participated in research described having a better understanding of the concepts they had learned in class and stronger ties with faculty. Both of these factors positively affected students' performance and persistence.

Chapter Eight: Discussions and Conclusions

The Law of Social Quotas mandates that all public universities in Brazil reserve 50 percent of their admission slots for low income (i.e. public school graduates) and minority students by 2016. While some federal universities have had quota policies in place for the last decade, the focus for many HEI's has shifted from simply admitting low-income and minority students to implementing practices to help retain them. In spite of this new focus, few researchers have examined factors that impact the academic performance and persistence of quota students. In addition, there is limited research that specifically examines quota students in STEM fields. As such, this study sought to shed light on the factors that affect the academic performance and persistence of quota students in STEM. In doing so, the study seeks to highlight the obstacles quota students majoring in STEM face as they pursue their degree and the support services offered to them by the university.

This chapter begins with a summary of the findings presented in chapter four. This is followed by a discussion of how the findings intersect with the theoretical framework and existing literature. The chapter concludes with the implications for future research and practice.

Summary of Findings

This study examined the factors that affected the academic performance and persistence of quota students in STEM fields. Interviews with participants highlighted four broad themes: the pre-college experiences of STEM quota students, the college experiences of STEM quota students, their college outcomes, and barriers to graduation and institutional responses. Each of these themes contained push and pull factors that either positively or negatively impacted student achievement.

Pre-College Experiences. Students spoke at length about the educational disparities that existed between the public schools they attended and private schools in the state. Although the majority of students attended public high schools that scored higher than the state average for public schools on national standardized tests, students felt that their public school education inadequately prepared them to enter the university. Several students attributed their poor education to a lack of qualified teachers and a weak science and math curriculum.

In an effort to boost their chances at being accepted into the university, students participated in courses that would help them prepare for the entrance exam. According to students, the prep courses gave them a stronger foundation in math and science. For many students the extra boost helped them gain admission into the university.

Another factor students commented on in relation to their pre-college experiences was their exposure and interest in STEM. Several students noted that their interest in STEM began in high school and was a direct result of their early academic success in science and math courses. Other students noted that supportive teachers and lucrative job prospects positively influenced their decision to major in a STEM field.

Finally, students spoke of parental involvement as part of their pre-college experiences. Students perceived their parents as both a push and pull factor as they pushed students towards attending the university but often attempted to pull them away from majoring in a STEM discipline. Many students reported that their parents feared that the STEM courses would be too difficult and that they subsequently would not be able to graduate and earn a degree.

First generation students found themselves facing an additional challenge. Because they were the first in their family to attend college, they had to navigate the entire process on their own. Although their parents were pleased they had gained acceptance into the university, they were

unable to share any knowledge about what students should expect or needed to do in order to be successful in their college career.

College Experiences. Students reported that their identity as quota students and underrepresented minorities largely shaped how they perceived the campus climate. Nearly all of the students suggested that their status as a quota student did not negatively impact their view of the global campus climate. They attributed this to the fact that there is no way to identify who entered the university as a quota student. Despite the fact that there are is no obvious way to determine who were the beneficiaries of affirmative action, students recognized that within their major assumptions were often made. Students and faculty assumed that poor performing students must have attended public school and thereby entered the university via the public school quota. These stereotypes paired with the small presence of racial minorities in STEM fields, led students to report a chilly environment within their major.

In contrast to the general finding reported by the group regarding the STEM environment, female students noted that their gender positively affected the way they experienced the climate within their major. Also few in number, the female students were thought to be exceptional for pursuing a degree in a STEM field.

Relationships with faculty seemed to have a lasting impression on how students experienced the campus. Students described their interactions with faculty as being either supportive or unsupportive. Those faculty members who knew students on an individual and human level, and were willing to help students were thought to be supportive. In contrast, faculty who were cold, distant, and had little accountability were viewed as unsupportive.

Pedagogical quality was the final topic students spoke about when reporting on their college experiences. Overall, students felt that the majority of STEM classes were focused on

theory and taught in a lecture format that limited student interaction. Professors who used this style of teaching often spent the class having students copy notes. More often than not students suggested that these were “bad teachers” whose classes they found boring. Consequently, students were unmotivated to study and earned low grades in class. In contrast, faculty members who encouraged student participation, fostered opportunities for group work, and connected the texts to real life kept students engaged. Not surprisingly, students reported being the most successful in these classes and noted that they enjoyed them the most.

College Outcomes. When speaking about their performance in class, quota students reported that they struggled to pass their core math and science courses. The majority of students failed gateway courses such as calculus A and physics 1. Students attributed their failing grades to the poor education they received in public school.

When speaking about persistence, students mostly spoke about quota student retention in STEM fields. Students and faculty suggested that the difficult nature of core math and science classes led many students to either switch majors or leave the university all together. Many of the students in the current study reported failing their first and second semester classes. Participants suggested that having to repeat courses negatively affected students’ level of self-esteem. Moreover, as students are only given a limited number of opportunities to repeat a course, many choose to leave their STEM major for less rigorous majors in humanities.

While some students leave the university all together, students suggested that quota students often choose to remain. According to students, they have worked too hard to earn a spot in the university to simply give up. Furthermore, many feel that earning a degree will improve their lives and the lives of their family members.

Barriers to Graduation. Students spoke of several obstacles they faced in route to graduation. The majority of students recounted that academic difficulty was the greatest barrier they encountered since entering the university. For these students, the fact that they struggled to understand course material and to successfully pass their classes jeopardized their ability to persist at the university. For others, adapting to the university was a huge hurdle they had to overcome. Many of the students who expressed these concerns were first generation students who had no knowledge of what to expect at the university. The first in their families to go to college, these students reported feeling alone as they lacked social capital and navigated the college going experience on their own.

When asked what obstacles quota students in general face, students reported that the largest problems were related to their lack of an academic base and lack of finances. Having attended public schools, students and faculty suggested that quota students struggle at first to perform at the necessary level to be successful. They spoke of how teachers uniformly expect students to enter the university with a certain level of knowledge, but that quota students rarely do as the curriculum in their schools did not expose them to many of pre-requisite math and science courses.

Students also spoke at length about the need for additional finances. Although the public universities are free from tuition, quota students often come from low-income families and require additional funds to pay for their transportation, books, meals, and other costs students incur. Even students who receive one of the university's many scholarships suggest that the money is too little to cover their basic needs. Consequently, many quota students would find work outside of the university. This resulted in students either dropping out or taking fewer classes per semester.

Institutional Responses. Students and faculty spoke of institutional supports as being either financial or academic. Institutional data showed that a significant portion of the university's

15,000 scholarships were earmarked for low-income students. Participants remarked that along with the research scholarships, income-based scholarships such as transportation vouchers, meal vouchers, and the residence halls were the types of institutional supports most commonly used by quota students. In spite of the seemingly large number of scholarships available, students reported that the monthly stipend of R\$400 was not enough to cover their needs.

Students and faculty frequently complained that the university lacked significant academic supports. While the university sponsors a monitoring program in which students work as teaching assistants and peer tutors, students felt that the program was of little use. Students called the program ineffective because monitors received no training on how to teach and their limited availability did not pair well with students' schedules.

Although students did not openly acknowledge undergraduate research as a type of academic support, nine of the ten students attributed improvements in their academic performance and relationships with faculty as a result of their participation in academic research. Students noted that while there are many research scholarships available, a large portion go unused as students are unaware of which faculty members have research projects.

Many of the participants noted that what was needed was some type of bridge course that would give public school students a stronger foundation in math and science. Similar to bridge programs in the U.S., students recommended having these courses prior to entering the university so they could enter with the same knowledge and skills as their private school peers.

Discussion of Findings

This study was guided by the extensive research that explores affirmative action, campus climate, student success, and the challenges and experiences underrepresented minorities in STEM fields face in pursuit of an undergraduate degree. While some of the findings from this study

support current research, the study also offers new insights on quota students in STEM and the factors that affect their academic performance and persistence. The following section begins with a discussion of how the findings intersect with the conceptual framework and research questions.

The conceptual framework derived from Museus et al.'s (2011) REM STEM model was used to shape the methodological design and data analysis of this study. Students were asked to discuss topics such as their pre-college experiences, their perceptions of the campus climate and STEM environment, their relationships with family, faculty, and peers, the obstacles they encountered, and their academic successes and failures. Based on the theoretical framework, individual interviews, and observations, I identified four variables that influence the academic performance and persistence (college outcomes) of quota students in STEM disciplines. These factors include: The pre-college experiences of STEM quota students, the college experiences of STEM quota students, their barriers to graduation, and institutional responses. Each of these areas contained factors that either positively or negatively influenced quota students' academic performance and persistence.

The Pre-College Experiences of STEM Quota Students

Educational Inequities. Museus et al.'s (2011) model suggests that minority students' pre-college ability is often impacted by educational inequalities. In alignment with the REM STEM model, students spoke at length about their pre-college experiences and the manner in which they impacted student success. Having attended public schools, quota students often discussed the educational inequities they experienced. All ten students cited their subpar education as one of the obstacles they faced in gaining admittance into the university. In their study which examined the difficulties black quota students face during their first semester, Almeida da Silva and Cordeiro (2011) found that quota students felt harmed by their high school education. Participants in their

study suggested that their high school teachers were not adequately prepared to teach their classes and that they didn't receive the base they needed for future academic study. Students went on to say that the curriculum in public schools was geared more towards the job market than entrance into the university. Findings from this study aligned with current literature as students also cited poor teacher quality and gaps in their high school curriculum as reasons they were ill prepared to face the academic rigors of the university.

Public schools in Brazil continue to struggle with issues such as overcrowded classrooms, lack of qualified teachers (specifically in science and math fields), poor infrastructure, lack of supplies, and violence (Novais, 2011). Consequently, the public schools that have been long abandoned by the elite and upper class are now shunned by the growing middle class as well. "In many cities and towns, public schools are, quite simply, for those with no other choice" (Kugel, 2010). Those who do have a choice send their children to private school, where students are said to be on average three years ahead of students attending public school (Kugel, 2010).

Although public schools have been noted for having poor quality education, students admitted under the public school quota considered that they attended some of the best public schools in the state. National indicators such as IDEB and ENEM scores reinforced the fact that students attended some of the state's top ranking public schools. Both students and faculty admitted that the majority of quota students accepted into the university matriculate from the better public schools at in the state. Of the top ranking schools, both the military school and the federal technical school are said to be on par with private schools.

While participants and research link minority students' performance in STEM to their pre-college educational experiences, findings from this study suggest that the type and quality of high school a student attends cannot accurately predict their academic performance at the university

level. Based on the number of courses students failed and their timely matriculation, Akacia is one of the top achieving students. The youngest student in the sample, Akacia has never had to repeat a class and has consistently earned high marks on her exams. Her stellar performance is even more remarkable considering she came from the high school with the lowest IDEB and second to lowest ENEM scores. Living on Itaparica Island, Akacia attended a rural and poorly funded high school. In contrast, students like Cecilia, Ruth, and Paula attended some of the state's top performing public schools but struggled significantly with their initial math and science courses. The school Cecilia and Ruth attended had standardized test scores well above the state's public school average. In spite of this, both girls failed all of their first semester courses and failed additional classes in the subsequent semesters. Likewise, Paula had to change majors for fear of failing out of the university. Originally a computer science major, she failed two of her core courses three times.

Several students attributed their lack of a strong foundation in math and science to unqualified teachers at the high school level. When drafting the National Curriculum Parameters, the Ministry of Education noted the importance of teacher training in STEM fields. "It is obvious that an appropriate teacher training is required for Biology, Physics, Chemistry, and Mathematics teachers, in order for the modernity of their knowledge not to result in superficiality or cognitive impoverishment" (The Ministry of Education, 1999, p. 59).

According to 2013 data, 59.4 percent of high school teachers in Brazil are highly qualified. Findings from this study did not suggest a strong correlation between school rankings and the rate of participation of highly qualified teachers. The federal technical school had one of the highest rates of qualified teachers with 60.5 percent of teachers recognized as highly qualified. Surprisingly, this percentage fell far behind one of the state public schools. At the Colégio Estadual

Thales de Azevedo, the high school both Etienne and Paula attended, 75.7 percent of teachers were highly qualified. Both Etienne and Paula commented that the school had good teachers, although Etienne noted that students did not have access to the best teachers until later on in your matriculation. In spite of attending the same school and having access to a significant number of highly qualified teachers, Etienne and Paula's academic performance varied greatly. While Etienne entered the university and passed all of his core classes, Paula failed two of her core classes repeatedly during the first three semesters.

The Colégio Estadual Mário Augusto Teixeira de Freitas was another school that fared reasonably well on the standardized exams. Interestingly, they employed the least amount of highly qualified teachers (11.9 percent). Attended by both Cecilia and Ruth, the two suggested that they had good quality teachers. Cecilia actually stated that she believed many of the professors to have had degrees in the subjects they taught. Ruth suggested that she too had great teachers but suffered educational deficits due to teacher strikes. Though these students believed themselves to have highly qualified teachers, data from the state suggests otherwise. Therefore, it is possible that the poor instruction they received could have largely impacted their academic success at the university as both students failed all three of their core classes during the first semester.

Another interesting finding is that one of the lower performing high schools had a greater percentage of highly qualified teachers than some of the better performing schools. Akacia's high school ranked lower than the state average on standardized scores but 42.1 percent of teachers were highly qualified compared to 39.8 percent at the military college. When analyzing various education indicators, Guimarães (2012) noted a positive correlation between teacher qualifications and the pace of learning in mathematics. This would hold true for Akacia, who has performed well in her all of her math classes. However, the positive correlation between teacher qualifications and

math achievement is not evident for all students. Data from the current study reveals mixed results as one of the highest performing students (Akacia) attended a school where less than a quarter of the teachers were high performing and one of the lowest performing students (Paula) attended a school where more than three quarters of the teachers were high performing.

To date, there is no research that examines a correlation between public high school ranking and quota student admittance into public universities. Guimarães et al. (2010) found that students attending the federal public high schools and the military high schools benefited most from the introduction of quotas. Though it is widely accepted that a large number of quota students come from a small number of high performing public schools, no one has remarked that the quotas failed to incorporate the most marginalized students [i.e. low-income minority students attending average and low performing public schools]. This may be due to the fact that neither the Law of Social Quotas nor the universities themselves make a distinction as to the type of public high school students must have attended to qualify for the quota. Furthermore, universities such as UFBA, which use public school graduation as a quota criterion, also require verification of the student and parents' income. In these cases, the per capita family income must be equal to or less than the minimum salary and a half. Therefore, even those students who matriculate from the better public schools are still acknowledged as being economically disadvantaged. Moreover, data from this study suggests that high school ranking is not a strong indicator of student's university level performance.

Inadequate Preparation to Enter the University. It is not uncommon for public school students, even those attending high performing schools, to suffer educational gaps and subsequently feel unprepared to take the college entrance exam or *vestibular*. “Graduates of public schools or individuals who are self-taught are unlikely to score high enough on the *vestibular* to

be admitted to a public university” (Fleischer, 2013, para 2). Poor basic education paired with an increasing demand for university admittance has led to a sharp rise in the number of private and public prep courses available to students.

In April 2014, the Secretary of State of Bahia announced that there would be 21,785 vacancies for its publicly funded *cursinho*, *Universidade Para Todos*. Offered in over 183 locations throughout Bahia classes were open to public school attendees who are in their third year of high school. While there is no data available on the number of students who register for and attend prep courses in Brazil, Lloyd (2009) notes that low-income and black families often cannot afford quality preparatory courses to assist with the admissions exam. Consequently, this further reduces underrepresented minorities chances of gaining admission to the competitive public universities. All but two of the students reported having to take a prep course in order to prepare for the entrance exam. Though all of the other students participated in some form of prep course several of them noted that the course they took was not of very high quality. Students reported that their families did not have the funds to pay for the better, more expensive courses.

According to the REM STEM model, educational inequities during the K-12 years impact students’ academic preparedness and their early disposition towards STEM. While quota students reported being inadequately prepared due to deficiencies in the public school system, many of them still described having an early interest in STEM fields. Furthermore, all of the students credited an experience they had in the public school system for sparking their interest in STEM. Consistent with literature, some students chose to enter the field because of early academic success in science and math courses. Research conducted by Eccles (2005), found that students were more likely to select math and science majors when they have a high self-concept of their abilities in those fields. Others reported being encouraged by teachers or mentors in STEM while two students

decided on their majors after examining the prospective job market. These findings also aligned with current research as both the presence of strong mentors (Lee 1999; Tsui, 2007) and early exposure to STEM careers (Museus et al., 2011) have been shown to positively influence minority student performance in STEM.

Museus et al.'s (2011) model incorporates early exposure to STEM careers as part of the K-12 construct. Data from the current study suggests that students' career aspirations may play an equally important role. Santos' (2013) study on quota and non-quota students' perceptions of their academic experiences found that career outlook was the one variable that best explained the variance in the scores of quota students in relation to their satisfaction with graduation.

Students' Perceptions of Parental Involvement. According to Museus et al. (2011) parental expectations and involvement influence every aspect of minority students' college going experience. Research has shown that regardless of race or class, children with more involved parents are more likely to graduate and go on to postsecondary education (Rowan-Kenyon, Bell, & Perna, 2008). Moreover, studies have found that parental support and encouragement is one of the most important indicators of students' educational aspirations (Auerbach, 2002; Fann, Jarsky, & McDonough, 2009; Paulsen, 1990).

Tierney and Auerbach (2005) note that lack of social capital is less common among students with college-educated parents. "Having college-educated parents confers advantage on students not only through its association with higher family income, student aspiration, and rates of enrollment directly after high school but through its association with practices like college encouragement," (p. 41). According to Paulsen (1990), parental encouragement is extremely important as it may have a greater impact on student aspirations than either family SES or student ability. First generation students felt encouraged by their parents to enter the university, but noted

that they were at a disadvantage because no one in their family could help guide them once they entered the university system.

First generation students reported that their parents wanted them to enter college but nearly half did not support their choice of major. Due to the rigorous course work associated with STEM disciplines, first generation students stated that their parents were concerned that the majors they chose might be too difficult for them to complete. Having to overcome many hurdles just to gain admission, parents preferred that they enroll in less rigorous courses as this may ensure degree completion. Atwell and Levin (2007) suggest that poorer families have lower education expectations for their children. This is in part due to the fact that poorer families are not exposed to the various opportunities available to their children. Similarly, quota students remarked that their parents just wanted them to go to college. To their parents, the end goal was to get a degree so they could get enter the job market. Therefore, students were better off selecting a major where they would not face many academic difficulties.

Research on American universities suggests that the selection of academic majors is segregated according to race and gender. According to Porter and Umbach (2006), both females and minority students are more likely to major in interdisciplinary studies and social sciences than STEM. Consequently, the representation of women and racial and ethnic minorities in STEM disciplines remain significantly lower than their overall representation in college enrollment.

The tendency to select non-STEM majors has been attributed to various factors including parental encouragement. Fries-Britt, Burt, and Franklin (2013) noted that first generation students' parents believe that the primary reason to attend college is to find gainful employment. As such, they encourage their children to pursue majors in vocational fields. The expectation is that the student will graduate, go on to work, and consequently be able to help support the family. Jaschik's

(2005) support this notion as first generation students in that study were more likely than other students to major in business or vocational fields and less likely to major in science.

Some of the students who reported being discouraged by family members noted that their families were concerned that it would be difficult for them to find work in their field. A large part of pursuing a college degree was to create upward mobility for themselves and the family as a whole. As such, family members discouraged students from going into fields like physics and chemistry that had relatively few jobs in the Brazilian market.

Another factor that is said to play a role in minority and low-income students' choice of academic major is the likelihood that the selected degree will allow students to give back to their community. In her book, *Opting Out*, Beasley (2011) reported that blacks trend towards service oriented and racialized jobs. Consequently, black students' career aspirations correspond to fields in which they appear in greater numbers and to racialized occupations such as social work. Although many students feel that careers in STEM will not allow them to be of service to their communities, the concept of giving back remains important even among those who do select STEM majors. Conrad, Canetto, Macphee, and Farro (2009) found that among first generation students the second most common reason students decided to major in physical sciences and engineering was the prospect that majoring in these fields would allow them to, "contribute to the well-being of their communities and of society as a whole" (p. 1363).

Students who either had a parent or sibling attend college prior to them enrolling in UFBA reported varying levels of parental support. Unlike first generation students, none of the other students reported being discouraged because their parents felt the course was too difficult. Instead, parents were more concerned about their child's ability to enter the workforce after completion of their degree.

College Experiences

Global Campus Climate. Researchers have widely accepted the fact that the manner in which minority students experience college matters (Kuh & Love, 2002; Museus & Quaye, 2009; Rendon, Jalomo, & Nora, 2006). More specifically, studies have noted that a lack of cultural congruity between minority students and the campus can lead to feelings of alienation, isolation, and marginalization (Feagin, Vera, & Imani, 1996; González, 2002; Museus, 2007; Rendon et al., 2000). Due to UFBA's diverse racial make-up, quota students who identified as black and brown reported that they did not feel ostracized or marginalized on campus. These findings were consistent across students who had darker and lighter complexions. Therefore, students' racial identification did not negatively impact their perception of the global campus climate. Instead, black and brown quota students described the general campus as welcoming and validating. This could be a result of the university enrolling large numbers of black and brown students. Green (1988) and Hurtado et al. (1998) suggest that minority students' perceptions of campus climate improve once the campus has reached a critical mass.

Black quota students' strong sense of belonging may prompt observers to ask, "Does race really matter?" Unlike many of the other public universities, the majority of students enrolled at UFBA are black or brown. Therefore, quota students at UFBA have not experienced the level of discrimination and isolation that is common among quota students who attend predominantly white campuses. On campuses such as the University of Brasilia (UnB), the importance of considering students' race is evident as in the absence of racial quotas 71.5 percent fewer black students would have been admitted to UnB over the last decade. The intersectionality of race and class are equally apparent at UFBA where the majority of quota students self-identify as black or brown (91 percent) compared to only 65 percent of non-quota students. According to Pompeu

(2014), data such as this offers proof that quotas, particularly those with racial allowances, help increase access for a population that had previously been discriminated against and largely excluded from higher education. “Indigenous and Afro-descendant populations were often systematically ignored or blended into a national homogenized culture where both class and ethno-racial inequality and discrimination ensured their impoverishment” (Peria & Bailey, 2014, p. 1).

STEM Environment. While half of the students enrolled at UFBA are now black or brown, the number of black and brown students in STEM disciplines is much smaller. Furthermore, the racial identity of faculty still largely resembles that of the white, upper class. Consequently, some students felt that their social class limited the amount of available opportunities.

Though widely implemented, the quota system remains a controversial issue. Faculty and students who oppose the use of quotas argue that students admitted through affirmative action policies are unable to compete academically with their non-quota peers. Students suggested that these sentiments were openly expressed across campus. Even faculty who disagreed with the general stereotypes regarding quota students found it difficult to ignore the academic deficiencies they had as a result of attending inferior public schools. Consequently, students’ performance in class was often used as an indicator of their status as a quota student. Those students who struggled or scored poorly on tests were routinely thought to have attended public schools and entered the university through the quota system. Johnson (2012) posits that negative academic stereotypes held by faculty and peers can reinforce feelings of not belonging, particularly among students of color and women. Similar findings were reported in the present study where students expressed a sense of not belonging in their field of study. Bastos et al. (2014) released a report that examined the patterns of interaction between quota and non-quota students in different undergraduate majors

at UFBA. The results indicated a greater tendency for students to form homogenous groups, specifically in majors of high prestige. Sousa, Bardagí and Nunes's (2013) study found that when compared to non-quota students, quota students reported having greater difficulty in their ability to form bonds of friendship and support networks at the university. Similar findings were reported by students in this study as they described having close ties with few students; most of whom were other quota students in their major.

Women, specifically minority women, have been underrepresented and face significant challenges to their success in STEM (Amon, 2010). Traditionally an area dominated by white males, women in STEM disciplines often report experiencing a "chilly" environment and diminished sense of belonging (Brown, 2008; Diekman, Weisgram, & Belanger, 2015; Ong, 2005; Tate & Linn, 2005). Johnson (2012) describes the reasons why female students in STEM feel isolated.

Many female students in STEM have experienced a lack of belonging because they were treated as outsiders by male faculty and peers, excluded from informal faculty interactions, discouraged by faculty from pursuing their major, overlooked for their contributions to group projects, and subjected to blatant forms of sexism. (p. 336)

Interestingly, the female participants in this study had a different experience. Nearly all of the female students spoke positively about their experiences as women in STEM. Overall, students said they felt valued and recognized for having selected their major. As opposed to feeling marginalized and discriminated against, the woman in this study described feeling "special" and consequently felt proud to be a part of their academic communities. According to research, an increased sense of belonging can positively impact students' academic achievement and persistence.

A few of the women reported instances in which they did not feel welcome or a strong sense of belonging. For some, the small number of women in the program contributed to feelings

of discomfort and exclusion. Students described times and conversations where they felt as if they were being, “treated like one of the boys.” Rypisi et al., (2008) found that women in STEM often face isolation as their scarce presence in the field creates an environment ripe for sexist stereotypes.

According to institutional data, 54.4 percent of quota students and 55.1 percent of non-quota students admitted to UFBA for the 2012 academic year were female. While women account for more than half of the student body, their presence in STEM fields is much smaller. A study by Santo (2013) revealed that in 2006 only 3.8 percent of students majoring in mechanical engineering at UFBA were female compared to 86 percent who majored in education. Though nearly a decade later, these trends remain as Beatriz suggested that only four women were in her cohort. Likewise, Ruth recalled being one of few female students majoring in physics.

Students who were further along in their degree acknowledged that things had improved over the years as an increasing number of women were enrolled in their programs and they felt encouraged by the presence of female faculty members. Many times, the female faculty members served as role models for the students. Cole and Espinoza (2008) found that the presence of faculty role models gives students an example of an individual who has successfully navigated the educational system. Additional studies suggest that females and minority students have an easier time trusting same gender, same race faculty members.

One participant had strong negative feelings about being a black woman in her major. Unsure if she was treated “differently” because of her race or gender, she shared stories of being mistreated by professors. In her eyes, being a black woman in STEM meant she already had two strikes against her. According to Johnson (2012), this is a common occurrence for women of color as their ethnic and racial identity present additional challenges to their experiences of belonging in STEM disciplines.

Students' relationships with faculty are said to play an important role in their ability to feel connected to the university. Participant's descriptions of their relationships with faculty varied greatly. For some, the faculty members were open, helpful and receptive. For others, faculty purposefully distanced themselves.

Regardless of what department students were in, they all reported feeling closest to faculty members who were open and willing to help students. For the majority of students these professors were in their major or served as their instructor or mentor on a research team. Students described these faculty members as caring individuals who knew them by name and were always working to help their students succeed. Students' findings align with research that shows that faculty who have provided support and helped to humanize the educational experience positively impacted student success. "These studies indicate that faculty members who are warm to, provide holistic support for, and go above and beyond their normal duties to serve racial and ethnic minority students can have a positive impact on their college experience" (Museus & Ravello, 2010, p. 48).

Students reported an unsupportive environment when the faculty were not approachable and did not employ, "good teaching strategies." Professors who lectured all class, refused to meet with students, and did not give students feedback on their work made students feel unwelcomed and unsupported in their major. Research by Seymour and Hewitt (1997) revealed similar trends as participants in their study reported experiencing large classes, an unsupportive culture, and poor teaching by faculty. Interestingly, the two black female students majoring in physics noted that the faculty members created a hierarchy in which they were at the top and untouchable, while students were at the bottom. Both of the students recalled experiences in which they were treated poorly and at times, unfairly, by the faculty in their major. Consequently, they had the strongest and most negative reactions to the STEM climate. Their feelings are supported by studies that show that

faculty members who display subtle forms of prejudice and discrimination towards students negatively impact minority students' experiences.

Interviews with students and faculty revealed that students are not assigned faculty advisors. Instead, students are given the course curriculum and left to navigate their way through the semesters independently. According to research, this can negatively affect educational outcomes as academic advising has been found to have an impact on persistence and graduation (Pascarella & Terenzini, 2005). In spite of these findings, Museus and Ravello (2010) posit that the limited amount of research linking academic advising to student success may be one of the reasons institutions fail to capitalize on the use of academic advisors. Light (2001) expressed similar sentiments, referring to academic advisement as, "the single most underestimated characteristic of a successful college experience" (p. 81).

Researchers note that academic advising does not always occur in a formal context. Advising often occurs when faculty and students have established strong, positive relationships. Drake (2011) notes that positive relationships are the key to good student advising. "It's about building relationships with our students, locating places where they get disconnected, and helping them get reconnected," (p. 8). As such, one might argue that the faculty members students developed personal relationships with have taken on the role of an advisor. Students like Etienne and Ruth reported feeling like these professors advocated for them and opened the doors for them to have additional academic opportunities. Thus, while the university does not have an established plan for academic advising, quota students who have formed strong bonds with faculty members describe having relationships with professors that mirror the traditional role of faculty advisors.

Pedagogical quality was another factor students said influenced their academic performance. Students reported that faculty in their STEM courses predominantly taught using a

lecture style format. In these classes students had little opportunity to interact with one another and were primarily expected to copy the notes from the board. Students described classes that were operated in this manner as their least favorite and reported having lower grades in these classes than in others. These findings are aligned with the literature as current research has shown that an active learning pedagogy leads to increased student engagement, greater social and academic integration, and a greater likelihood that students will return the following year (Braxton et al., 2000). In the National Curriculum Parameters (1991), the Ministry of Education highlighted the importance of interactive, student-driven classes in STEM fields.

A more effective, scientific and pedagogical development calls for changes in schools themselves, in such a way as to foster new attitudes on the part of both students and the community. It is necessary to change misconceptions – culturally disseminated throughout society – that students are the passive party, that teachers are the active parties and that the school is nothing but the stage on which the teaching process takes place. (p. 59)

Several students also reported feeling frustrated with the content of their courses. According to students, many of their classes focused on theory and professors made no attempt to connect the theory with real life. Researchers have begun to recognize this as a flaw common with many STEM disciplines and cite it as another reason underrepresented minorities are leaving STEM. Hurtado et al. (2007) state the following:

Researchers report that STEM fields have failed to highlight the social value and relevance of scientific subject matter (Farrell, 2002; Goodchild, 2004). Students may encounter a disconnect between what they learn in their classes and laboratories and the potential for scientific discovery in real life. This is especially relevant for URM students who frequently leave the sciences because of a perceived lack of relevance to improving conditions for their communities (Bonous-Hammarth, 2000). (p 846)

Finally, students described being more successful in classes that afforded them the opportunity to work in groups. Students valued peer to peer interaction and several students reported understanding concepts better when they were able to discuss them with peers.

College Outcomes

Academic Performance. Museus et al.'s (2011) REM STEM model has six constructs, minority students' K-12 experiences, K-12 outcomes, parental expectations, financial influences, college experiences, and STEM specific opportunities that directly impact college outcomes. Students in this study commented that their academic performance, particularly during the first two semesters, was extremely poor. Nine of the ten undergraduate students interviewed struggled with their core math and science courses, and six of the ten reported failing nearly every course during the first year. Students cited their lack of a strong academic base as the reason for their failing grades.

In comparison to the students who benefited from a private school education, quota students felt they entered college with a huge academic deficit. This proved especially crippling for quota students in STEM as more than half of the students had to repeat gateway courses like Calculus A and Analytical Geometry. Hurtado et al. (2007) noted that a student's academic adjustment was linked to the student's intrinsic assessment of their success in navigating the new academic environment. Almeida da Silva and Cordeiro (2011) found that evasion and repetition rates during the first year were highest in majors that required calculus (i.e. mathematics, chemistry, and physics). Quota students in Almeida da Silva and Cordeiro's (2011) study stated that repetition at the university level is a direct result of the poor quality education they received in high school. They argued that the work in high school only required students to remember concepts whereas the university requires students to interpret them. Non-quota students in the same study stated that repetition was a result of students arriving at the university without a sufficient base. In his study on the relationship between affirmative action and math education, Gomes da

Silva (2013) noted that a large majority of public school graduates do not have a strong foundation in basic math.

Hurtado et al. (2007), Amon (2010), and Museus et al. (2011) acknowledge the importance of students' prior and current educational experiences on their academic achievement and persistence. "Arguably one of the most essential elements in increasing success in STEM undergraduate programs is a strong secondary school education. Successful collegiate level work in STEM disciplines is dependent upon students matriculating with competence especially in math and science," (Amon, 2010, p. 59).

In their profile of quota students at UFBA, Nascimento and Pereira (2014) that more than 40 percent of students with low academic achievement¹² are majoring in areas of mathematics, physical sciences, and technology and they have a socio-economic profile that is very similar to that of general admits. These findings indicate that both quota and non-quota students in STEM disciplines struggle academically.

According to some faculty members, students' poor performance in math and science courses was noted to have long lasting, negative effects. Rask and Tiefenthaler (2008) found that lower grades led to lower persistence among students. According to Claro (2014), "Repetition has a negative effect on self-esteem and motivation of students," (p. 7). Blanco and Cordeiro (2009) found that the most common reasons for quota student evasion were difficulty with course content, economic hardships, and differences in the treatment of quota and non-quota students. In a study on retention at the university, UFBA officials reported that repetition of courses has lasting negative effects as it jams educational flows and elevates the per student cost (Claro, 2014).

¹² According to the authors low academic achievement is defined as students whose grade point averages are in the bottom 25 percent

The academic plight of low-income and minority students has been well documented. According to recent data, low-income, first generation students were nearly four times more likely to leave higher education after the first year as compared to students who had neither of these risk factors. Six of the ten undergraduate students were first generation college students. Many of them reported feeling alone and stated that they were unprepared for academic challenges they would face in the university. In Santos' (2013) study on the adaptation of quota and non-quota students at UFBA, 78.9 percent of students who reported having the most academic difficulty were first generation students. Though most of the students described struggling through their courses, only one gave up along the way. After three failing semesters as a Computer Technology major, Paula decided to change to an interdisciplinary bachelors program in humanities. She felt she would be more successful there as she would not have to deal with the difficult math and science courses. For Paula, receiving a university degree meant more to her than persisting in STEM.

Opponents of the quota system may be inclined to suggest that the findings of this study support the mismatch theory. Heard in nearly every country that implements preferential policies, this is essentially the argument of access over merit. Critics of affirmative action policies use the entrance exam scores of favored students to suggest that their academic ability is lower than that of general admits. Assuming that all individuals have equal access, opponents believe that admissions should be solely based on merit and that reservation policies which admit unqualified individuals is unfair. The mismatch theory goes on to suggest that candidates who do not qualify for ordinary admission would perform better at institutions or in majors that were more closely aligned with their abilities. Proponents of this view posit that affirmative action has a negative effect on minority students. "Affirmative action may actually make minority admits worse off, either through lost time spent in college or through a discouragement effect" (Bertrand et. al., 2009,

p. 1). Kochar's (2004) study on quota students admitted to a top engineering school in India supports this argument, suggesting that because the initial ability of quota students is much lower than their peers, the overall academic rigor of the institution is lowered. Consequently, the reduction in average student ability creates poor learning conditions, which subsequently affects all students.

At face value, the academic performance of quota students in STEM suggests that they have been admitted to a university for which they are not academically well-prepared. However, a closer analysis of the data reveals the following: 1) STEM quota students' poor academic performance in initial math and science classes is not indicative of quota student performance across majors and 2) assuming that quota students in STEM perform poorly because they were admitted via a relaxed set of standards and therefore have inferior academic ability contradicts the fact that a large number quota and non-quota students in STEM fail their first year math and science courses. These assumptions also ignore the fact that quota students' poor academic performance is a direct result of the subpar education they received in high school versus their inherent ability.

Aligned with the Mismatch Theory, the idea of "catch up" asks if low performing students admitted under reservation policies are able to catch up to their peers. Critics of affirmative action posit that the educational gaps between favored and non-favored students remain. As a result, favored students' academic achievements may fall short of general admits, which later impedes their ability find gainful employment (Kochar, 2009). Findings from the current study refute the idea that quota students' performance continues to lag behind that of their non-quota peers. Institutional data, as well as data from the current study, reveal that after the first few semesters, the academic performance of quota students in STEM is on par with their non-quota peers.

Students in the current study suggested that this was in large part a result of quota and non-quota students having had exposure to the same topics in their college courses. This ensures that all students have the same foundation after the first few semesters and subsequently enables quota students to perform the academic tasks with much greater ease.

Persistence. Self-efficacy has long been thought to influence students' academic performance and persistence (Vogt, Hocevar, & Hagedorn, 2007). In the REM STEM model, self-efficacy is incorporated in the K-12 outcomes construct. In this study, it appears that having entered the university under the quota program played a part in students' self-efficacy. Many of the students reported that while the number of students enrolled in their programs and classes greatly diminish throughout the year, the number of quota students remains relatively constant.

Students attributed their ability to persist to the support systems they had developed. Many of the quota students relied on one another to understand the concepts taught in class. In two of the three departments one student was the point of contact for the others. Typically this student had higher grades and was recognized for having a good understanding of course content. Recognizing the value in peer assistance, students begin to study together and schedule their classes with one another. These findings are supported by research which suggests that minority STEM students friends help provide a supportive environment (Cross & Vick, 2001; Harper & Quaye, 2007; Museus, 2008).

Finally, students suggested that family and faculty support positively impacted their academic performance and persistence. Students recalled having family members and faculty encourage them along the way. They described situations in which they wanted to quit when a family member would remind them how far they have come and reassure them that they could

successfully make it through. Similarly, some students reported having faculty members who encouraged them not to give up.

Barriers to Graduation

In Museus et al.'s (2011) REM STEM model each of the constructs contains variables that could possibly act as barriers to minority students' successful completion of a degree in a STEM field. Students in the current study listed their lack of an academic base, lack of finances, and lack of social capital as the largest obstacles they faced in route to their degree.

Six of the ten undergraduate students reported that the biggest challenges they had were academic and stemmed from their lack of a strong base in fundamental math and science courses. Several of these students noted that they did not take trigonometry or pre-calculus in high school; both of which are pre-requisites for their first year calculus class.

In 1996, the Brazilian government implemented the National Education Guidelines and Framework Law which in addition to increasing the length and number of teaching days, required the curricula in primary and secondary education to have a common national basis. According to the law, the secondary curriculum is composed of both a national core curriculum and a state curriculum. Thus, the national curriculum is complemented with coursework created by the regional education offices and individual schools. Currently, the high school curriculum requirements mandate a minimum of 2,400 hours of instruction over a period of three years. There are three broad areas of study that must be covered during this three year period:

- Languages, arts, and physical science
- Mathematics, natural sciences and related sciences
- Humanities

As demonstrated in Table 19, required core subjects include: art education, biology, health programs, literature, chemistry, one foreign language, mathematics, physical education, physics,

Portuguese, and social studies. At least 75 percent of the school curriculum must contain instruction in these subjects. The remainder of the curriculum is determined by the state, municipality, or school.

Table 19. *National and Regional Curriculum for Secondary Education*

National Curriculum 75%	
Subject	Number of Courses Required
Portuguese Language/Literature	1
Physical Education	1
Art Education	1
Chemistry	2
Mathematics	2
Physics	2
Biology	2
History	3
Geography	3
Regional Curriculum 25%	
Foreign Language	1
Sociology	3
Philosophy	3
Others	2
Computer Science	0

Source: Adapted from Monroy and Clark, 2012

Although the national curriculum mandates a minimum of two mathematics courses, it does not specify which math courses must be taught. Instead, the parameters allow states and individual schools to design their math curriculum in a way that accommodates, “the development of students who may have differing motivations, interests and abilities” (p. 52). The parameters go on to suggest that math education should be viewed by students as a set of techniques and strategies that will be an essential part of their professional activities. They further note that the teaching and learning of mathematics in secondary education is not, “the case of having students acquire many sophisticated strategies, but rather to develop a sense of initiative and the sureness to adapt them to different contexts” (p. 53). Therefore, schools such as the military and federal public high schools may offer higher level math classes while others only offer basic math classes.

Based on the recommendations of the National Curriculum Parameters, high school course offerings are determined by students’ expected career paths, teacher certification, and regional

needs. Therefore, it is not without reason to assume that in the public school system, where just under half of all teachers are not highly qualified and a large percentage of students will either enter the job market or attend a private college, high level math and science courses are not regularly incorporated into the curriculum. This is consistent with research that has shown that underrepresented minorities have less opportunity during high school to experience demanding STEM course work (Roach, 2013).

Students reported that professors uniformly expected all students to come in with the same basic knowledge, despite the fact that having attended public school, quota students did not have access to much of the same information. While quota students do not want to be treated differently or have lower standards, they voiced concern over the fact that there is a tremendous gap between what they are taught in high school and what they are expected to enter college knowing. Furthermore, students reported feeling belittled when they asked questions about the content because faculty would respond with comments like, “This is basic. You should’ve learned this in high school.”

Finances play a significant role in minority and low-income student’s ability to persist in college. Furthermore, many quota students need additional resources to attend and stay in school. While attending a public university comes with the benefit of being tuition free, additional needs such as transportation, books, food, and other materials for class inevitably add to the cost of education. With limited funds, students spoke of the difficulty of having to choose between food and transportation.

For many students the biggest financial burden was the opportunity cost of attending school. According to students, the class schedule and academic demands of STEM majors made it nearly impossible for students to work outside of the university. Although many of the students

were recipients of one of the university's research grants, they suggested that the monthly stipend of R\$400 (\$150) was not enough to cover their basic needs, let alone support the additional costs associated with college. To put students' financial concerns into context, let's consider the different expenses an average student might incur in one month. The cost of a single bus fare in Salvador is R\$2.80. If a student were to only take one bus to and from school five days a week they would spend R\$28 per week or R\$112 per month on transportation. The second expense nearly all of the students spoke about was the cost of food. I found food to be very expensive in Brazil. At the university restaurant lunch was sold to those who did not have a meal plan at the discounted price of R\$14 per kilo. With a small bottle of water costing R\$2, students' could easily spend R\$12 daily or about \$R240 monthly on lunch. For most of the students in STEM the cost of food is even greater as the need to spend the entire day on campus means they will have to eat more than one meal outside of home. Thus, the costs of transportation and food alone use the bulk of students' stipends, leaving little money for additional needs such as the purchase of books and materials.

Many quota students have additional family responsibilities that require them to work outside of campus. Unable to successfully balance work and school, these students end up taking fewer classes and a much longer time to matriculate. Some students described situations where working students withdrew from school altogether. Although small, the money they made from working was a larger incentive than the trials and tribulation they faced in an effort to earn their degree.

In addition to academic and financial difficulties, students reported that having a lack of social capital impaired their initial success at the university. Parents' knowledge of the college going process plays a role in their child's ability to enter and persist in the university setting.

According to researchers, parents who have attended college are knowledgeable about important aspects such as the application process, required testing, financial obligations, and what to expect of college courses. Assisting first-time students with these tasks can be daunting for parents who have never been to college as they have neither experience with college preparation nor sufficient access to necessary information (Cabrera & La Nasa, 2001; Dounay, 2006; Fann et al., 2009; McDonough, 2004; Rowan-Kenyon, et. al., 2008). This is particularly true of low income and minority parents. “Parents of color/low SES are constrained from many forms of proactive, instrumental engagement in their children’s college preparation due to limited college knowledge and resources, as well as structural and practical barriers” (Tierney & Auerbach, 2005, p. 46).

First generation college students spoke of how a lack of social capital led to additional challenges. Students described feeling “lost” when they first entered the university system. The first in their families to go to college, they had no one to teach them how to study or to speak to them about what to expect from their college courses. “Low-income, minority, and first-generation students are especially likely to lack specific types of ‘college knowledge.’ They often do not understand the steps necessary to prepare for higher education which include knowing about how to finance a college education, to complete basic admissions procedures, and to make connections between career goals and educational requirements” (Vargas, 2004, p. 8). Consequently, several students suggested that adapting to the university was one of the biggest obstacles they faced.

Dating back to the mid-1980s, educational researchers have identified parents as a critical component of the college going process. Consequently, universities began to encourage school high school counselors to conduct outreach to parents and supply them with basic college information as well as resources on financial aid. In the following years, Hossler (1991) suggested that counselors work with parents in an effort to encourage students to develop college aspirations

and plans. Likewise, Fallon (1997) urged counselors to specifically work with the parents of first generation college bound students to help shape their college aspirations. Though school counselors are absent from public high schools in Brazil, it is important for universities find a way to share information about the college going process with parents, particularly those of first generation students.

Interestingly, faculty and students had very different views about the barriers quota students face. While students suggested that a lack of a strong academic foundation, finances, and social capital negatively affected their academic success, faculty suggested that the largest obstacle quota students faced was a lack of self-esteem.

Institutional Responses

Over the years UFBA has worked to establish various support systems for low-income and quota students. To date they have developed twenty-two different programs that are intended to support students as they matriculate through the university. When asked about the supports the university offers, participants primarily spoke about six of these different programs; scientific research (PIBID & PIBIC), the Scientific Mobility Program, the residence halls, transportation aid, meal vouchers, health assistance, and the monitor program. Students stated that many of the scholarships (i.e. research, transportation, and meal vouchers) were regularly used by quota students. While a large number of students benefit from the scholarships, students felt that these programs were insufficient as the funds they received for their work with science research were minimal and the meal plans, residence halls, and transportation aid targeted only a small group of students. According to participants, full meal plans were typically reserved for the students living in the residence halls. All other students qualified for subsidized meals, but the portion of the cost they had to pay was still too high. Likewise, transportation aid was reserved for students travelling

a long distance to the university. Those students who lived within the city limits were responsible for their own transportation.

While the university continues to work diligently to help assist low-income and quota students pay for the costs associated with attending the university, little has been done to address the academic difficulties students face. Of the twenty-two programs, only the monitoring program can really be said to help address students' academic difficulties. Operating much like the teacher assistants (TA) program in many colleges in the U.S., monitors are students who are selected to serve as a teacher's assistant for a specific class. Students dismissed the program, saying that in order for it to be helpful, monitors need to be more readily available and trained to work with students. All of the students interviewed said that they felt the monitors were in the class more for the faculty than to help the students.

Sousa and Portes (2011) suggested that it was necessary to create programs to assist students who enter the university through affirmative action policies in order to ensure that they persist after entering the university. Literature on support programs targeting underrepresented minorities in STEM suggest that integrated approaches work best. These programs should offer assistance with student matriculation (i.e. financial aid, academic advising, orientation), academic support services (tutoring, study skills), links to program specific minority student organizations, and research related work experience. Simmons (2013) cautions that integrative programs like those listed above, still inadequately address social capital deficits. This is crucial for campuses serving low-income, minority, and first generation students.

Universities aiming to increase the persistence of minorities in STEM have worked to address students' academic, social, and financial needs. The bulk of programs instituted at UFBA

were created to address students' financial needs. Meanwhile, quota students' academic and social needs often go unmet.

Applicability of the REM STEM Model to STEM Quota Students in Brazil

Museus et al.'s (2011) REM STEM model was specifically designed to examine racial and ethnic minority STEM students at universities in the U.S. Although the model provided a solid theoretical framework for the current study, findings revealed that additional variables should be considered and applied when examining the academic performance and persistence of STEM quota students in Brazil.

Beginning with the construct for students' K-12 experiences, researchers examining quota students in Brazil must pay particular attention to the type of high school students attended. In the current model, educational inequities are determined by analyzing school funding, teacher quality, teacher expectations, and academic tracks. While these variables may also affect STEM quota students in Brazil, what is of greater importance is the type of school students attended. As demonstrated by the current study, the greatest educational inequities were found between the private and public school system. Furthermore, students described the diverse nature of the public school system whereby federal technical schools and military schools provide a stronger educational foundation than either the state or municipal public schools.

A second factor within the K-12 construct that deserves attention is the concept of a culturally relevant curricula. As opposed to discussing the need for a culturally responsive curriculum, students identified a weak math and science curriculum as one of the main issues they faced in their secondary education. The National Curriculum Parameters require only two years of math be taught in high schools. A part from this mandate schools are allowed to determine which math courses will be taught and, this determination is supposed to be linked to the students'

interests, abilities, and prospective career track. Thus, high schools like the federal technical school have a curriculum specifically designed to assist students with their transition into the university while other public schools may only offer two lower level math courses as they expect their students to forgo a college education. In the context of Brazil, it would be important for researchers to examine the STEM curricula at the high schools from which quota students graduated. Having this knowledge will give researchers a better understanding of students' academic preparedness in STEM and how it subsequently impacts students' early academic success in the university setting.

When looking at students' college experiences the REM STEM model considers three constructs: college campus and STEM environments, pedagogical quality, and the quality and quantity of interactions with institutional agents. Data from the current study suggests that all three of these constructs apply to STEM quota students in Brazil. However, it is important to note that a student's race is not the only demographic trait that affects their perception of the campus and STEM climate. Instead, this construct should include a thorough analysis of students' perceptions of campus climate on the basis of both their identity as a quota student and their race. Findings from this study revealed that students' identity as a quota student did not negatively affect their perceptions of the global campus climate. However, stereotypes about quota students' lower academic performance produced among faculty and student peers negative perceptions of quota students.

At UFBA quota students are not openly identified. This, along with the diverse nature of the campus, allowed quota students to easily blend with other students and subsequently feel a strong sense of belonging. However, quota students may feel much more marginalized and isolated on campuses that are less diverse and that do not protect quota students' identity. Furthermore, on campuses where black and brown students are a racial minority, students' race may be incorrectly

used as an indicator of their status as a quota student. Thus, researchers cannot assume that all quota students will have the same shared experiences as black and brown quota students may face additional discrimination on less diverse campuses.

Additionally, I would recommend that researchers in both the U.S. and Brazil expand the Parental Expectations and Involvement construct. While these components play a critical role in the students' ability to enter and succeed in STEM fields, this study has shown that parents' level of educational attainment and socio-economic status play an equally important role.

In both the U.S. and Brazil, parents' level of educational attainment can largely impact a students' entrance and success in a university. Students whose parents have graduated from college are knowledgeable about the admissions process and what is required to successfully matriculate at a university. These parents offer their children social and cultural capital that often opens doors for additional academic opportunities. In contrast, parents who have never attended college can offer little guidance and may even try to discourage their child from majoring in a STEM discipline.

Findings from the current study suggests that in Brazil, parents' socio-economic status also affects students' performance and persistence in STEM. In Brazil, parents' socio-economic status is tied to factors like public school attendance, participation in a university prep course, and university funding. Research has shown that public schools in Brazil are primarily attended by poor students, as middle and upper social class parents send their children to private schools. Therefore, parents' income level is linked to a students' ability to enter the university through socio-economic quotas. Additionally, the family's level of income is often used to determine whether the student is able to enroll in a private prep course or *cursinho*. As demonstrated by the

students in the current study, the quality of the prep course is often positively correlated to the cost.

At UFBA and many of the other public universities in Brazil, institutional funding is reserved for quota students and students who come from low-income households. Although students have to apply for the various scholarships, most are reserved from those students whose families earn no more than 5 times the minimum wage. While poor students are more likely to benefit from university funding, findings from the current study imply that these students may also be more likely to drop-out as the monthly stipend is not sufficient to cover their educational and personal needs. Researchers examining quota students in STEM will benefit from knowing how students' family income impacts their access to university funding.

Finally, a model better suited to the national contexts of Brazil would take into account students' ability to find gainful employment in STEM fields. While the Brazilian government is heavily investing in STEM, the truth is, that outside of teaching there are few jobs for students majoring in fields like chemistry and physics. Quota students in engineering fields found that there are a greater number of jobs available in their field but recalled having to face stiff competition as these positions often require graduates to have command of two foreign languages.

Museus et al.'s (2011) REM STEM model provides a useful framework for examining the factors that affect the educational outcomes of underrepresented minorities in STEM. However, the use of race-based and class-based quotas, along with traits unique to the educational system in Brazil, highlight the importance of including additional factors. In addition to those outlined in the REM STEM model, researchers examining factors that affect the academic performance and persistence of STEM quota students in Brazil should pay attention to the following:

- The type of high school from which students graduated (i.e. federal, military, state, municipal)

- The high school's STEM curriculum
- The impact of students' racial and quota identity on their perceptions of campus climate
- College curriculum and supplemental courses required for graduation
- National employment opportunities in STEM
- Parent's level of academic attainment and income level

Conclusions

The use of quotas in higher education in Brazil were implemented to increase minority and low-income students' access to public universities. Largely populated by poor black and brown Brazilians, the public school system offers students a subpar education. Consequently, quotas have been used to rectify the grave educational disparities that exist between the public and private school system and the unfair advantage private school attendance subsequently gives middle and upper-class students in the college going process. While the quota system has increased access by boosting the enrollment rates of public school graduates and underrepresented minorities, findings from this study suggests that additional supports may be needed to guarantee equal outcomes, especially for quota students in STEM fields.

This study examined the various factors affecting the academic performance and persistence of quota students in STEM disciplines. In doing so, the study shed light on the obstacles quota students in STEM face and the institutional responses to address said challenges. Findings from the study outlined four key areas that influenced students' ability to successfully matriculate at the university: the pre-college experiences of quota STEM students, the college experiences of quota STEM students, barriers to graduation, and institutional responses. Each of these areas contained additional push and pull factors that either positively or negatively affected student performance and persistence.

Results from this study indicated that several factors affect quota students' performance and persistence in STEM disciplines. Findings demonstrated that educational inequities, namely the lack of qualified teachers and a strong science and math curriculum, led quota students to feel inadequately prepared for the university's entrance exams and subsequently for their core math and sciences classes. Consequently, students attributed their failing grades during the first few

semesters to the subpar education they received in public schools, as they felt they had received poor instruction in their high school math and science courses. Several students noted that they had not been exposed to courses such as trigonometry and pre-calculus, which served as prerequisites to calculus. Thus, the broad requirements established by the National Curriculum Parameters may play a role in public school students' academic deficiencies as high schools are not required to offer the high level math and science courses that serve as pre-requisites for many of the core courses STEM students take during their first two semesters in the university.

Quota students that were also the first in their families to attend college, described facing additional obstacles as a lack of social capital meant they entered the university unaware of the academic expectations or strategies needed to succeed in college. Moreover, first generation students reported having parents who discouraged them from pursuing a degree in STEM as their parents were afraid they would not be able to keep up with the rigorous pace of the major.

At UFBA, public school graduation is one of two criteria for being admitted under the quota policy. As demonstrated by this study, attending public school, even those recognized for being high performing, negatively impacts quota students' academic performance during the first few semesters. Students who were once at the top of their class experienced frustration and lowered self-esteem as they earned failing grades and needed to repeat courses. Faculty and students reported that academic difficulties in core courses like calculus and physics were largely responsible for the number of students who dropout or switch majors in the first two years. Researchers have found that negative experiences such as these can affect persistence as students' first year in college sets the stage for the remaining undergraduate experience (Hurtado et al., 2007; Nora et al., 2005; Tinto, 1993).

While students and faculty acknowledged that quota students often have academic deficiencies as a result of attending public schools, the university has not implemented mechanisms to give students the academic support they need. Since 2007, UFBA has seen a 200% increase in the amount of assistance it offers to low-income and quota students. Though funding covers a range of issues, academic support has largely been untouched. With the exception of the monitoring program, the university does little to help low-income and quota students with their academic transition.

Students' perceptions of the global campus climate and STEM environment also affected their academic performance. Due to the procedures in place at UFBA, none of the academic offices have information regarding students' identity as a quota student. This level of anonymity has helped to create an environment that is inclusive and welcoming to all students. Black and brown students reported having the same feeling of belonging in the general campus environment.

In that more than half of UFBA's students self-identify as black or brown, the university has reached a critical mass and is recognized as a racially diverse institution. Students' comfort level as quota students and racial minorities were said to positively impact the way they viewed the campus. However, students felt that their status as quota students and minorities made them feel more isolated in STEM disciplines. Many quota students recalled being looked down upon and treated as if they did not have the capacity to perform at the academic level required by their courses. They reported that within STEM, it was common to stereotype quota students as being low performing. Black and brown students went on to note that the small number of minority students and professors in their fields often led others to use their race as an indication of their social class and identity as a quota student. These findings are in alignment with current studies in which underrepresented minorities report chilly STEM environments. The marginalization

students felt in STEM was a direct contrast to the inclusiveness they reported feeling about the general campus. As result, quota students tended to form strong bonds with other quota students. They created informal learning communities by scheduling their classes together and meeting before and after class to study.

Surprisingly, the female students had positive perceptions of the STEM climate at UFBA. In contrast to research that suggests that women in STEM often feel isolated, marginalized, and discriminated against, students in the current study reported feeling special and celebrated for being part of their academic communities. The divergent findings of this study may be attributed to the fact that female students received high levels of support by their peers and faculty. According to students, the women were thought to be courageous for electing to major in a STEM discipline. The support helped to boost students' level of self-confidence and subsequently their willingness to persist.

As demonstrated by the women's experiences in STEM, students' relationships with faculty and peers can impact students' academic performance and persistence. All of the students suggested that supportive faculty members helped students feel more connected to the university and encouraged them to be more engaged in the class material. Students reported developing relationships with professors who were either in their major or whom they worked with on research teams. These faculty members connected with students on an individual level and often went above and beyond the call of duty. For many students, these bonds were developed as a result of having a professor many times or because of a shared demographic trait such as gender, race, or social class.

While students benefited from having faculty members who largely took on the role of advisor, the university does not have a system in place for student advising. As the university

continues to seek programs to help retain quota and low-income students, officials at UFBA should consider assigning students faculty advisors, at least for the first year. The main role of academic advisors would be to:

- Offer incoming students guidance and answer questions regarding the curriculum for their major
- Act as an initial support for students' academic and social needs
- Monitor student performance and discuss options with students facing academic difficulties

Lastly, findings suggested the need to re-examine the structure of STEM classes and content. According to students, the majority of classes in STEM fields are taught in a lecture style format that discourages student participation. Teachers spend the bulk of class reading from notes while students are responsible for copying from the board. This style of teaching, paired with the heavy theoretical content of courses, made it difficult for students to comprehend course material. Consequently, students reported having low grades, feeling bored in class, and unmotivated to complete assignments. In contrast, classes that fostered student participation and helped to link theory to real life helped to motivate students. Additionally, students reported having higher grades and better relationships with faculty in these types of courses. STEM fields have been known for their heavy reliance on theoretical concepts and promoting competition amongst students. Universities seeking to promote academic success and persistence of racial minorities and quota students should develop a curriculum that encourages group work and fosters learning by connecting theory to real life practice.

In order to reduce the shock quota students experience when they enter the university and limit the negative effect of their poor public school education, the university should look to implement an integrated academic support system that includes the following features:

- Assistance with student matriculation (i.e. academic advising)
- Academic support services that target the traditionally difficult core courses

- Linkages to minority student organizations and other types of social supports
- Research and/or work related experiences

If asked to design a program at the university level to help improve the academic performance and persistence of quota students in STEM, I would begin by addressing the immediate academic and social needs of quota students in STEM. Upon successfully passing the entrance exam and being accepted into a STEM discipline at the university, quota students would be invited to participate in a six week intensive bridge program that would take place prior to the start of their first semester. During this time, students will meet with a faculty advisor, take an introductory to college course (i.e. Freshman 101), and take a foundations in math course. The faculty advisor will be a member of the department in which the student is majoring and will meet with students at least twice during the six week period. During the initial meeting, the advisor will welcome the student to the university, explain the curriculum and academic requirements of the major, and answer any questions students may have. Once the academic year begins, advisors will meet with students to discuss their academic performance.

The introductory to college course is designed to help prepare students with their transition to the college campus. Classes will be interactive and cover topics such as time management, study skills, finding funding, research opportunities, and campus resources. This class will be a way for students to familiarize themselves with the campus in general and the services and opportunities that are available to students in STEM. In addition, the class will be a safe place where students can ask questions and express their concerns about the university.

Finally, students will be enrolled in a foundations math course. This is not to be confused with the remedial courses ill-prepared students at American universities have to take before being able to enroll in their core classes. Specifically aligned with the Calculus A class required of all first year students in STEM, the foundations course will be required of all students in the program and

is designed to give public school graduates the base they need to be successful in their entry level math and science courses. Because this course will require students to learn complex mathematical concepts in a short period of time, it will be paired with supplemental instruction. Three times a week students will meet with a SI leader who will work with students to improve their understanding of the material taught in class. Although the class will not count for a grade students will be evaluated weekly so both the students and professors can identify areas of concern. By mandating all students to attend SI, the program is reducing the stigma associated with needing academic help and simultaneously encourages better study habits.

Once the academic year begins students who participated in the summer bridge program will be given the opportunity to participate in research during the semester breaks and will be encouraged to participate in STEM conferences. In addition, social and academic activities will be held throughout the semester to allow students the opportunity to foster strong relationships with faculty and peers and increase students' sense of belonging. Upon the completion of the first year, students will take part in a short undergraduate research project and have an intensive refresher course. This course is intended to recap the material students learned in their first year mathematics courses and to prepare them for the next level course. The program will end prior to students beginning their second academic year. Students will still have access to their faculty advisors and may attend SI sessions for any courses in which they are offered. In addition, students who complete the program may be invited back to serve as SI leaders or to assist faculty with the introduction to college course.

This study sheds light on the importance of further research to examine the academic experiences and outcomes of quota students in STEM. As the university strives to meet the requirements of the Law of Social Quotas by 2016 and to prepare the next generation of scientific

leaders, it is essential that it understands the specific needs of quota students in STEM and works to address those needs.

Implications for Research and Policy

When the Brazilian Government passed the Law of Social Quotas they implemented one of the most aggressive affirmative action policies of all times. Studies by Telles (2004), Carvalho (2006), and Velloso (2009) point to the fact that increasing access does not guarantee equal outcomes. Consequently, there are many implications to be considered by administrators and faculty at the university.

Implications for Research. Campus climate has been cited for having a significant impact on the academic achievement of students, particularly minority students (Amon 2010; Cabrera et al., 1999; Harper & Hurtado, 2007; Hurtado & Carter, 1997; Hurtado, Carter & Spuler, 1996; Locks et al., 2008). Prior to the implementation of quotas, public universities in Brazil were homogenous in nature where less than two percent of university students identified as Afro-Brazilian (Carvalho & Segato, 2002). In that the Law of Social Quota requires public universities to reserve half of their vacancies for low-income and black and brown students by 2016, campuses are quickly becoming more heterogeneous. Due to a rapid shift in the composition of the student body universities may not be adequately prepared to deal with students' varying needs and abilities. As such, Brazilian universities and educational researchers should undertake studies that examine the campus climate at public universities and its impact on student performance. Particular attention should be given to predominantly white institutions as students' racial identity is likely to be used as an indicator of their status as a quota student on these campuses.

Many STEM majors have gateway courses that are challenging for students. Without a strong foundation in math and science, public school graduates are at a greater disadvantage than

students who attended private school. The university should research gatekeeper courses and other “killer courses¹³” that hinder student success. Academic supports such as supplemental instruction or a tutoring center should be implemented to address the needs of students. Additionally, the university should examine the use of a summer bridge program for quota students in STEM majors as research indicates that there is a positive relationship between minority retention and participation in a summer bridge program.

This study revealed that a large number of quota students are coming from the same high schools. According to public records, these high schools are among the top performing in the state. Further research should be conducted to see if the quota students who are regularly admitted into the public universities are graduating from a few top performing public schools. If this is the case then the quota policy may not be as helpful as it is intended to be as it is merely skimming off the top.

Public universities in Brazil regularly collect data on the highest level of education attained by students’ parents. This, along with family income, is used to help gauge the socio-economic status of the student. Institutional data revealed that more than half of students admitted through the quota program are first generation students. While this information is used to determine eligibility as a quota student, the university does not conduct research on or offer additional supports for students who are first generation. Public universities should research the performance and persistence of first generation students. Moreover, universities should establish programs to help educate first generation students and their parents about the college going process. This could be successfully carried out in a number of ways including hosting regularly scheduled open houses

¹³ Killer courses are classes in which the 50 percent or more of students earn a D, fail, or withdraw from the course.

and information sessions for interested students and parents, visiting local high school, and conducting a series of workshops for accepted students.

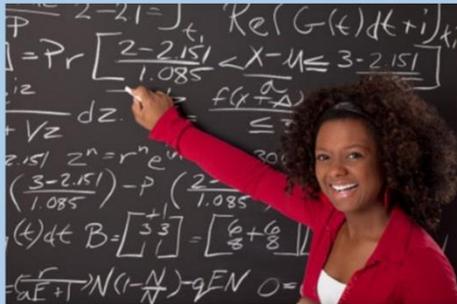
Implications for Policy. Several studies have noted that the public school system in Brazil is inadequately preparing students for the academic rigors of the university. In 1998, the Brazilian government introduced the *Exame Nacional do Ensino Médio* (ENEM), or High School National Exam to measure high school student performance. In 2009, the Ministry of Education established that the ENEM would be the official university exam and pushed for it to replace the vestibular. Aligned with the secondary curriculum, the ENEM was designed to give a more accurate view of what students have learned. Once admitted into the university, many quota students find that they are at an academic deficit. In order to remedy this problem, universities should collaborate with the public school system to implement curriculum alignment across secondary and postsecondary education. Particular attention should be given to the science and math curriculum. In addition to ensuring that all student have access to courses such as trigonometry in the high school curriculum, which prove essential to their understanding of entry level math courses, school administrators must work to verify that teachers are certified and equipped to teach the courses they are assigned.

Finally, the quota system, like all affirmative action policies, was designed to be a temporary solution. If the problems with the public school systems are never addressed than there will always be a discrepancy between the education public school students receive and that of private school students. The Brazilian government will need to address the fundamental issues with secondary public education if it wants to position itself to no longer need quotas by the end of 2016.

Appendices

Appendix A: Recruitment Flyer

Você é um cotista cursando em matemática ou ciências?



O objetivo da minha pesquisa é identificar os fatores institucionais que influenciam o desempenho e persistência dos alunos cotistas que estão cursando ciências, tecnologia, engenharia e matemática. Essa pesquisa irá mostrar os obstáculos (acadêmicos, sociais e financeiros) que os alunos cotistas enfrentam e os sistemas de suporte que a universidade possui no sentido de ajudá-los.

**Se você estiver interessado em participar contate com
Yasmin (71 9391-7386) o Aurea (71 9143-7065)**

Appendix B: Student Interview Consent Form (English)

Project Title	<i>Institutional Factors and Academic Achievement of Quota Students in STEM</i>
Purpose of the Study	<p><i>This research is being conducted by Dr. Nelly Stromquist and Mrs. Porsha Childs at the University of Maryland, College Park. We are inviting you to participate in this research project because you are 1) a student age 18 or over who has been admitted under the quota program at UFBA and 2)majoring in one of the STEM fields at the university. The purpose of this research project is to identify institutional factors that influence quota student performance and persistence in STEM fields. We are seeking this information in order to understand the obstacles quota students in STEM face and what support services may improve the academic achievement and persistence rates of said students.</i></p>
Procedures	<p><i>There will be three data collection sessions. The first two consists of in-person, open-ended interviews. If you agree to participate, I will set up a time and a meeting place where you feel comfortable speaking. The interview will take place between September 2014 – December 2014.</i></p> <p><i>Participation consists of responding to interview questions, which will take between 60-90 minutes. During the first Interview, questions will focus on your high school experience and initial college experiences as a quota student in STEM. Examples of questions include: “How are quota students viewed and treated on campus?” and “What barriers or obstacles do you think quota students face in completing their degree?” Questions from the second interview will focus more on the climate within your field. Examples of questions include, “What classes are you most successful in?” and “How would you describe your relationship with faculty.”</i></p> <p><i>You will be informed of the researchers wish to audiotape the interview for purposes of accuracy; however, you have the right to decline being audio recorded. Your participation will be voluntary, and you may withdraw from the study at any time. You will be asked to sign a consent form. You may be re-contacted if the researcher wants to get further clarification about any of your responses.</i></p> <p><i>The third data collection will be for select students only. Based on your responses to the interviews, you may be asked to be observed. Observation will occur on the campus and will involve having the researcher follow both in and outside of class.</i></p>
Potential Risks and Discomforts	<p><i>There may be some risks from participating in this research study. Because these interviews may be audio recorded, this project presents some risk to you. To ensure anonymity, the student investigator will assign you a pseudonym, but will keep the records and transcripts of the conversation</i></p>

	<i>for accuracy. Your identity will not be known to other participants. You will not be asked questions that would compromise your positions as a student. The potential risks and benefits will be explained to you before your participation begins.</i>
Potential Benefits	<i>There are no direct benefits to you, but some possible benefits include a greater understanding of how various institutional factors may impact the academic performance and persistence of quota students in STEM fields. Outcomes of the project may include providing further data on college retention. In addition, it may add to other studies that analyze minorities or the use of affirmative action in higher education. The potential risks and benefits will be explained to you before your participation in the study.</i>
Confidentiality	<p><i>In order to protect your privacy, your identity will remain confidential. The student investigator will assign a pseudonym to you. Your actual name will not appear on interview data. The key linking you to the pseudonym will be kept in a separate document on the student investigator's computer in a separate folder, away from the folder with the interview data. Information identifying you will be disclosed only if you give consent to provide such information. All electronic data will be securely stored in a password protected file on the principle investigator's password protected office computer. Hard copies of data will remain in the principle investigator's office in a locked file cabinet. All data will be destroyed (i.e., shredded or erased) when their use is no longer needed, but not before a minimum of ten years after data collection.</i></p> <p><i>If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.</i></p> <p><input type="checkbox"/> I agree to be audio-taped. <input type="checkbox"/> I do not agree to be audio-taped.</p>
Medical Treatment	<i>The University of Maryland does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the University of Maryland provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.</i>
Right to Withdraw and Questions	<i>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study</i>

	<p><i>or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. Your grade will not be negatively or positively affected by your participation in the study.</i></p> <p><i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:</i></p> <p><i>Porsha (Yasmin) Childs</i> 646-778-1050 pchilds@umd.edu</p> <p><i>or</i></p> <p><i>Dr. Nelly Stromquist</i> (301-405-7925) stromqui@umd.edu</p>	
Participant Rights	<p><i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i></p> <p style="text-align: center;">University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>	
Statement of Consent	<p><i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i></p> <p><i>If you agree to participate, please sign your name below.</i></p>	
Signature and Date	NAME OF SUBJECT [Please Print]	
	SIGNATURE OF SUBJECT	
	DATE	

Appendix C: Student Interview Consent Form (Portuguese)

Título do Projeto	<i>Fatores Institucionais e Desempenho Acadêmico dos Alunos Cotistas em Ciência, Tecnologia, Engenharia e Matemática</i>
Objetivo do Estudo	<p><i>Esta pesquisa está conduzida pela Porsha (Yasmin) Childs na Universidade de Maryland, College Park. Estou convidando você a participar deste projeto de pesquisa, porque você são: 1) um estudante de 18 anos que tenha admitido do sistema de cotas da UFBA e 2) com especialização em ciência, tecnologia, engenharia o matemática. O objetivo da minha pesquisa é identificar os fatores institucionais que influenciam o desempenho e persistência dos alunos cotistas que estão cursando ciências, tecnologia, engenharia e matemática. Essa pesquisa irá mostrar os obstáculos (academicos, sociais e financeiros) que os alunos cotistas enfrentam e os sistemas de suporte que a universidade possui no sentido de ajudá-los.</i></p>
Procedimentos	<p><i>Haverá três sessões de coleta de dados. Os dois primeiros consiste em entrevistas. Se você concordar em participar, vou criar um tempo e um lugar de encontro, onde você se sente confortável. Eu farei entrevistas para minha pesquisa durante os meses de Setembro à Dezembro de 2014.</i></p> <p><i>Eu vai realizar duas entrevistas e cada entrevista terá a duração de aproximadamente uma hora a uma hora e medio. A primeira entrevista incidirá sobre suas percepções das dimensões sociais do campus, e os obstáculos (preocupações acadêmicas, sociais e financeiras) que enfrentam os alunos cotistas em ciências e matematica após a admissão. Por exemplo, uma pergunta será: " Como você acha que os alunos cotistas são vistos e tratados no campus?" Outro exemplo de uma pergunta é: "Quais barreiras ou obstáculos que os alunos cotistas enfrentam para completar o seu grau?" O segundo entrevista vai focar mais em suas experiências dentro da sala de aula e vai incluir perguntas como: "Nas aulas do seu curso, qual a porcentagem de alunos cotistas?" o "Como você descreveria seu relacionamento com professores?"</i></p> <p><i>Você será informado dos pesquisadores desejam para gravar a entrevista para a exatidão, no entanto, você tem o direito de recusar ser áudio gravado. Sua participação será voluntária, e você pode retirar do estudo a qualquer momento. Você será solicitado a assinar um termo de</i></p>

	<p><i>consentimento. Você pode voltar a ser contactado se o pesquisador quer obter mais esclarecimentos sobre qualquer uma das suas respostas.</i></p> <p><i>A coleta de dados terceiro será para estudantes selecionado. Dependendo em suas respostas à entrevista, você pode ser convidado para ser observada. Observação ocorrerá no campus e em sua aula. O pesquisador irá observá-lo em não mais de cinco ocasiões.</i></p>
<p>Riscos Potenciais e Desconfortos</p>	<p><i>Qualquer perda potencial de confidencialidade serão minimizados por armazenamento de dados em um local seguro, ou seja, o computador do investigador. Após as transcrições são concluídos os arquivos de áudio serão apagados. Além disso, a qualquer momento seu nome não será identificado ou ligada aos dados. Os dados fornecidos através de suas respostas não serão compartilhadas com seu professor ou outros alunos em sua curso. Apenas o investigador terá acesso aos nomes dos participantes.</i></p>
<p>Benefícios Potenciais</p>	<p><i>Não há benefícios diretos para você, mas alguns possíveis benefícios incluem uma maior compreensão de como vários fatores institucionais podem afetar o desempenho e persistência dos alunos cotistas em os areas de ciência, tecnologia, engenharia e matemática. Os resultados do projeto pode incluir o fornecimento de mais dados sobre a retenção de alunos cotistas. Além disso, pode adicionar a outros estudos que analisam as minorias ou o uso de ação afirmativa no ensino superior. Os potenciais riscos e benefícios será explicado a você antes de sua participação no estudo.</i></p>
<p>Confidencialidade</p>	<p><i>A fim de proteger a sua privacidade, a sua identidade será confidencial. O investigador irá atribuir um pseudônimo para você. Seu nome real não aparecerá nos dados da entrevista. O pseudônimo será mantido em um documento separado no computador do investigador em um arquivo separado, longe do arquivo com os dados das entrevistas. Informações que identificam você será divulgada somente se você dar o seu consentimento para fornecer tais informações. Todos os dados eletrônicos serão armazenados com segurança em um arquivo protegido por senha no computador do escritório protegido por senha do investigador. Cópias de dados permanecerão no cargo do investigador em um arquivo bloqueado. Todos os dados serão destruídos (ou seja, desfiado ou apagados), quando o seu uso não é mais necessário, mas não antes de um mínimo de dez anos após a coleta de dados. Apenas o investigador principal terá acesso à cópia digital e duro dos arquivos.</i></p>

	<p><i>Se eu escrever um relatório ou um artigo sobre este projeto de pesquisa, sua identidade será protegida na medida máxima possível. Suas informações podem ser compartilhadas com representantes da Universidade de Maryland, College Park ou as autoridades governamentais se você ou alguém está em perigo ou se formos obrigados a fazê-lo por lei.</i></p> <p>___ Eu concordo em ser de áudio gravado.</p> <p>___ Eu não concorda em ser de áudio gravado.</p>
<p>Direito de Recesso e Perguntas</p>	<p><i>Sua participação nesta pesquisa é totalmente voluntária. Você pode optar por não participar. Se você decidir participar desta pesquisa, você pode parar de participar a qualquer momento. Se você decidir não participar deste estudo ou se você parar de participar a qualquer momento, você não será penalizado ou perderá todos os benefícios a que de outra forma se qualificar. Sua nota não será negativa ou positivamente afectada pela sua participação no estudo.</i></p> <p><i>Se você decidir parar de tomar parte no estudo, se tiver dúvidas, preocupações ou reclamações, ou se você precisa informar uma lesão relacionada com a pesquisa, entre em contato com o investigador:</i></p> <p><i>Porsha (Yasmin) Childs</i></p> <p>(71) 9391-7386</p> <p>pchilds@umd.edu</p> <p><i>or</i></p> <p><i>Dr. Nelly Stromquist</i></p> <p>(001-301-405-7925)</p> <p>stromqui@umd.edu</p>
<p>Direitos do Participante</p>	<p><i>Se você tiver dúvidas sobre seus direitos como participante da pesquisa ou desejam relatar uma lesão relacionada com a pesquisa, entre em contato:</i></p> <p>University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742</p>

	<p align="center">E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p><i>Esta pesquisa foi revisado de acordo com a Universidade de Maryland, College Park procedimentos IRB para pesquisas envolvendo seres humanos.</i></p>	
Termo de Anuência	<p><i>Sua assinatura indica que você tem pelo menos 18 anos de idade; você leu este formulário de consentimento ou já teve ler para você, suas perguntas foram respondidas a sua satisfação e voluntariamente concordar em participar desta pesquisa. Você receberá uma cópia deste formulário de consentimento assinado.</i></p> <p><i>Se você concordar em participar, por favor, assine o seu nome abaixo.</i></p>	
Assinatura e Data	NOME	
	[por favor, imprima]	
	ASSINATURA	
	Data	

Appendix D: Faculty/Staff Interview Consent Form (English)

<p>Project Title</p>	<p><i>Institutional Factors and Academic Achievement of Quota Students in STEM</i></p>
<p>Purpose of the Study</p>	<p><i>This research is being conducted by Mrs. Porsha Childs at the University of Maryland, College Park. I am inviting you to participate in this research project because you are 1) a faculty or staff member who has been employed at UFBA for 10 or more years and 2) you teach or support quota students in one of the science, technology, engineering, and math fields at the university. The purpose of this research project is to identify institutional factors that influence quota student performance and persistence in math and science fields. I am seeking this information in order to understand the obstacles quota students in math and science face and what support services may improve the academic achievement and persistence rates of said students.</i></p>
<p>Procedures</p>	<p><i>There will be one data collection session. If you agree to participate, I will set up a time and a meeting place where you feel comfortable speaking. Interviews can be on or off campus and will take place between Septmeber2014 – December 2014.</i></p> <p><i>Interviews will take between 60-90 minutes and questions will focus on your perceptions of quota students in math and science fields. Examples of questions include: “In what ways does the university make quota students feel like they belong here?” and “Why might quota students have a difficult time fitting in?” These questions will be followed by questions that examine faculty/administrators perceptions about the barriers quota students face and the services available to them. This section will contain questions such as, “What do you think is the biggest challenge quota students face?” and “what institutional supports are available to help quota students with academic challenges?”</i></p> <p><i>You will be informed of the researchers wish to audiotape the interview for purposes of accuracy; however, you have the right to decline being audio recorded. Your participation will be voluntary, and you may withdraw from the study at any time. You will be asked to sign a consent form. You may be re-contacted if the researcher wants to get further clarification about any of your responses.</i></p>

<p>Potential Risks and Discomforts</p>	<p><i>There may be some risks from participating in this research study. Because these interviews may be audio recorded, this project presents a slight risk of loss of confidentiality. To ensure anonymity, the student investigator will assign you a pseudonym, and will only keep the transcripts of the conversation for accuracy. Once the transcripts are completed the audio files will be deleted. Your identity will not be known to other participants. You will not be asked questions that would compromise your positions as a student. The potential risks and benefits will be explained to you before your participation begins.</i></p>
<p>Potential Benefits</p>	<p><i>There are no direct benefits to you, but some possible benefits include a greater understanding of how various institutional factors may impact the academic performance and persistence of quota students in STEM fields. Outcomes of the project may include providing further data on college retention. In addition, it may add to other studies that analyze minorities or the use of affirmative action in higher education. The potential risks and benefits will be explained to you before your participation in the study.</i></p>
<p>Confidentiality</p>	<p><i>In order to protect your privacy, your identity will remain confidential. The investigator will assign a pseudonym to you. Your actual name will not appear on interview data. The key linking you to the pseudonym will be kept in a separate document on the investigator's computer in a separate folder, away from the folder with the interview data. Information identifying you will be disclosed only if you give consent to provide such information. All electronic data will be securely stored in a password protected file on the principle investigator's password protected office computer. Hard copies of data will remain in the principle investigator's office in a locked file cabinet. All data will be destroyed (i.e., shredded or erased) when their use is no longer needed, but not before a minimum of ten years after data collection. Only the principal investigator will have access to the digital and hard copy of the files.</i></p> <p><i>If I write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.</i></p>

	<p>___ I agree to be audio-taped. ___ I do not agree to be audio-taped.</p>
<p>Right to Withdraw and Questions</p>	<p><i>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. Your grade will not be negatively or positively affected by your participation in the study.</i></p> <p><i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:</i></p> <p><i>Porsha Childs</i></p> <p><i>(71) 9391-7386</i></p> <p><i>pchilds@umd.edu</i></p> <p><i>or</i></p> <p><i>Dr. Nelly Stromquist</i></p> <p><i>(001-301-405-7925)</i></p> <p><i>stromqui@umd.edu</i></p>
<p>Participant Rights</p>	<p><i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i></p> <p style="text-align: center;">University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>
<p>Statement of Consent</p>	<p><i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i></p>

	<i>If you agree to participate, please sign your name below.</i>	
Signature and Date	NAME OF SUBJECT [Please Print]	
	SIGNATURE OF SUBJECT	
	DATE	

Appendix E: Faculty/Staff Interview Consent Form (Portuguese)

Título do Projeto	<i>Fatores Institucionais e Desempenho Acadêmico dos Alunos Cotistas em Ciência, Tecnologia, Engenharia e Matemática</i>
Objetivo do Estudo	<i>Esta pesquisa está conduzida pela Porsha (Yasmin) Childs na Universidade de Maryland, College Park. Estou convidando você a participar deste projeto de pesquisa, porque você são: 1) um facultade ou membro da equipe que tem sido empregado na UFBA por 10 ou mais anos e 2) você ensinar ou trabalhar com os alunos cotistas em uma curso de ciência, tecnologia, engenharia, e de matemática na universidade. O objetivo da minha pesquisa é identificar os fatores institucionais que influenciam o desempenho e persistência dos alunos cotistas que estão cursando ciências, tecnologia, engenharia e matemática. Essa pesquisa irá mostrar os obstáculos (academicos, sociais e financeiros) que os alunos cotistas enfrentam e os sistemas de suporte que a universidade possui no sentido de ajudá-los.</i>
Procedimentos	<p><i>Haverá uma sessão de coleta de dados. Se você concordar em participar, vou criar um tempo e um lugar de encontro, onde você se sente confortável. Eu farei entrevistas para minha pesquisa durante os meses de Setembro à Dezembro de 2014.</i></p> <p><i>Eu vai realizar uma entrevista e cada entrevista terá a duração de aproximadamente uma hora a uma hora. Exemplos de questões incluem, "Como são cotistas tratado e visto neste campus?" "Por que alunos cotistas têm dificuldade na montagem?"_Essas questões serão seguidas por questões que examinam os professores / administradores percepções sobre os barreiras que cotistas enfrentam e os serviços disponíveis para eles. Esta seção conterà perguntas como, "Que barreiras ou obstáculos que você acha cotistas enfrentam para completar o seu grau?" Que tipos de programas ou serviços que a universidade tem que ajudar os alunos de cotas com as suas necessidades acadêmicas?</i></p> <p><i>Você será informado dos pesquisadores desejam para gravar a entrevista para a exatidão, no entanto, você tem o direito de recusar ser</i></p>

	<p><i>áudio gravado. Sua participação será voluntária, e você pode retirar do estudo a qualquer momento. Você será solicitado a assinar um termo de consentimento. Você pode voltar a ser contactado se o pesquisador quer obter mais esclarecimentos sobre qualquer uma das suas respostas.</i></p> <p><i>A coleta de dados terceiro será para estudantes selecionado. Dependendo em suas respostas à entrevista, você pode ser convidado para ser observada. Observação ocorrerá no campus e em sua aula. O pesquisador irá observá-lo em não mais de cinco ocasiões.</i></p>
<p>Riscos Potenciais e Desconfortos</p>	<p><i>Qualquer perda potencial de confidencialidade serão minimizados por armazenamento de dados em um local seguro, ou seja, o computador do investigador. Após as transcrições são concluídos os arquivos de áudio serão apagados. Além disso, a qualquer momento seu nome não será identificado ou ligada aos dados. Os dados fornecidos através de suas respostas não serão compartilhadas com professores ou alunos em la universidade. Apenas o investigador terá acesso aos nomes dos participantes.</i></p>
<p>Benefícios Potenciais</p>	<p><i>Não há benefícios diretos para você, mas alguns possíveis benefícios incluem uma maior compreensão de como vários fatores institucionais podem afetar o desempenho e persistência dos alunos cotistas em os areas de ciência, tecnologia, engenharia e matemática. Os resultados do projeto pode incluir o fornecimento de mais dados sobre a retenção de alunos cotistas. Além disso, pode adicionar a outros estudos que analisam as minorias ou o uso de ação afirmativa no ensino superior. Os potenciais riscos e benefícios será explicado a você antes de sua participação no estudo.</i></p>
<p>Confidencialidade</p>	<p><i>A fim de proteger a sua privacidade, a sua identidade será confidencial. O investigador irá atribuir um pseudônimo para você. Seu nome real não aparecerá nos dados da entrevista. O pseudônimo será mantido em um documento separado no computador do investigador em um arquivo separado, longe do arquivo com os dados das entrevistas. Informações que identificam você será divulgada somente se você dar o seu consentimento para fornecer tais informações. Todos os dados eletrônicos serão armazenados com segurança em um arquivo protegido por senha no computador do escritório protegido por senha do investigador. Cópias de dados permanecerão no cargo do investigador em um arquivo bloqueado. Todos os dados serão destruídos (ou seja, desfiado ou apagados), quando o seu uso não é mais necessário, mas não antes de um mínimo de dez anos após a coleta de dados. Apenas o investigador principal terá acesso à cópia digital e duro dos arquivos.</i></p>

	<p><i>Se eu escrever um relatório ou um artigo sobre este projeto de pesquisa, sua identidade será protegida na medida máxima possível. Suas informações podem ser compartilhadas com representantes da Universidade de Maryland, College Park ou as autoridades governamentais se você ou alguém está em perigo ou se formos obrigados a fazê-lo por lei.</i></p> <p>___ Eu concordo em ser de áudio gravado .</p> <p>___ Eu não concorda em ser de áudio gravado .</p>
<p>Direito de Recesso e Perguntas</p>	<p><i>Sua participação nesta pesquisa é totalmente voluntária. Você pode optar por não participar. Se você decidir participar desta pesquisa, você pode parar de participar a qualquer momento. Se você decidir não participar deste estudo ou se você parar de participar a qualquer momento, você não será penalizado ou perderá todos os benefícios a que de outra forma se qualificar.</i></p> <p><i>Se você decidir parar de tomar parte no estudo, se tiver dúvidas, preocupações ou reclamações, ou se você precisa informar uma lesão relacionada com a pesquisa, entre em contato com o investigador:</i></p> <p><i>Porsha (Yasmin) Childs</i></p> <p>(71) 9391-7386</p> <p>pchilds@umd.edu</p> <p>or</p> <p><i>Dr. Nelly Stromquist</i></p> <p>(001-301-405-7925)</p> <p>stromqui@umd.edu</p>

Appendix F: Demographic Questionnaire (English)

Please take a few minutes to answer each of the questions below.

Age: _____

Gender: _____

Race (circle one): black, brown, indigenous, yellow, white

Name and type of high school you graduated from (for example, public, private, military etc.):

Major: _____

Year you entered the university: _____ Actual semester: _____

Pseudonym: _____

Appendix G: Demographic Questionnaire (Portuguese)

Questionário Demográfico

Por favor, dedique alguns minutos para preencher este questionário.

Idade: _____

Sexo: _____

Race (círculo um): preto, pardo, indígena, amarelo, branco

Nome e tipo de colégio que frequentou (por exemplo, particular, público, outro):

Curso: _____

Ano que entrou na universidade: _____ Semestre atual: _____

Pseudônimo: _____

Appendix H: Student Interview Protocol #1

Interview # 1

Purpose of Interview: The purpose of this interview is to gain an in-depth understanding of the social dimensions of the campus and how it is experienced by quota students in STEM fields. The questions in this interview will focus on students' overall views of the campus, including their relationships with other students and informal interactions with faculty and staff. In addition, students will be asked about the obstacles they believe quota students face and the support services that are available to them on campus.

[These questions are intended to give me some general background about the student and their entry into a STEM field.]

1. What part of Bahia are you from?
2. Think back to the high school you attended. Can you tell me a little bit about the school?
 - How well do you feel it prepared you to enter college?
3. What is your major?
4. Tell me about your interest in _____ (specific major)?
 - When and how did you decide you wanted to major in this area?
 - Was anyone influential in your decision to enter this field? Who and in what way?
5. Have you ever been encouraged or discouraged to pursue a degree in _____ (major)? In what way?
6. Under which quota program did you enter the university?
7. What do you think about the quota system?
 - In what ways does it help students?
 - Is there any way in which the quota system can be viewed as harmful?

[RQ2: In what ways does campus climate affect quota student persistence and academic performance in STEM fields?]

I'm now going to shift and ask questions about your experiences here on campus. I want you to be very honest but remember you do not have to answer any question you don't want to.

8. Describe your overall perceptions of the campus environment.
 - What factors have shaped your perceptions?
9. Tell me what it's like to be a quota student in _____ (major) at this university?

10. How are quota students viewed and treated on campus?
- Do faculty and students have different views about quota students?
 - What things do you see or experience around campus that express these views?
11. Have you ever had any experiences in which you felt singled out or treated differently because you are a quota student?
- Are there any places on campus where you feel unwelcome?
 - Are there any places on campus where you feel welcome and valued?

[The following questions are race and gender specific and will only be asked to female and/or black students]

12. Tell me what it means to be black in _____(major)?
- What challenges do you face?
 - What opportunities do you have?
13. How have your experiences as a black student shaped your perceptions of the campus environment?
- Do you ever feel as if you are treated differently because you are black?
14. Tell me what it means to be a women in _____(major)?
- What challenges do you face?
 - What opportunities do you have?
15. How have your experiences as a woman shaped your perceptions of the campus environment?
- Do you ever feel as if you are treated differently because you are a woman?

[RQ3: What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ?]

16. We just spoke about how you feel quota students are treated on campus. What barriers or obstacles do you think quota students face in completing their degree?
17. Why do you think these are challenges for quota students?
18. Are there some obstacles that are specific to your major? Explain
19. What has been the biggest challenge you have faced since starting college?

[RQ4: What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?]

20. What types of programs or services does the university have to help quota students with their academic needs?

Have you ever used any of these programs or services?

- If so, how did you find them?
- If not, why haven't you used them?

21. What types of programs or services does the university offer to help quota students feel like they are part of the university community?

Have you ever used any of these programs or services?

- If so, how did you find them?
- If not, why haven't you used them?

22. What types of programs or services does the university offer to help quota students with their financial needs?

Have you ever used any of these programs or services?

- If so, how did you find them?
- If not, why haven't you used them?

23. What types of STEM specific programs or services does the University offer?

Have you ever used any of these programs or services?

- If so, how did you find them?
- If not, why haven't you used them?

24. What types of programs or services are missing from the university? What do you think they need to have in order to ensure that quota students in STEM are successful?

Peers are often considered a part of a students' support system. The final questions will be about your friends here on campus.

25. Describe the friends you have made on campus.

- Are these students in your class or major?
- What brought you together as friends?

26. In what ways do your friends add to or detract from your studies?

Conclusion

These are all of my questions. Is there anything else you would like to add about your experience as a quota student in STEM?

Thank you again for participating in this interview. I will forward you a copy of the transcript with the themes I have identified so that you have the opportunity to clarify or elaborate on any of the topics we discussed. Additionally, I may follow up with you if I need further clarification on any of your responses. Are there any questions or concerns that you have for me?

Appendix I: Student Interview Protocol # 1 (Portuguese)

Entrevista n ° 1

Objetivo da Entrevista: O objetivo desta entrevista é conseguir chegar a um conhecimento profundo das dimensões sociais do campus e como os estudantes cotistas em ciências e matemática as vivenciam. As perguntas desta entrevista estarão focadas nas percepções dos estudantes cotistas sobre o ambiente do campus, incluindo suas relações com os outros estudantes e interações com os professores. Além disso, os alunos serão questionados sobre os obstáculos que enfrentam e os serviços de suporte que estão disponíveis para eles.

[Essas questões têm a intenção de dar-me algumas informações gerais sobre o aluno e as razões de suas escolhas acadêmicas.]

1. De que parte do estado da Bahia você é?
 2. Fale sobre a escola onde você terminou o nível médio.
 - Como foi a sua preparação para entrar na faculdade?
 3. Qual é o seu curso?
 4. Fale sobre o seu interesse em _____ (curso específico)?
 - Quando e como você decidiu que queria entrar nesta área?
 - Houve alguma pessoa influente na sua decisão? Quem e por quê?
 5. Você já foi encorajado ou desencorajado a estudar em _____ (curso) ? De que maneira?
 6. Você é a primeira pessoa de sua família a ir para a faculdade?
 7. Em que programa de cotas você entrou na universidade? No programa de colégio público ou racial?
 8. O que você acha sobre o sistema de cotas?
 - De que forma o sistema de cotas ajuda os alunos?
 - Existe alguma maneira em que o sistema de cotas pode ser visto como ruim? Explique.
- [RQ2 : De que forma o clima do campus afeta a persistência e desempenho acadêmico dos estudantes cotistas em matemáticas e ciências]
Agora gostaria de saber sobre suas experiências aqui no campus.
9. Descreva as suas percepções globais do ambiente do campus.
 - Quais os fatores que moldaram a sua percepção?
 10. Como você acha que os alunos cotistas são vistos e tratados no campus?
 - Os professores e alunos têm opiniões diferentes sobre alunos cotistas?
 - Pode dar alguns exemplos que retratem o seu depoimento?

11. Fale o que é ser um estudante cotista em seu curso?

12. Você já teve alguma experiência em que você se sentiu apontado ou tratado de forma diferente por você ser um estudante cotista?

- Existe algum lugar no campus onde você se sente indesejável?
- Existe algum lugar no campus onde você se sente bem-vindo e valorizado?

[As seguintes perguntas são dirigidas aos estudantes do sexo feminino]

13. Fale o que significa ser uma mulher em _____ (curso)?

- Quais são os desafios que você enfrenta?
- Quais as oportunidades que você tem?

14. Como mulher, que experiências contribuíram para formar as suas percepções no ambiente do campus?

- Você já se sentiu de forma diferente por que você é mulher?

[RQ3 : Que obstáculos (preocupações acadêmicas, sociais e financeiras) enfrentam os alunos cotistas em ciências e matemática após a admissão, e como diferem as percepções dos estudantes e professores?

15. Acabamos de falar como se sentem os alunos cotistas e como são tratados no campus. Quais barreiras ou obstáculos que os alunos cotistas enfrentam para completar o seu grau?

16. Por que você acha que estes são obstáculos para os alunos de cotas?

17. Há alguns obstáculos específicos para os alunos cotistas em seu curso? Explique.

18. Muitos alunos cotistas têm falado sobre a dificuldade de as matérias e como eles tiveram que repetir. Alguma vez você já teve que repetir uma matéria? Se sim, qual matéria e quantas vezes você precisa repeti-lo?

19. Qual foi o maior desafio que já enfrentou desde o início da faculdade?

[RQ4 : Quais serviços institucionais estão disponíveis para apoiar os alunos cotistas e quais dos serviços os alunos usam mais frequentemente]

20 . Que tipos de programas ou serviços a universidade tem para ajudar os alunos de cotas com as suas necessidades acadêmicas ?

Alguma vez você já usou algum desses programas ou serviços?

- Se sim, fale como é ?
- Se não, diga por quê?

21 . Que tipos de programas ou serviços a universidade oferece para ajudar os alunos de cotas se sentirem como parte da comunidade universitária?

Você já usou algum desses programas ou serviço?

- Se sim, Fale como é?

- Se não, diga o por quê?

22 . Que tipos de programas ou serviços a universidade oferece para ajudar os alunos de cotas com as suas necessidades financeiras?

Alguma vez você já usou algum desses programas ou serviços?

- Se sim, Fale como foi?
- Se não, Diga o por quê?

23 . Que tipos de programas ou serviços específicos ao seu curso a Universidade oferece?

Alguma vez você já usou algum desses programas ou serviços?

- Se sim, fale como foi?
- Se não, diga o por quê?

24 . Que tipos de programas ou serviços estão faltando na universidade? O que você acha que precisa ter a fim de garantir que os alunos cotistas em seu curso sejam bem sucedidos?

Muitas vezes os seus colegas são considerados uma parte do sistema de apoio de estudantes. As últimas perguntas serão sobre os teus amigos no campus.

25 . Descreva os amigos que fez no campus.

- Eles são alunos do seu curso?
- Como vocês se tornaram amigos?

26 . De que forma os seus amigos ajudam ou prejudicam seus estudos?

Conclusão

Estas são todas as minhas perguntas . Existe alguma coisa que você gostaria de acrescentar sobre a sua experiência como estudante de cota em seu curso?

Obrigada mais uma vez por participar desta entrevista. Brevemente irei dar-lhe uma cópia desta entrevista para que você, caso seja necessário, tenha a oportunidade de esclarecer ou de mudar alguma resposta. E, se for necessário algum esclarecimento adicional, poderei contactá-lo? Existe alguma dúvida ou preocupação da sua parte?

Appendix J: Student Interview Protocol #2

Interview #2

Purpose of Interview: The purpose of this interview is to gain an in-depth understanding of the academic dimension of the campus and how it is experienced by quota students in STEM fields. The questions in this interview will focus on students' views of the community within their major and will include questions regarding students' experiences in class as well as the formal relationships they have with faculty and academic staff.

[RQ2: In what ways does campus climate affect quota student persistence and academic performance in STEM fields?]

1. On average, how many quota students would you say are in each of your classes? What percentage of the class do they make up?
 - How does it make you feel to have that many/that few other quota students in class with you?
2. Do the other students in the class know who the quota students are? How is this determination made?
 - How does this make you feel?
3. Does the teacher make any distinctions between non-quota and quota students? Explain
 - Do you see any differences in the way the professor speaks to students?
 - Does the professor have different expectations of students?
 - Are stereotypical assumptions about quota students revealed in the classroom dialogue?
4. Which students participate most in class? (ask and/or answer questions)
 - Is this the same in all of your classes? If not, what do you think the differences are?
 - Why do you think this is the case?
5. Which class(es) do you enjoy the most? Why?
6. Which class(es) have you had the most academic success in?
 - What factors contributed to your success?
7. Which class(es) do you enjoy the least why?

8. Which class(es) have you struggled in academically?
 - What factors contributed to your lack of success?
9. Who do you go to when you are having problems understanding things in class?
10. Who would you go to for help with other problems?

[RQ2: In what ways do faculty-student and peer to peer relationships impact quota student persistence and academic performance in STEM fields]

I'd now like to ask questions about your in-class interactions with faculty and peers.

11. How would you describe your relationship with the faculty at the university?
12. Are there any faculty members that you feel particularly close with?
 - What do these faculty members do that set them apart from others?
 - If no, why do you think it has been hard to build a relationship with faculty?
13. How do you think faculty members feel about quota students?
 - What actions or words do they use to demonstrate these feelings?
14. What is your relationship like with other students in your major?
15. Do you know who the other quota students are in your program? What is your relationship like with them?
16. Are there opportunities in your classes or program to work with other students?
 - What do these experiences look like?
 - How are students grouped?
17. Are there opportunities to work with faculty outside of the classroom (i.e. research)?
 - What do these opportunities to look like?
 - How can a student take part in these opportunities?
 - Which students typically do these things?

[RQ2: In what ways does campus climate affect quota student persistence and academic performance in STEM fields?] For the final few questions I'd like you to think about your experiences in the classroom and your relationships with both faculty and peers.

18. How would you describe the sense or feeling of community (interactions between faculty and students) within your major?

- What is your biggest concern about the community in _____(major)?
- What changes would you make to improve the sense of community in _____(major)?

19. As a _____ (major), how is your experience different from students in other majors not related to STEM?

- Do you feel that your coursework and requirements are harder than others?
- Is the feeling of community stronger or weaker in your major?
- What factors have led to these differences?

Conclusion

These are all of my questions. Is there anything else you would like to add about your experience as a quota student in STEM?

Thank you again for participating in this interview. I will forward you a copy of the transcript with the themes I have identified so that you have the opportunity to clarify or elaborate on any of the topics we discussed. Additionally, I may follow up with you if I need further clarification on any of your responses. Are there any questions or concerns that you have for me?

Appendix K: Student Interview Protocol # 2 (Portuguese)

Entrevista n ° 2

Objetivo da Entrevista : O objetivo desta entrevista é conseguir chegar a um conhecimento profundo das dimensões sociais do campus e como os estudantes cotistas em ciências e matemática as vivenciam. As perguntas desta entrevista incidirão sobre as experiências dos alunos da comunidade dentro do seu curso.

[RQ2: Como o ambiente do campus afeta a persistência e desempenho dos estudantes cotistas em matemática e ciências?]

1. Quais os alunos que participam mais em sala de aula? (pedir e / ou responder a perguntas)
 - a. Isso acontece em todas as suas aulas? Se não, explique
2. Que aulas você gosta mais? Por quê?
3. Que aulas você gosta menos? Por quê?
4. Quais as aulas onde você obteve o maior sucesso acadêmico?
 - a. Quais os fatores que contribuíram para o seu sucesso?
5. Quais as aulas em que você sente maior dificuldade?
 - a. Quais os fatores que contribuíram para a sua falta de sucesso?
6. Quem você procura quando está tendo problemas em entender alguma matéria?
7. Quem você procura para pedir ajuda com outros problemas?

[RQ2 : Como é que as relações entre faculdade -aluno e aluno-aluno influenciam o desempenho dos estudantes cotistas]

8. Agora gostaria de fazer perguntas sobre a sua interação com professores e colegas em sala de aulas.
9. Como você descreveria seu relacionamento com professores?
10. Existem membros da faculdade com os quais você se sente particularmente próximo?
 - a. O que esses professores fazem para que você os considere diferentes de outros?
 - b. Se não, por que você acha que tem sido difícil construir um relacionamento com os professores?
11. Como é a sua relação com outros estudantes em seu curso?

12. Existem oportunidades em suas aulas ou programa para trabalhar com outros alunos?
 - a. Fale dessas experiências.
 - b. Como são os alunos agrupados?
13. Há oportunidades para trabalhar com os professores fora da sala de aula (por exemplo, fazer trabalhos de pesquisa)?
14. Que tipo de oportunidades costumam surgir?
 - a. Como pode um aluno participar dessas oportunidades?
 - b. Quais os alunos que costumam ter estas oportunidades?

[RQ2 : De que forma o ambiente do campus afeta a quota de persistência dos alunos e desempenho escolar em cursos de matemática e ciências?] Para as perguntas finais eu gostaria que você pensasse sobre as suas experiências em sala de aula e suas relações com os professores e colegas.

15. Como você descreveria a sensação ou sentimento de comunidade (as interações entre professores e alunos) dentro de seu curso?
 - a. Qual é sua maior preocupação com a comunidade em _____ (curso)?
 - b. Que mudanças você faria para melhorar o senso de comunidade em _____ (curso)?
16. Em que difere a sua experiência acadêmica em relação a outros estudantes de outros cursos não relacionados à matemática e ciência?
 - a. Você sente que os seus cursos e os requisitos são mais difíceis do que outros? Explique.
 - b. É o sentimento de comunidade mais forte ou mais fraco em seu curso?
 - c. Quais os fatores que levaram a essas diferenças?
17. O que você quer fazer depois de se formar?

Conclusão

Obrigada mais uma vez por participar desta entrevista. Brevemente irei dar-lhe uma cópia desta entrevista para que você, caso seja necessário, tenha a oportunidade de esclarecer ou de mudar alguma resposta. E, se for necessário algum esclarecimento adicional, poderei contactá-lo? Existe alguma dúvida ou preocupação da sua parte?

Appendix L: Faculty/Staff Interview Protocol

These questions are intended to give me some general background about your position here at the university.

1. How long have you been employed at the university?
2. During that time what positions have you held?
3. In what ways does your current position allow you to interact with quota students?
4. How many quota students are typically in one class? What percentage of the class does this comprise?
5. Do you see any differences between quota and non-quota students in the classroom setting?
 - Which students participate (ask and answer questions in class) most in class?
 - How do the grades of quota students compare with those of non-quota students?
 - If there are large differences, why do you think these differences occur?

I am now going to move towards asking you more specific questions about the quota program here at UFBA and your interactions with quota students.

6. The implementation of quotas began in 2005. Can you describe what the campus and student body were like prior to that time?
7. In what ways did the implementation of quotas change that?
8. What are your thoughts about the use of quotas?
 - In what ways are quotas beneficial?
 - In what ways are quotas detrimental?
 - What academic areas are most impacted by the quota policies?
9. Upon implementing the quota program did the university have any type of diversity training for faculty or add any specific guidelines as to how quota students should be treated?

[RQ2: In what ways does campus climate affect quota student persistence and academic performance in STEM fields?] I'm now going to shift and ask questions about your view of the campus climate. I want you to be very honest but remember you do not have to answer any question you don't want to.

10. How would you describe quota students?

- Do they “fit-in” academically with other students?
- Do you think this varies by major? Why or why not?
- Do they fit in socially with other students?

11. Overall, describe your perception of the campus environment

12. How are quota students treated and viewed on this campus?

- Have you heard of any times when quota students felt left out or marginalized?
- What practices lead to these feelings?

13. Why might quota students have a difficult time fitting in?

- What separates them from other students at the university?

14. In what ways does the university make quota students feel like they belong?

15. As a faculty member what have or can you do in the class to make quota students feel more welcome?

- Are other faculty members doing these things?
- Do you see the need for any type of “special treatment” or effort made to incorporate quota students into the class culture?

[RQ3: What barriers (major academic, social, and financial concerns) do quota students in STEM fields face after admission and how do student and faculty perceptions of these barriers differ?]

16. What barriers or obstacles do you think quota students face in completing their degree?

- Are these challenges the same across majors? If not, explain.

17. Why do you think these are challenges for quota students?

18. In what ways does the quota system help alleviate or aggravate these problems?

[RQ4: What institutional services are available to support quota STEM students and which of these services do STEM students use most frequently?]

19. What types of programs or services does the university have to help quota students with their academic needs?

- Are these programs well known by students?
- How frequently are they used?

20. What types of programs or services does the university offer to help quota students feel like they are a part of the university community?
- Are these programs well known by students?
 - How frequently are they used?
21. What types of programs or services does the university offer to help quota students with their financial needs?
- Are these programs well known by students?
 - How frequently are they used?
22. What types of STEM specific programs or services does the University offer?
- Are these programs well known by students?
 - How frequently are they used?
23. What types of programs or services are missing from the university? What do you think they need to have in order to ensure that quota students are successful?

Conclusion

These are all of my questions. Is there anything else you would like to add about your experience as a quota student in STEM?

Thank you again for participating in this interview. I will forward you a copy of the transcript with the themes I have identified so that you have the opportunity to clarify or elaborate on any of the topics we discussed. Additionally, I may follow up with you if I need further clarification on any of your responses. Are there any questions or concerns that you have for me?

Appendix M: Faculty Interview Protocol (Portuguese)

Estas perguntas têm a intenção de me dar algumas informações gerais sobre a sua posição aqui na universidade.

- 1 . Quanto tempo você tem sido empregado na universidade?
- 2 . Durante esse tempo, o que as posições que você realizou?
- 3 . Eu entendo que alunos cotistas não são identificados de forma diferente do que os estudantes não-cotista. Você acha que os professores muitas vezes fazem suposições sobre o que os alunos cotistas?
- 4 . Você vê alguma diferença entre cotistas e não- cotistas em sala de aula?
 - Que os alunos participam (fazer e responder perguntas em sala de aula), a maioria em sala de aula?
 - Como é que as notas dos alunos cotistas comparar com os dos não-cotistas?
 - Se existem grandes diferenças, por que você acha que essas diferenças ocorrem?

[RQ2 : De que forma o campus clima afeta a persistência estudante quota e desempenho acadêmico em campos STEM ?]

Estou indo agora para mudar e fazer perguntas sobre a sua visão do clima campus. Eu quero que você seja muito honesto, mas lembre-se que você não tem de responder a qualquer pergunta que você não quer.

- 5 . No geral, descrever a sua percepção do ambiente de campus
- 6 . Como são cotistas tratado e visto neste campus agora?
 - Você já ouviu falar de todas as vezes em que os alunos de cotas se sentiu deixado de fora ou marginalizados?
 - Que práticas levam a esses sentimentos?
- 7 . De que forma a universidade faz para que o cotistas se sinta parte dela?
- 8 . Como um membro do corpo docente que tem ou que você pode fazer na classe para fazer alunos cotistas se sintam mais bem-vindo ?
 - Os outros membros do corpo docente de fazer essas coisas ?

- Você vê a necessidade de qualquer tipo de "tratamento especial " ou esforço para incorporar alunos cotistas na cultura de classe?

[RQ3 : Que barreiras (maiores preocupações acadêmicas, sociais e financeiros) não cotistas em campos STEM enfrentar após a admissão e como as percepções de estudantes e professores dessas barreiras diferem]

9 . Que barreiras ou obstáculos que você acha cotistas enfrentam para completar o seu grau?

- São estes desafios que os mesmos majors em toda ? Se não , explicar .

10 . Porque você acha que estes são desafios para os alunos de cotas?

11 . De que forma o sistema de cotas ajudar a aliviar ou agravar esses problemas?

12. Muitos cotistas têm dito que eles têm de repetir as materias. Que materias são as mais difíceis para os alunos a passar? Que sistemas de apoio que você tem para ajudar os alunos a passar essas materias?

[RQ4 : Quais serviços institucionais estão disponíveis para apoiar os alunos quota -tronco e que esses serviços não STEM alunos usam mais freqüentemente]

13 . Que tipos de programas ou serviços que a universidade tem que ajudar os alunos de cotas com as suas necessidades acadêmicas ?

- São esses programas bem conhecido pelos alunos?

- Com que freqüência eles são usados ?

14. Que tipos de programas ou serviços que a universidade oferece para ajudar alunos cotistas se sentem como eles são uma parte da comunidade universitária ?

- São esses programas bem conhecido pelos alunos?

- Com que freqüência eles são usados ?

15 . Que tipos de programas ou serviços que oferece o universitário para ajudar os alunos de cotas com as suas necessidades financeiras ?

- São esses programas bem conhecido pelos alunos?

- Com que freqüência eles são usados ?

16 . Que tipos de programas ou serviços específicos STEM é que a Universidade oferece?

- São esses programas bem conhecido pelos alunos?

- Com que frequência eles são usados ?

17 . Que tipos de programas ou serviços estão faltando na universidade? O que você acha que precisa ter, a fim de garantir que os alunos cotistas são bem sucedidos?

Conclusão

Obrigada mais uma vez por participar desta entrevista. Brevemente irei dar-lhe uma cópia desta entrevista para que você, caso seja necessário, tenha a oportunidade de esclarecer ou de mudar alguma resposta. E, se for necessário algum esclarecimento adicional, poderei contactá-lo? Existe alguma dúvida ou preocupação da sua parte?

Appendix N: Interview Protocol ~ Basic Math Course (Portuguese)

Entrevista sobre o curso básico de matemática

1. Qual a sua posição na Universidade?
2. Já foi um estudante aqui? (Se ele responde sim, usar as perguntas na segunda página também)
3. Fale um pouco sobre a matemática básica que você ensina. Quando e por que você iniciou o programa?
4. Como você decidiu quais matérias iria oferecer?
5. Com que frequência você oferece essas matérias?
6. Para quem você criou essas matérias? E como os alunos sabem sobre o programa?
7. Normalmente quantos alunos frequentam as aulas?
8. Que tipos de alunos frequentam as aulas?
9. Você mantém algum registro com os dados desse trabalho? Como você sabe que as aulas estão ajudando?
10. Os estudantes têm que pagar por esses cursos?
11. Quem financia este projeto?
12. Falei com vários estudantes sobre os diferentes tipos de suportes que a universidade oferece e parece que há muito pouco oferecido em termos acadêmicos. Em seu trabalho com os alunos que tipos de programas que você acha que a universidade deve oferecer aos alunos que têm problemas com as aulas?

1. Em que ano você entrou na universidade?
2. Que tipo de ensino médio que você frequenta?
3. Fale sobre a escola onde você terminou o nível médio.
 - Como foi a sua preparação para entrar na faculdade?
4. Que curso você faz aqui na UFBA?
Você entrou pelo sistema de cotas?
5. O que você acha sobre o sistema de cotas?
 - De que forma o sistema de cotas ajuda os alunos?
6. Fale sobre o seu interesse em _____ (curso específico)?
 - Quando e como você decidiu que queria entrar nesta área?
 - Houve alguma pessoa influente na sua decisão? Quem e por quê?
7. Você já foi encorajado ou desencorajado a estudar em _____ (curso)? De que maneira?
8. Você é a primeira pessoa de sua família a ir para a faculdade?
9. Quando você estava na faculdade quais as dificuldades que você enfrentou?
 - Acadêmicas.
 - Como uma mulher em seu curso
 - Financeira
10. Quais as matérias que foram os mais difíceis para os alunos quando você estava na universidade?
11. Você teve dificuldade em alguma de suas matérias?
12. Quais os fatores que ajudaram a você se formar?
13. Quando você se formou?
14. O que você tem feito desde então?
15. Que dificuldades encontrou após a graduação?

Conclusão

Obrigada mais uma vez por participar desta entrevista. Brevemente irei dar-lhe uma cópia desta entrevista para que você, caso seja necessário, tenha a oportunidade de esclarecer ou de mudar alguma resposta. E, se for necessário algum esclarecimento adicional, poderei contactá-lo? Existe alguma dúvida ou preocupação da sua parte?

Appendix O: Interview Protocol ~ Monitoria (Portuguese)

- 1.** Quando o programa monitoria começou na UFBA?
- 2.** O que levou à criação deste programa?
- 3.** É este programa financiado pelo governo federal ou é financiado pela Universidade?
- 4.** Quem decide quais cursos tem monitorias? Existem alguns cursos que são difíceis e sempre tem monitorias?
- 5.** Como os monitores são selecionados?
- 6.** Quais são as funções e responsabilidades de uma monitoria?
- 7.** Os monitores faz algum tipo de treinamento?
- 8.** Descrever como funciona o programa?
- 9.** Eu sei que você tem monitorias com bolsas e voluntários? Qual é a diferença?
- 10.** Você coleta dados sobre quantos alunos se encontram com os monitores?
- 11.** Como você avalia se o programa está funcionando ou ajudando os alunos? Você tem dados sobre o número de estudantes que repetem cursos com monitores contra os sem?
- 12.** Em sua opinião qual a parte do programa tem sido mais bem sucedida?
- 13.** O programa pode ser feito melhor? Como você gostaria de ver o programa melhorar?

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