
Electronic Theses and Dissertations, 2020-

2020

A Comprehensive Investigation of Hispanic Student Success in Gateway STEM Courses at Five State of Florida Institutions

Renee Becker
University of Central Florida



Part of the [Higher Education Commons](#)

Find similar works at: <https://stars.library.ucf.edu/etd2020>

University of Central Florida Libraries <http://library.ucf.edu>

This Doctoral Dissertation (Open Access) is brought to you for free and open access by STARS. It has been accepted for inclusion in Electronic Theses and Dissertations, 2020- by an authorized administrator of STARS. For more information, please contact STARS@ucf.edu.

STARS Citation

Becker, Renee, "A Comprehensive Investigation of Hispanic Student Success in Gateway STEM Courses at Five State of Florida Institutions" (2020). *Electronic Theses and Dissertations, 2020-*. 17.

<https://stars.library.ucf.edu/etd2020/17>

**A COMPREHENSIVE INVESTIGATION OF HISPANIC STUDENT
SUCCESS IN GATEWAY STEM COURSES AT FIVE STATE OF
FLORIDA INSTITUTIONS**

by

RENEE Y. BECKER

B.S. State University of New York College at Brockport, 2001

M.S. State University of New York University at Albany, 2003

M.S. University of Rochester, 2008

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Education
in the College of Community Innovation and Education
at the University of Central Florida
Orlando, Florida

Spring Term
2020

Major Professor: Thomas Cox

© 2020 Renee Becker

ABSTRACT

National employment data forecasts a significant need for graduates in the STEM disciplines for middle-income American jobs. If the American labor force is to keep pace with the global economy, it is critically important that American higher education increase STEM degree production. Currently, minority populations lack access and thus opportunity for success in higher education, but, among them, Hispanic peoples account for about 59 million Americans, are the youngest demographic, and have the highest growth rate of any ethnic group. Hispanic students are inadequately represented in higher education enrollment numbers, graduation rates, graduate degree attainment, and STEM degree attainment. While only 14% of American institutions of higher education are designated as Hispanic Serving Institutions (HSIs), 64% of Hispanic American college students attend an HSI. As a result, HSIs are in a unique position to improve student success in STEM disciplines. A statistical analysis of the grades of Hispanic and White students in introductory STEM courses at three Florida HSI universities, University of Central Florida, Florida International University, and Florida Atlantic University, and two non-HSI universities, University of West Florida and Florida Gulf Coast University, revealed 1) White students significantly outperformed Hispanic students in CHM 2045 at UWF, FGCU, and UCF and 2) White students significantly outperformed Hispanic students in MAC 2311 at UWF and FGCU and 3) Hispanic students at the HSIs (FAU and FIU) earned significantly higher grades in CHM 2045 compared to the Hispanic students at non-HSIs (UWF and FGCU). All other comparisons revealed no statistically significant difference in mean course grades.

TABLE OF CONTENTS

LIST OF FIGURES	x
LIST OF TABLES	xi
LIST OF ABBREVIATIONS.....	xiii
CHAPTER ONE: INTRODUCTION.....	1
General Background	1
Statement of the Problem.....	4
Theoretical Framework.....	6
Significance of the Study	7
Purpose Statement.....	9
Research Questions	10
Null and Alternative Hypotheses	11
Definition of Terms.....	13
Emerging Hispanic Serving Institution.....	13
First Generation College Student.....	13
Hispanic Serving Institution	14
Hispanic Student	14
STEM Disciplines	14
STEM Gateway Course	14

Student Success.....	15
Summary.....	15
CHAPTER TWO: LITERATURE REVIEW	17
Introduction.....	17
Higher Education Students in the 21 st Century.....	18
Hispanic Student Success: The Research	21
Student Factors.....	21
College Preparation.....	21
Socioeconomic Status.....	23
First Generation College Student Status.....	26
Institutional Factors	28
Financial Aid.....	29
Campus Environments.....	30
Demographics of Faculty.....	31
STEM: The History and Current State.....	33
STEM: 1957 to 2013.....	34
STEM: 2014 to 2018.....	35
Gateway STEM Courses.....	37
Literature Review.....	37

Hispanic Serving Institutions	42
Florida State University System	47
History.....	47
Summary	50
Theoretical Framework.....	50
Critical Race Theory	51
Latin Critical Theory.....	52
Focus on Race and Racism.	52
Contesting Dominant Ideologies.....	53
Focus on Social Justice.	54
Recognition of Experiential Knowledge.....	55
Focus on Historical Context.....	56
Conclusion	57
CHAPTER THREE: METHOD	59
Introduction.....	59
Research Questions.....	60
Null and Alternative Hypotheses	61
Research Design.....	62
Setting.....	64

University of West Florida.....	65
Florida Gulf Coast University.....	65
University of Central Florida.....	66
Florida Atlantic University.....	67
Florida International University.....	68
Population and Participants.....	69
Sample.....	70
Sampling Techniques.....	70
Data Collection Methods.....	71
Procedure.....	71
Instrumentation.....	71
Reliability and Validity.....	72
Alignment of Research Questions to Data Collection.....	74
Analysis Methods.....	75
Limitations and Delimitations of the Study.....	77
Summary.....	79
CHAPTER FOUR: FINDINGS.....	79
Sample Description.....	79
Research Question One.....	82

University of West Florida.....	83
Florida Gulf Coast University.....	85
University of Central Florida.....	88
Florida Atlantic University.....	90
Florida International University.....	93
Research Question Two.....	95
University of West Florida.....	96
Florida Gulf Coast University.....	98
University of Central Florida.....	101
Florida Atlantic University.....	103
Florida International University.....	106
Research Question Three.....	108
Research Question Four.....	112
Summary.....	115
CHAPTER FIVE: CONCLUSION.....	117
Summary.....	117
Method Summary.....	117
Findings by Research Question.....	118
Research Question One.....	118

Research Question Two	121
Research Question Three	123
Research Question Four	124
Limitations	124
Data Related Limitations	125
Geographical-Demographical Limitations.....	126
Statistical Limitations	128
Recommendations for Practice	130
Recommendations for Future Research	133
Method Recommendations	133
Content Recommendations	134
Conclusion	135
APPENDIX A – INTRODUCTION EMAIL.....	138
APPENDIX B – THANK YOU EMAIL.....	141
APPENDIX C – REMINDER EMAIL.....	143
APPENDIX D – IRB APPROVAL	145
REFERENCES	147

LIST OF FIGURES

<i>Figure 1.</i> Percentage distribution of highest level of education attained by socio-economic status	25
<i>Figure 2.</i> Percent distribution of undergraduates' parents' highest educational attainment.....	27
<i>Figure 3.</i> Histogram of dependent variable for Research Question One, UWF.....	84
<i>Figure 4.</i> Histogram of dependent variable for Research Question One, FGCU.....	86
<i>Figure 5.</i> Histogram of dependent variable for Research Question One, UCF.....	89
<i>Figure 6.</i> Histogram of dependent variable for Research Question One, FAU.....	91
<i>Figure 7.</i> Histogram of dependent variable for Research Question One, FIU.....	94
<i>Figure 8.</i> Histogram of dependent variable for Research Question Two, UWF.....	97
<i>Figure 9.</i> Histogram of dependent variable for Research Question Two, FGCU.....	99
<i>Figure 10.</i> Histogram of dependent variable for Research Question Two, UCF.....	102
<i>Figure 11.</i> Histogram of dependent variable for Research Question Two, FAU.....	104
<i>Figure 12.</i> Histogram of dependent variable for Research Question Two, FIU.....	107
<i>Figure 13.</i> Histogram of dependent variable for Research Question Three.....	109
<i>Figure 14.</i> Histogram of dependent variable for Research Question Four.....	114

LIST OF TABLES

Table 1 STEM Graduation Rates by Race/Ethnicity & Level of Degree	9
Table 2 Percent Distribution of Degrees Attained by Race/Ethnicity	19
Table 3 Percent Distribution of STEM Degrees Attained by Race/Ethnicity	19
Table 4 Financial Aid Offered Based on Ethnicity for 2011-2012 Academic Year.....	20
Table 5 Degree Completion Rate Comparison for Low Income and First-Generation College Students.....	24
Table 6 Degree Completion Rates by Family Income as a Percent of the Federal Poverty Threshold	25
Table 7 Population Demographics for the United States of America and the State of Florida ...	48
Table 8 Fall Enrollment in Degree-granting Higher Education Institutions for the United States of America and the State of Florida by Ethnicity	48
Table 9 Six Year Graduation Rates for the United States and the State of Florida.....	49
Table 10 Percent of Full-time Faculty at State University System of Florida Universities and United States Public Universities.....	49
Table 11 Institutional Summary of Enrollment Data.....	69
Table 12 Research Questions and Source Information.....	74
Table 13 Data Analysis Distribution of Research Questions.....	76
Table 14 Assumptions for Research Questions One and Two	80
Table 15 Assumptions for Research Questions Three and Four.....	81
Table 16 Group Statistics for Research Question One, UWF	84
Table 17 Group Statistics for Research Question One, FGCU.....	87

Table 18	Group Statistics for Research Question One, UCF.....	89
Table 19	Group Statistics for Research Question One, FAU	92
Table 20	Group Statistics for Research Question One, FIU	94
Table 21	Group Statistics for Research Question Two, UWF.....	97
Table 22	Group Statistics for Research Question Two, FGCU	100
Table 23	Group Statistics for Research Question Two, UCF.....	102
Table 24	Group Statistics for Research Question Two, FAU.....	105
Table 25	Group Statistics for Research Question Two, FIU	107
Table 26	Group Statistics for Research Question Three.....	110
Table 27	Pairwise Comparison Results for Research Question Three	112
Table 28	Group Statistics for Research Question Four	115
Table 29	Summary of Mann-Whitney U Test Results for Research Question One	119
Table 30	Percent of Hispanic Student and Faculty at UWF, FGCU, UCF, FAU, and FIU	121
Table 31	Summary of Mann-Whitney U Test Results for Research Question Two	122
Table 32	State of Florida Hispanic Demographics by County	127
Table 33	State of Florida Hispanic Disaggregated Demographic by County.....	128

LIST OF ABBREVIATIONS

CRT	Critical Race Theory
FAU	Florida Atlantic University
FGCU	Florida Gulf Coast University
FIU	Florida International University
HACU	Hispanic Association of Colleges and Universities
HBCU	Historically Black Colleges and Universities
HEA	Higher Education Act
HHEC	Hispanic Higher Education Coalition
HSI	Hispanic Serving Institution
INA	Immigration and Nationality Act
LatCrit	Latin Critical Theory
PWI	Primarily White Institutions
SES	Socioeconomic Status
STEM	Science, Technology, Engineering, and Mathematics
SUSF	State University System of Florida
UCF	University of Central Florida
UWF	University of West Florida

CHAPTER ONE: INTRODUCTION

General Background

The recession that began in December of 2007 quickened the shift to American jobs requiring a postsecondary education, especially in the STEM fields of science, technology, engineering, and mathematics (Carnevale, Smith, & Strohl, 2010). The impact of this recession has been felt by all American citizens, but specifically by minority groups for which unemployment rates have been slow to rebound. In 2010, the unemployment rate for White and Hispanic Americans was 8.7% and 12.6%, respectively (Carnevale, Smith, & Strohl, 2010). The economic recovery of the past several years has been accompanied by falling unemployment rates, but the Hispanic American unemployment rate still trails the White unemployment rate by 26% (BLS, 2017). The 2016 labor force statistics indicated that, while 90% of employed White and Black Americans have at least a high school diploma, only 74% of Hispanics have a high school diploma (BLS, 2017).

A concurrent challenge for America is access to higher education for minority populations. Hispanics account for about 59 million or 18.1% of the American population and have the highest growth rate of any ethnic group (Massey, Durand, & Malone, 2003; USCB, 2018a). However, only 3.2 million or 16.5% of American college students identify as Hispanic (NCES, 2016). Only 8.3% of post-baccalaureate students identify as Hispanic, demonstrating an even wider education gap than in undergraduate enrollment (NCES, 2016c).

Hispanic Serving Institution (HSI) was made a federal designation in the 1990s and federal funding was attached to the designation. To be a federally designated HSI, an institution has to confirm that the Hispanic student enrollment is at least 25% of the overall student

enrollment and that 50% of the Hispanic students are either low income and/or first-generation college students (Gasman, Nguyen, & Conrad, 2015). In the past decade, there has been a 78% increase in the number of institutions classified as HSIs (Ayala, 2017). In 2017, HSIs accounted for approximately 14% of all public and private institutions of higher education and served 64% of all Hispanic American students (Ayala, 2017).

Hispanic student enrollment increased 65% between the years of 2000 and 2015 (NCES, 2016c). Access to higher education has increased dramatically but Hispanic student success has not (NCES, 2016a). The Hispanic demographic is not well represented in overall graduation rates, graduate degree attainment, and STEM degree attainment (NCES, 2016a; 2016h).

In response, educators, student service professionals, and administrators have devoted considerable time and effort to study factors that affect Hispanic student success, generally either secondary or post-secondary school factors. Although there may be far more research on post-secondary school factors, in fact, manipulation of secondary school factors may yield a greater impact.

Research into secondary school factors that affect Hispanic student declaration of a STEM major has shown that high-school teachers can have both an enormously positive and a negative effect on declaration of majors and Hispanic student success in the STEM circuit (Moller, Banerjee, Bottia, Stearns, Mickelson, Dancy, Wright, & Valentino, 2015). There is a statistically significant positive effect on student declaration of STEM majors when students experienced secondary school faculty who are satisfied with their careers and used student-centered teaching practices, and when the school administration promoted a collaborative professional community (Moller et al., 2015). In addition, a secondary school teacher passionate

about his or her field of expertise positively affects Hispanic students' interest in declaring a STEM major. Conversely, indifferent teachers negatively affect Hispanic students' interest in declaring a STEM major (Moller et al., 2015).

The factors that contribute to or hinder Hispanic student post-secondary school success have been studied at length. The three most indicative obstacles are poor college preparation (Swail, Cabrera, Lee, & Williams, 2005), low socioeconomic status (Pell, 2011) and first-generation student status (Ishitani, 2003). The top four contributing factors for Hispanic student success in STEM disciplines are financial resources, institutional category, college and departmental climate, and institutional agents (ASHE, 2011).

Deficiencies in the literature include the lack of quantitative studies on Hispanic student success in STEM gateway courses—an entry level course that is a pre-requisite to higher level STEM courses that eventually lead to a STEM degree (UNM, 2012). These STEM gateway courses are considered “weed-out” courses, which a high percent of students fail and, therefore, do not graduate with a STEM degree (Mervis, 2011). Unfortunately, the time-honored practice of using “weed-out” STEM courses has been shown to hamper diversity in STEM degree attainment (Mervis, 2011; BAYER, 2012).

Bayer's 15th Annual Science Education Survey revealed that 84% of higher education STEM administrators felt that increasing the diversity in STEM degree completion was important, 46% felt that “weed-out” STEM courses are disparately detrimental to minority student success, and 57% stated that there was no need to change their “weed-out” STEM courses (BAYER, 2012). It is important to point out that, while approximately half of STEM administrators agree that “weed out” courses disproportionately affect minority students, the

majority of the administrators have no plans to further evaluate or modify these practices (BAYER, 2012).

STEM gateway courses have high rates of failure and are significant predictors of STEM degree attainment (BAYER, 2012). Providing information to STEM faculty members and other higher education professionals regarding specific STEM gateway course student success could be a catalyst for further research and subsequent targeted interventions that could increase Hispanic student STEM degree attainment (UNM, 2012; 2013).

Statement of the Problem

While STEM graduation rates for Hispanic students have been increasing throughout the last several decades, Hispanic students continue to be drastically underrepresented in STEM degree attainment (Massey, Durand, & Malone, 2003; NCES, 2016h). Current national employment statistics and projections demonstrate a notable shift, from high-school diploma to undergraduate degree to master's and doctoral degrees in required education for most middle-income American jobs (Carnevale, Smith, & Stohl, 2010). In the past decade there has been a significant increase in STEM employment positions available and this shift towards an information-based economy is projected to continue (Carnevale, Smith, & Stohl, 2010). There will be 55 million job openings through the next several years (Carnevale, Smith, & Stohl, 2013). Of these job openings, 24 million will be new positions and 31 million will be due to baby boomer retirements (Carnevale, Smith, & Stohl, 2013). STEM occupations will be one of the fastest growing markets, but STEM occupations will also require high levels of post-secondary education (Carnevale, Smith, & Stohl, 2013).

Overall, the nation will need more STEM graduates to keep pace with the global economy, yet there is projected to be a shortage of five million STEM employees by 2020 (Carnevale, Smith, & Stohl, 2013). It is imperative that STEM degree conferrals increase to satisfy the national employment needs. To increase the number of STEM graduates Hispanic student success in STEM must be addressed. The Hispanic population is the youngest and fastest growing group, yet there is a significant disparity regarding STEM degree attainment when compared to their White peers. Educational research is not addressing the issue and seeking targeted interventions to increase Hispanic STEM degree attainment. If STEM degree completion does not increase, the deficits in educated workers will negatively affect the nation's economy, technological advances, and global dominance.

HSIs, however, serve a vital role in contributing to Hispanic student STEM degree attainment. The state of Florida has the third highest HSI student enrollment in the nation and is the home to a significant number of HSIs; therefore, the need for the success of Hispanic STEM students in Florida HSIs cannot be overstated (Santiago, Calderon, & Taylor, 2015).

While extensive research has been conducted on the efficacy of Texas and California HSIs, there is limited research regarding Florida HSIs. Given equity issues and U.S. economic and labor needs, more research is needed, specifically into student STEM degree attainment in Florida HSIs.

This study will address the problem of the academic success of Hispanic students at three Florida State public HSIs (University of Central Florida, Florida Atlantic University and Florida International University) and two non-HSIs (University of West Florida and the Florida Gulf Coast University), and in two gateway STEM courses: General Chemistry I & Calculus I. There

will be three main components in this study. The first component will include a statistical analysis of whether there is a difference in student success in STEM gateway courses, Chemistry I and Calculus I, based on race at all five institutions. The second component will compare Hispanic student success in STEM gateway courses, General Chemistry I and Calculus I, at Florida State HSIs and non-HSIs. The third component will apply the theoretical framework of Latin Critical Theory (LatCrit) to the interpretation of the statistical results.

Theoretical Framework

The guiding theoretical framework for this study is Latin Critical Theory (LatCrit), which is rooted in Critical Race Theory (CRT). While a deeper investigation of LatCrit will be provided in Chapter Two of this study, principally LatCrit builds upon the CRT to allow the distinct voices and interests of the Hispanic population to be heard (Delgado & Stefancic, 2012). The Hispanic voice is multilayered and contains numerous identities within the group. This multiple identity is based on their life experiences as Americans, multilingual speakers, immigrants, males, females, etc. (Nunez, 2014; Trucios-Hayes, 2000). One of the pioneers of LatCrit, Francisco Valdes, asserted that there are four essential functions of LatCrit including:

1. The construction of information to create understanding of Hispanic culture
2. The progression of change in the form of social change
3. The expansion and connection of the struggles of all subordinated groups
4. The cultivation of community and coalition of scholars and activists (Valdes, 1996; 2002)

LatCrit will be the lens that is employed when discussing the general background, the literature review, statistical results and corresponding findings, limitations of the study, theoretical explanations, and recommendations for future study.

Significance of the Study

One of the most critical issues in America is the underemployment of minority populations (Young & Mattingly, 2016), due in part to the lack of access to higher education (Young & Mattingly, 2016). To attain gainful employment in today's middle-income career fields, a bachelor's degree or higher is required. The underemployment of minority people, especially in the burgeoning STEM fields, reveals the disparity between the successful education of Hispanic students and national occupation needs (Carnevale, Smith, & Stohl, 2010; 2013).

Underemployment has serious consequences for Hispanics and the American economy. While underemployed individuals accrue less human and economic capital, under-utilization of labor increases strain on the American economy. Underemployed individuals earn less, which in turn, decreases consumer demand and lowers economic output (Young & Mattingly, 2016). For example, it is estimated that more than \$68 billion was lost in earnings in the 2008 Great Recession due to underemployment (Sum & Khatiwada, 2010).

Hispanic people account for about 58 million, or 18%, of the American population and have the highest growth rate of any ethnic group (Massey, Durand, & Malone, 2003; Pew, 2017). The growth in the Hispanic American population is responsible for approximately half of the nation's overall population growth since 2000 (Pew, 2017). While this demographic's growth has slowed in recent years, Hispanics are the second largest ethnic or racial group behind Whites (Pew, 2017). The rate of growth has shifted from immigrants to natural born citizens, with 65.6% being natural born and 34.4% being immigrants (Pew, 2017). Another major difference in the Hispanic-American population is its low median age, compared to that of other racial and ethnic groups. They are the youngest population, with an overall average age of 28 whereas the

average age of the White population is 43 (Pew, 2017). The immigration and resulting proliferation of the Hispanic community in America has permanently changed national demographics. A census study performed by William H. Frey in 2018 predicts that the United States of America will become a *minority White* country by the year 2045 (Frey, 2018).

While Hispanic-Americans have the fastest growth rate of any ethnic group, higher education graduation rates, and specifically STEM graduation rates of Hispanic Americans, are unfavorably represented (Massey, Durand, & Malone, 2003; NCES, 2016h). See Table 1 (page 9). Comparing the overall American population data to degree attainment can be misleading and not representative of minority access to higher education. While 18% of Americans identify as Hispanic, 12% of this demographic is college-aged (18-24 years old). In comparison, 61% of the American population is White, but only 8% of that demographic is college-aged (NCES, 2016b; USCB, 2018a). A larger proportion of the Hispanic population is college-aged compared to the White demographic. Due to the inequity in the demographics of college-aged Americans, a direct comparison of the demographics of the American population to the demographics of college students is not representative of adequate access to higher education.

A review of the latest data from the National Center for Education Statistics (2016h) demonstrates a serious deficit in Hispanic student STEM graduation rates. As illustrated in Table 1 (page 9), this disproportionality can be seen most dramatically with bachelor's, master's, and doctoral degree attainment (NCES, 2016h).

Table 1

STEM Graduation Rates by Race/Ethnicity & Level of Degree

Ethnicity	Enrollment	Overall	Associate's	Bachelor's	Master's	Doctoral
White	354,000	65.5%	62.9%	67%	66.6%	75.4%
Hispanic	63,562	10.9%	14.4%	9.5%	7.6%	5.7%
Black	50,741	9.3%	13.4%	7.2%	8.1%	4.6%

Note. Data collected from NCES, 2016h

James Brown, the executive director of the STEM Education Coalition in Washington, D.C., has stated that “the future of the economy is in STEM, and that’s where the jobs of tomorrow will be” (Vilorio, 2014). In addition, the Bureau of Labor Statistics has stated that STEM careers will grow at an accelerated rate, to more than nine million, between 2012 and 2022 (Vilorio, 2014). Moreover, degree requirements for STEM careers will be shifting from associate’s and bachelor’s towards graduate degrees, as more occupations will require graduate degrees (Vilorio, 2014). These points are of critical importance, considering the fastest growing ethnic group in America has extremely low graduate STEM degree attainment.

Although the Hispanic population is the fastest growing ethnic group in America, it is underrepresented in STEM degree attainment. This lack of preparation in STEM careers is a predicament for the Hispanic outlook in future employment and U.S. national economic productivity, especially since a continuing shift towards STEM careers is predicted.

Purpose Statement

The purpose of this study is to investigate Hispanic student success at Florida state institutions in gateway STEM courses compared to their White peers. Florida is home to

approximately 10% of the Hispanic higher education students who attend an HSI, approximately six percent of all HSIs, and is the number one producer of Hispanic STEM degrees (Excelencia, 2018; Santiago, Calderon, & Taylor, 2015; Heithaus, 2015). Given that the State University System of Florida educates a significant percent of Hispanic students and that national data indicates that Hispanic students trail behind their White peers in STEM degree attainment, it is of great interest to study Hispanic student success in Florida (NCES, 2016h).

General Chemistry I and Calculus I have been chosen as the STEM gateway courses to be studied because together they cover all STEM majors. Success in STEM gateway courses is a predictor of STEM degree attainment (UNM, 2012; 2013). As a result, the universities to be studied will consist of three HSIs (University of Central Florida, Florida Atlantic University, and Florida International University) and two non-HSIs (University of West Florida and Florida Gulf Coast University). These universities have been selected based on similar freshman admittance numbers, freshman SAT & ACT scores, and student enrollment.

The second goal of this study will be to explore Hispanic student success in gateway STEM courses at Florida state HSIs (University of Central Florida, Florida International University, and Florida Atlantic University) versus non-HSIs (University of West Florida and Florida Gulf Coast University) to see if there is a relationship between Hispanic student success in gateway STEM courses and the type of Florida state institution attended. The findings of this investigation will be analyzed through the lens of the Latin Critical Theory.

Research Questions

The impetus for this exploration is the hypothesis that attending an HSI has a positive effect on Hispanic student success in STEM gateway courses. By using statistical analysis of

raw data from University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University, this study will answer the following questions:

1. Is there a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
2. Is there a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
3. Is there a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
4. Is there a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?

Null and Alternative Hypotheses

For Research Question One, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of

West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International.

H_a – There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

For Research Question Two, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

For Research Question Three, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean General Chemistry I grades for Hispanic students at each of the following universities: University of West Florida,

Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

For Research Question Four, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean Calculus I grades for Hispanic students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

Definition of Terms

The following terms are used throughout this study:

Emerging Hispanic Serving Institution

Emerging Hispanic Serving Institutions are defined as accredited degree-granting public non-profit institutions of higher education with 15 to 24% total undergraduate Hispanic full-time equivalent student enrollment (Excelencia, 2018).

First Generation College Student

For this study, first generation college student will be defined as a student in which neither parent earned a bachelor's, master's, or doctoral degree (Warburton, Bugarin, & Nunez, 2001; Ting, 1998).

Hispanic Serving Institution

Hispanic Serving Institution (HSI) is an accredited degree-granting college or university in which Hispanic students account for 25% or more of the full-time undergraduate enrollment and at least 50% of the Hispanic students belong to the low-income demographic (Laden, 2001; 2004).

Hispanic Student

For the 2010 United States Census, the term *Hispanic* was defined as a person of descent from one of the following: Cuba, Mexico, Puerto Rico, South or Central America, or other Spanish culture (USCB, 2010). The *Hispanic* designation is a self-identified characteristic which can encompass any person who identifies as *Hispanic*.

STEM Disciplines

This investigation will utilize STEM definitions set by the University of New Mexico (UNM). According to the UNM, STEM disciplines include biology, astrophysics, biochemistry, chemistry, earth and planetary sciences, environmental sciences, mathematics, physics, statistics, and any engineering discipline (UNM, 2012).

STEM Gateway Course

According to the STEM Gateway Title V program conducted by the University of New Mexico, a STEM Gateway course must satisfy one of the following:

1. An entry level (100 and 200 level) program required course that leads to a degree in an approved STEM discipline.

2. A companion course (labs, problem solving courses, etc.) that is connected to the corresponding entry level program required course.
3. A pre-requisite course that is required for the student to gain enrollment into a program required course.
4. A large-enrollment (>500 students/year) course that is required for degrees in the approved STEM disciplines and typically taken within the first two years in the field (UNM, 2012, p. 1).

Student Success

There has been extensive research into student success in the past several decades. A very broad definition of student success is *a favorable student outcome*. But, what is a favorable outcome? Tinto was a pioneer in the study of student success and has a large body of work addressing a variety of aspects of the definition (Tinto, 1975; 1987). Student success research has been based on student retention, educational attainment, academic achievement, student advancement, and holistic development (Tinto, 1975; 1987).

While student success has several definitions, for this study, it is the successful completion of a STEM gateway course with a grade of C or better.

Summary

While Hispanic Americans are the fastest growing and youngest population in America, they are significantly underrepresented in higher education access, degree attainment, and, specifically, STEM degree attainment (NCES, 2016; 2016a; 2016h). In addition, the American economy has been—and will continue to be—greatly focused on STEM field advancements. The

future of America depends heavily on the education of STEM personnel to fulfill current and future professions (Carnevale, Smith, & Stohl, 2010).

While advancements in Hispanic student access to higher education has made significant growth in the past several decades, due partly to HSIs, this community is still inversely represented in STEM degree attainment (NCES, 2016h). HSIs, which account for 15% of all higher education institutions, serve over 65% of all Hispanic students and account for the majority of STEM degrees conferred (Excelencia, 2018). The main issue in this phenomenon is the underrepresentation of the fastest growing and youngest population, Hispanic Americans, in STEM degree attainment, while there is a concurrent shift to STEM fields in American employment.

The State of Florida serves a significant percent of Hispanic students, and it is home to the third highest percent of HSIs and emerging HSIs in the U.S. (Excelencia, 2018). Considering the high percentage of STEM degrees awarded at HSIs and that these institutions are receiving federal funding to promote Hispanic student success, it is of great interest to examine the relationship between Hispanic student success at Florida State HSIs and non-HSIs. Building upon the initial statistical analysis, this data will be interpreted through the Latin Critical Theory. The goal of this research is to anticipate recommendations that could provide a basis for targeted interventions to improve Hispanic student success in STEM disciplines at American undergraduate higher education institutions.

CHAPTER TWO: LITERATURE REVIEW

Introduction

The following literature review includes subjects that are vital to research on Hispanic student success in STEM courses at Florida state Hispanic Serving Institutions and non-Hispanic Serving Institutions. The first topic to be explored is the demographics of 21st Century higher education students, including enrollment, degree completion, STEM degree completion, and financial aid based on race/ethnicity. Student and institutional factors that affect Hispanic student success, such as college preparation and college climate, will be discussed in the Hispanic student success section of the literature review. The third area to be explored, Science Technology, Engineering and Mathematics (STEM), will contain the history of STEM research and education in the United States and a brief review of Gateway STEM courses. The next topic to be explored, Hispanic Serving Institutions, will explore the social and legislative impetuses of the HSI designation. The fifth section of the literature review is a brief history of the Florida State university system, including comparative statistics on student enrollment demographics and graduation rates based on ethnicity. The Latin Critical Theory (LatCrit), which will be used as the theoretical framework for this investigation, will be discussed in the last section of the literature review. This section will include a brief overview of the critical race theory and a review of the five defining elements of LatCrit. The topics covered in the literature review are selected to provide a foundation for the investigation of Hispanic student success in STEM disciplines at Florida state HSIs and non-HSIs.

Higher Education Students in the 21st Century

The following section provides the demographics of 21st Century higher education students with regard to enrollment trends, degree completion, STEM degree completion, and financial aid awards as a basis for analysis that will be presented in Chapter 5.

In 2016, American higher education had a diverse student population that was 54.7 % White, 16.5% Hispanic, 13.4% Black, 6.4% Asian/Pacific Islander, and 0.73% American Indian/Alaska Native (NCES, 2016c). Undergraduate student enrollment consisted of 54.6 % White, 17.9% Hispanic, 13.6% Black, 6.4% Asian/Pacific Islander, and 0.78% American Indian/Alaska Native (NCES, 2016c). Undergraduate Hispanic student enrollment has increased significantly in the past several decades, with a 65% increase between 2000 and 2015 (NCES, 2016c).

While access to higher education for Hispanic students has improved significantly, the same cannot be said of degree attainment for Hispanic students. As seen in Table 2 (page 19), Hispanic students are significantly underrepresented in bachelor's, master's, and doctoral degree attainment (NCES, 2016d; 2016e; 2016f; 2016g).

Table 2

Percent Distribution of Degrees Attained by Race/Ethnicity

Race/Ethnicity	Percent Distribution			
	Associate's	Bachelor's	Master's	Doctoral
White	59.3%	66.5%	67.5%	69.3%
Hispanic	18.1%	12%	9.1%	7.2%
Black	13.8%	10.6%	13.6%	8.4%

Note. Data collected from NCES, 2016d; 2016e; 2016f; 2016g

Furthermore, the education gap between White and Hispanic students increases even more when the focus is on STEM degree attainment. As seen in Table 3, Hispanic students lag considerably behind White students for bachelor's, master's, and doctoral degree completion (NCES, 2016h). Although Hispanic student enrollment in STEM disciplines has increased in the past several decades, this increase is mostly at the associate's degree level (NCES, 2016d; 2016e; 2016f; 2016g).

Table 3

Percent Distribution of STEM Degrees Attained by Race/Ethnicity

Race/Ethnicity	Percent Distribution			
	Associate's	Bachelor's	Master's	Doctoral
White	61.1%	68.2%	65.4%	74.5%
Hispanic	15.3%	9.9%	8.1%	6.5%
Black	13.6%	6.2%	8.4%	4.2%

Note. Data collected from NCES, 2016h

The increase in access for minority students is due in part to the passage of the 1965 Higher Education Act (Scott-Clayton, 2015), but family income is responsible for a considerable gap in enrollment and completion (Scott-Clayton, 2015). The disparities in enrollment between high-income and low-income families were greater in 2011 than in the 1960s (Bailey & Dynarski, 2011). Although the relationship between financial aid and degree completion is complicated, further investigation may lead to a promising intervention that could positively affect Hispanic student degree completion rates.

In the 2011 academic year, 56% of all undergraduate students received financial aid of some type (NCES, 2013). Table 4 identifies the percent of White and Hispanic students that were awarded financial assistance, along with the percentage of the specific type of financial aid. In that year, 85% of Hispanic students were awarded some type of financial aid, compared to 59% of White students, and Hispanic students were offered grants, loans, and work study at a greater rate than White students, +34%, +49%, and +13% respectively (NCES, 2013). Since 24% of the Hispanic population is considered impoverished, and only 10% of Whites share this status, the 26% increase in overall financial aid offered to Hispanic students is reasonable (USCB, 2014).

Table 4

Financial Aid Offered Based on Ethnicity for 2011-2012 Academic Year

Ethnicity	Any Aid	Grants	Loans	Work Study
White Students	59%	47%	34%	17%
Hispanic Students	85%	81%	83%	30%

Note. Data collected from NCES, 2013

The 34% increase in grants offered to Hispanic students is of more importance than the increase in loans and work study, because it has been shown that Hispanic students are generally opposed to borrowing money for higher education (Ehrenberg, 1991).

Hispanic Student Success: The Research

Because of the growing body of work on Hispanic student success, for the purpose of this study, we will group specifically chosen characteristics into two categories: student factors and institutional factors. These factors are chosen based on the relevance to this study and the breadth of research on the topics.

For higher education institutions, the term “Hispanic” is a self-designated term that each student may choose upon applying for admittance. It is important to note that any race/ethnicity question asked on an application questionnaire is not mandatory for consideration of acceptance.

Student Factors

Student factors that can affect Hispanic student success have been studied at some length. The four factors that have been chosen to be discussed in this study are college preparation, socio-economic status, first-generation college status, and parental education attainment.

College Preparation. The leading factor that affects Hispanic student success in higher education is poor college preparation (Swail, Cabrera, Lee, & Williams, 2005). Hispanic student college preparation has been studied at length, and it has been shown that poor preparation greatly affects gaining admittance, enrolling, and succeeding in college (Swail, Cabrera, Lee, & Williams, 2005). Based on the research established in 2005, when compared to their White

peers, Hispanic students are more at risk of being underprepared for college (Swail, Cabrera, Lee, & Williams, 2005).

Standardized exams such as the American College Testing (ACT) and Scholastic Aptitude Test (SAT) use methods similar to the institutions to measure college preparedness and predict success. Review of ACT and SAT data reveals that the Hispanic student population consistently trails their White peers in college preparedness.

The ACT uses scores to set college preparation benchmarks, which if attained, signify college readiness (ACT, 2015). Despite there being a modest two percent increase in Hispanic students' ACT benchmark scores between 2011 and 2015, White students continued to meet the same benchmarks at twice the percent of their Hispanic peers (ACT, 2015). The SAT uses a college readiness benchmark score of 1550, which also signifies college readiness (SAT, 2013). Like the ACT, there is a huge discrepancy when comparing the percent of Hispanic students to White students who met the college readiness benchmark for the SAT (SAT, 2013). From the years of 2012 to 2015, 23.1% and 52.5% of Hispanic and White students attained SAT scores commensurate with college readiness (SAT, 2013). In 2015, the average SAT scores revealed that Hispanic students trailed White students in reading, math, and writing (SAT, 2015). As of 2015, Hispanic students lagged behind their White peers in every field by approximately 15% (SAT, 2015).

In response to inadequate Hispanic student college preparation, some states have implemented programs that aim to link K-12 and post-secondary schools. The main goal of these programs is to bridge the gap between K-12 and higher education in efforts to increase Hispanic student success (Yamamura, Martinez, & Saenz, 2010). In Texas, link programs have

developed and implemented College Readiness standards, which include providing a “college-going culture” in K-12 (Yamamura, Martinez, & Saenz, 2010). Yamamura, Martinez, & Saenz (2010) have stated that a crucial aspect of college preparation is producing a “college-going culture” early in the education process. This culture may include rigorous academic programs, early and frequent access to relevant college information, and adequate support structures (Jarsky, McDonough & Nunez, 2009).

Thus, poor college preparation is one of the main factors affecting Hispanic students’ ability to gain acceptance to, and graduate from, institutions of higher education (Swail, Cabrera, Lee, & Williams, 2005). Standardized national exams such as the ACT and SAT have revealed that there is an increase in the number of Hispanic students attempting the exams; however, Hispanic student college readiness is still approximately 50% less than that of White students (ACT, 2015; SAT, 2015).

Socioeconomic Status. Statistics released by the Pell Institute (2011) illustrates that students who originate from a low-income household have a significantly higher incidence of dropping out of college. As seen in Table 5 (page 24), the percent of low-income students who drop out is 75% higher than students who are not from low-income households (Pell, 2011). In a comparison of bachelor’s degrees attained, low-income students trail behind their peers significantly. Conversely, the percent of low-income students who attain an associate’s degree is about double that of their peers (Pell, 2011).

Table 5

Degree Completion Rate Comparison for Low Income and First-Generation College Students

	Bachelor's Degree	Associate's Degree	Still Enrolled	Dropped Out
Low Income	24.1%	18.8%	16.5%	40.6%
Mid and High Income	54%	9.3%	13.4%	23.3%

Note. Data collected from Pell, 2011

The previous trend of socio-economic status and education attainment is evident if we compare household status based on the percent of the federal poverty threshold to the percent of bachelor's degrees earned, associate degrees earned, and percent of students who dropped out (Table 6, page 25). Table 6 displays that as household income as a percent of the federal poverty threshold increases, the bachelor's degree attainment increases, the associate degree attainment decreases, and the percent of students who dropped out decreases (Pell, 2011). The data suggest that the more money a household earns, the higher the rate of educational attainment. Conversely, the less money the household earns, the higher the rate of drop-out (Pell, 2011). This trend is also apparent in Figure 1 (page 25): the higher the socio-economic status the higher the educational attainment (NCES, 2014).

Table 6

Degree Completion Rates by Family Income as a Percent of the Federal Poverty Threshold

% of Poverty Threshold	Bachelor’s Degree	Associate’s Degree	Dropped Out
Less than 150%	14.5%	24.4%	44.9%
151 to 200%	23.3%	22.4%	38.6%
201 to 300%	29.4%	19.7%	35.8%
301% and Above	44.6%	13.3%	28.1%

Note. Data collected from Pell, 2011

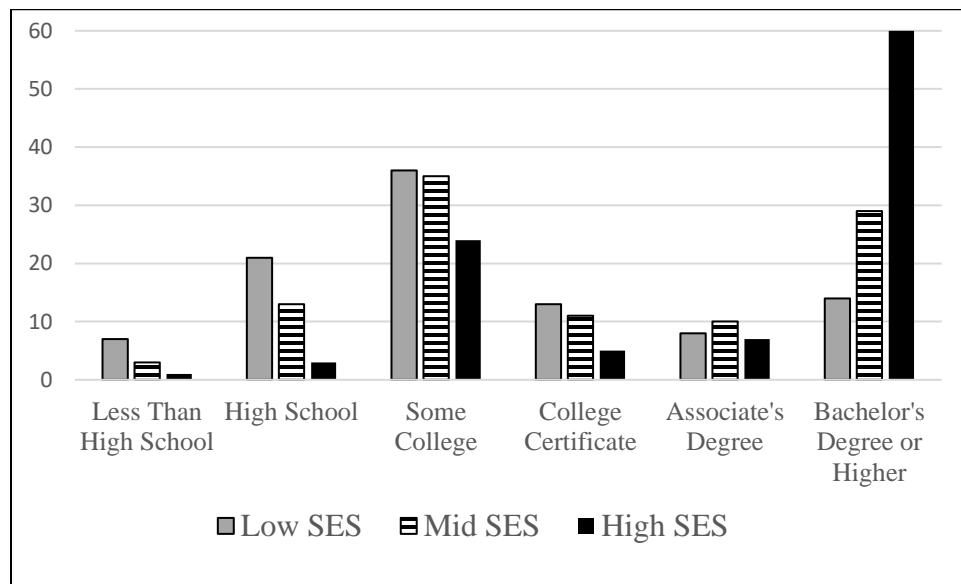


Figure 1. Percentage distribution of highest level of education attained by socio-economic status (NCES, 2014)

The relationship between socio-economic status (SES) and educational attainment can be further illustrated by the percentage of high school graduates enrolled in college based on socio-economic status: low (51%), mid (65%), and high (81%) (NCES, 2014). The relationship between socio-economic status and educational attainment is a major barrier, which negatively

affects Hispanic students since they are more likely to come from a low socio-economic household. In 2013, 23% of the American Hispanic population lived below the poverty level. In comparison, only 11.6% of White Americans shared this same experience (USCB, 2013).

First Generation College Student Status. About 32% of undergraduate college students are considered first-generation (NCES, 2012). Data released from the Department of Education reports that 25% of White and Asian students are first-generation students (NCES, 2012). By contrast, 61% of Hispanic students and 41% of Black students belong to this demographic (NCES, 2012). Approximately 60% of first generation college students do not complete a degree within six years of enrollment (NCES, 2012).

In the past twenty years, numerous investigations focusing on first generation college student characteristics have been published. The research demonstrates that first generation college students tend to be from low income households (Warburton, Bugarin, & Nunez, 2001; Ting, 1998), are members of minority groups (Ishitani, 2003), are more likely to be female (Ishitani, 2003; Lohfink & Paulsen, 2005), earn lower ACT and SAT scores (Warburton, Bugarin, & Nunez, 2001), attend community colleges at a greater rate than their White peers (NCES, 2012), are academically underprepared (Warburton, Bugarin, & Nunez, 2001), and feel as though they lack support from families and friends (Ishitani, 2003; Ting, 1998).

First generation college students may exhibit some of these characteristics, which can disadvantage them when they enroll in college (Darling & Smith, 2007). They are more likely to attend a community college (Pascarella, Pierson, & Wolniak, 2004), have acculturation stress (London, 1992), have lower self-esteem (London, 1992), tend to have lower first semester and freshman year grades (Chen & Carrol, 2005), generally attend part-time and work full-time

(Richardson & Skinner, 1992), and are more likely to drop out in the first year (Chen & Carrol, 2005).

A study completed by Chen and Carrol (2005) found that the similar characteristics that first generation college students share can contribute to an increase in withdrawal and failure rate. In addition, Garcia (2008) also found that first generation college students have a higher probability of being academically underprepared and have higher drop-out rates.

When reviewing the data in Figure 2, it is clear that the educational attainment of the parents of White students surpasses the education of Hispanic students' parents' (NCES, 2013). Comparatively, 28% of the White parents have a high school diploma or less, while 48% of the Hispanic parents have a high school diploma or less (NCES, 2013a). Figure 2 illustrates the disparity more clearly, showing that 45% of White undergraduates' parents hold a bachelor's degree or higher, while only 25% of Hispanic undergraduates' parents have a bachelor's degree or higher (NCES, 2013a).

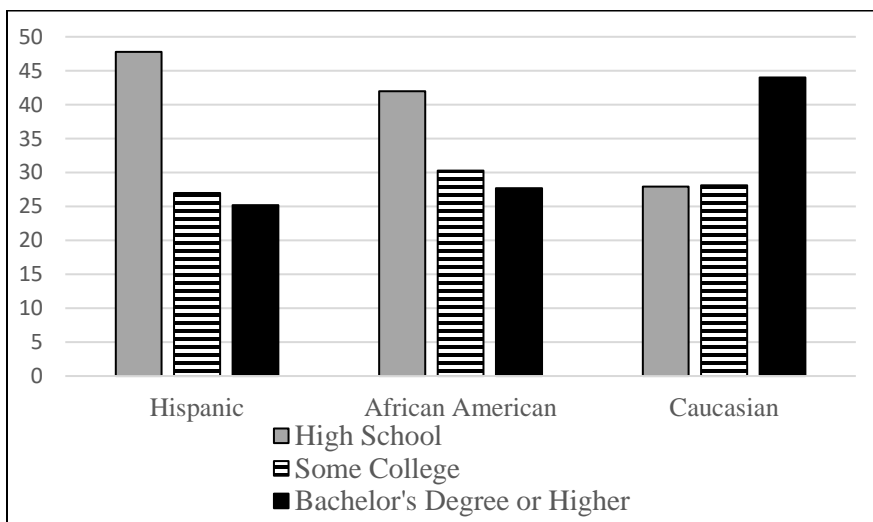


Figure 2. Percent distribution of undergraduates' parents' highest educational attainment (NCES, 2013)

Comparatively 48% of first-generation college students are Hispanic, while only 25.2% are White (NCES, 2013a). Therefore, on a percentage basis, there are almost twice as many Hispanic first-generation college students as there are White first-generation college students.

Institutional Factors

In the past, the focus of research on Hispanic student persistence has been mainly based on cognitive factors such as academic preparation and achievement (Castillo, Conoley, & Choi-Pearson, 2006). However, research in the last several decades has revealed that cognitive factors fail to properly predict Hispanic student persistence (Fry, 2004; Fuertes & Sedlacek, 1994). This failure has led to extensive investigation of environmental, interpersonal, and social noncognitive factors that can better explain Hispanic student persistence (Gloria, Castellanos, Lopez, & Rosales, 2005).

Current research on predictors of Hispanic student success have shifted models from Tinto's interactionalist theory, which is based on the premise that integration into the college social and academic communities increases persistence, to more holistic models (Castillo, Conoley, & Choi-Pearson, 2006). A combination of person-centered and situation-centered approaches creates a holistic model in which the unique Hispanic perspective can be studied (Castillo, Conoley, & Choi-Pearson, 2006). It is no longer feasible, nor acceptable, to expect minority students to assimilate to the predominantly white higher education institution environments. If the goal is to increase Hispanic persistence and success, a holistic model must be used to study what factors institutions can leverage to accomplish this goal (Castillo, Conoley, & Choi-Pearson, 2006).

The following section is a summary of the literature on how financial aid, college climate and culture, and the demographics of faculty and administrators can affect Hispanic student persistence and success.

Financial Aid. Financial aid plays an important role in Hispanic student access and persistence in higher education (Carter, 2006). Several studies have revealed that there is a relationship between college choice, persistence, student financial background, and need (Paulsen & St. John, 2002; St. John, Paulsen, & Carter, 2005; St. John, Paulsen, & Starkey, 1996).

The research reveals that college choice is based primarily on financial reasons. College prices and available financial aid are related to the overall college experience, which directly affects persistence (St. John, Paulsen, & Carter, 2005). Lower socio-economic status students who are constrained by available financial resources tend to commute to less expensive institutions located closer to their family household (Carter, 1999). Hispanic students attend community colleges closer to their family household at a much higher rate than students of other races and ethnicities (Carter, 1999).

Paulsen and St. John (2002) have studied how the type of financial aid offered affects student persistence based on student socio-economic status. While working class students are more likely to drop-out if their work-study and loans are inadequate, low income students are more likely to drop-out if their non-debt incurring financial aid is not adequate (Paulsen & St. John, 2002). A higher percentage of Hispanic students are from the low socio-economic status demographic, are averse to debt-incurring financial aid, and are more likely to drop-out if they do not receive adequate grant aid (Paulsen & St. John, 2002).

The knowledge that Hispanic students have an increased incidence of withdrawal when they are not offered adequate non-debt incurring financial assistance can be leveraged by institutions trying to improve Hispanic persistence and graduation rates (Carter, 2006). Considering that state and federal financial aid has been stagnant in the past decade, most institutions have raised tuition to compensate for state and federal deficiencies (Carter, 2006). Institutions that want to promote minority access and success can strive to make tuition as affordable as possible by not appreciably increasing tuition rates and offering more non-debt incurring financial aid.

Campus Environments. Research in the past decade has revealed that campus racial climates and cultures greatly affect the experiences of Hispanic students; therefore, directly affecting student persistence and success (Kiyama, Museus, & Vega, 2015). Campus racial climate is defined as “the overall racial environment” of higher education institutions (Solorzano, Ceja, & Yosso, 2000), while the campus racial culture is defined as “the collective patterns of tacit values, beliefs, assumptions, and norms that evolve from an institution’s history and are manifest in its mission, traditions, language, interactions, artifacts, physical structures, and other symbols, which differentially shape the experiences of various racial and ethnic groups and can function to oppress racial minority populations within a particular institution” (Museus, Ravello, & Vega, 2012).

To devise a holistic understanding of how the campus environment affects Hispanic student success, a study of both the campus racial climate and culture is required. Lowe, Byron, Ferry, & Garcia (2013) reported in a recent study that Hispanic students feel that campus climates are less welcoming, or hostile, compared to their White peers. The perceived hostility is

grounded on the institutions' cultivation and perpetuation of racial climates permeated with prejudice and discrimination, including racial stereotypes, low expectations from faculty and peers, exclusion from the curriculum, and instruction that marginalizes the voices of Hispanic college students (Castellanos & Gloria, 2007). The perceived hostility can result in increased feelings of marginalization and segregation, decreased sense of belonging, higher levels of stress, and decreased classroom participation, persistence, and degree completion (Castellanos & Gloria, 2007).

Gonzalez (2003) has established that most campus racial cultures in American higher education institutions are based on Eurocentric cultural values, perspectives, assumptions, norms, and symbols. This Eurocentric institutional model may exclude and marginalize the cultural backgrounds and identities of Hispanic students, which may negatively affect Hispanic student persistence and success (Gonzalez, 2003).

Museus (2011) has researched techniques that institutions can use to cultivate campus cultures that positively affect Hispanic student persistence and success. Providing culturally familiar campus spaces, increasing and publicizing culturally relevant curricula, providing service-learning opportunities, and increasing cultural validation are examples of institutional efforts to support and cultivate a positive campus environment for Hispanic students (Museus, 2011).

Demographics of Faculty. In the past several decades, there has been a substantial increase in Hispanic enrollment, yet Hispanic faculty growth has not kept pace (Ponjuan, 2011). In 2016, approximately 17% of the undergraduate student population identified as Hispanic, while only four percent of faculty identify as such (NCES, 2016C; 2018b). While the

demographics of the American higher education student population are drastically changing, faculty diversity is stagnant (Ponjuan, 2011).

The disparity in Hispanic student enrollment and faculty representation is a major concern. Hurtado (2001) has demonstrated that Hispanic faculty have a significant effect on Hispanic student success. Hispanic faculty make meaningful contributions to higher education including providing unique classroom engagement, serving as role models, increasing Hispanic student retention and degree completion rates, enhancing campus diversity, and conducting racially and ethnically relevant research (Hurtado, 2001). Inclusion of Hispanic faculty members is an important tool to increase Hispanic student success through the creation of a multicultural learning environment in which Hispanic students have role models and feel culturally validated.

Several studies have made recommendations aimed at recruitment and retention of Hispanic faculty members. The recommendations can be separated into two categories: pre-employment and post-employment recommendations. Pre-employment recommendations are factors that can be leveraged to increase the number and success of Hispanic graduate students. Some pre-employment recommendations are to increase Hispanic student enrollment, persistence, and success at the bachelor's level, efforts that could increase the number of Hispanic graduate students (Ponjuan, 2011). Establishing policies in graduate schools that improve professional and personal socialization into the academic discipline and department could lead to increased rates of persistence for Hispanic graduate students (Ponjuan, 2011). Cultivating Hispanic doctoral student socialization could also be accomplished by a mentor program between the "new" Hispanic graduate student and an existing Hispanic graduate student or faculty member (Ponjuan, 2011).

Post-employment recommendations consist of educating faculty search committees on the importance of diversity, developing Hispanic faculty learning communities to instill a sense of belonging, create equitable pre-tenure faculty work roles to ensure that minority faculty are not overwhelmed, and improve the faculty department climate to minimize any perceived hostility or unfairness (Ponjuan, 2011).

In summary, the literature suggests that increasing the diversity of faculty members can promote Hispanic student persistence and success but recruiting and retaining Hispanic faculty cannot be accomplished passively. Recruiting and retaining a diverse faculty population must be an institutional commitment visible through its policies and programs.

STEM: The History and Current State

STEM is an acronym for any career or educational field within the science, technology, engineering, and mathematics disciplines. STEM research, and the resulting breakthroughs, are responsible for global technological advances, which are paramount to future innovations. There has been a shift in employment opportunities towards STEM fields that will fuel our economy with new advances and ensure that the United States will continue to be globally competitive in the future (Carnevale, Smith, & Strohl, 2010).

In the past several decades, there has been a push to increase STEM higher education student enrollment in order to fulfill these current and future employment demands (Carnevale, Smith, & Strohl, 2010). While STEM degree attainment has increased by 35% in the past decade, postsecondary education is not producing adequate STEM-educated students to fulfill current and projected needs (NCES, 2016h).

The following review includes a brief history of American STEM research and a review of gateway STEM courses. Given the focus of this research study, the discussion of STEM research and education provides an important understanding of context and content.

STEM: 1957 to 2013

The original academic emphasis on STEM research in the United States is closely tied to aerospace and higher education history. On October 4, 1957, the Soviet Union launched an unmanned probe, Sputnik I, into space. This historic event occurred at the height of the Cold War, in which the United States and the Soviet Union were in a battle to demonstrate dominance in foreign and domestic initiatives (Dickson, 2001). The launch of Sputnik was the impetus for a new rivalry based on knowledge as opposed to manufacturing. In this new market, the commodity was information. This, in part, led to America's economy shifting from a manufacturing to a knowledge-based economy.

In 1958, the shift in national defense priorities was demonstrated by policy changes, beginning with the signing of the National Defense Education Act and the bill that formed NASA in 1958 and was signed by President Dwight D. Eisenhower. This act boosted federal spending on STEM research and culminated in a manned moon landing in 1969 (Dickson, 2001).

Unfortunately, the decades after the moon landing saw a decrease in public interest in STEM areas. National spending priorities again changed with the onset of the Civil Rights Movement in the 1960s and 70s, and spending shifted toward the goal of increasing access to education to minority and underserved populations (Bianchini, 2013).

By the 1990s, the United States dominance was again tested by a strong European Union and the developing economies of the Far East and India. These emerging economies were

investing significant amounts of funds into STEM education. Moreover, while foreign countries increased graduation rates in STEM fields, the United States experienced a decrease in STEM graduates (Bianchini, 2013).

In 2001, there was a reemergence of STEM research with the signing of the 2001 No Child Left Behind Act. This piece of legislation focused on improving K-12 public education in reading, writing, and mathematics. While this act had many opponents, mainly because it didn't assess science, it was a step in the right direction. In 2006, President George W. Bush announced the American Competitiveness Initiative, which was designed to recruit American students into STEM fields (Bush, 2006). As a follow-up to the American Competitiveness Initiative, Congress passed the America Competes Act in 2007, which authorized billions of dollars for STEM education and research (Bush, 2007).

STEM: 2014 to 2018

Since 1959, the American College Testing (ACT) readiness tool has been used as a gauge to measure college and career readiness in the United States. Due to recent national employment needs in STEM fields, the ACT has broadened its interest inventory to include assessments for expressed (student interest) and measured (student ability) interest in STEM disciplines. In 2014, 57% of the American high-school graduating class completed the ACT and the accompanying interest inventory. The ACT is an important assessment of the current state of American STEM education (ACT, 2014).

Although interest in STEM disciplines remains high, the discrepancies in expressed and measured interest do reveal that there is an opportunity to educate students about what a STEM career is and what is required to succeed in a STEM field. When students were prompted to

choose a major or career, approximately 49% of the students chose a STEM major or occupation (ACT, 2014). Of those students who chose a STEM path, 49% exhibited only an expressed interest, while 17% showed only a measured interest (ACT, 2014). Student success is high in STEM courses, however, when a student has both an expressed and a measured interest (ACT, 2014).

Another important conclusion that can be drawn from the ACT inventory is that proficiency in math and science needs to improve for students to fulfill their STEM interests. Even though 49% of high-school seniors are interested in a STEM major or occupation, only 50% and 43% of these students met the math and science benchmark respectively (ACT, 2014).

A significant difference exists between Hispanic and White students both in terms of their level of interest in STEM disciplines and in the college readiness benchmarks set by the ACT. Expressed STEM discipline interest is higher in White students, 58% of whom are interested in math and 52% in science, compared to Hispanic students, 36% of whom indicate math interest and 26% science interest (ACT, 2014). Another alarming issue that the ACT data reveals is that 63% of White students met both expressed and measured interest in STEM subjects, while only 39% of Hispanic students met the same benchmarks (ACT, 2014).

In summation, the ACT, which has been used by institutions of higher education to assess college readiness since 1959, is currently measuring expressed and measured interest in STEM fields. Having both a measured and expressed interest is a significant predictor of student success in STEM disciplines. Therefore, analysis of ACT statistics offers a snapshot of college readiness and predicted college completion in STEM areas. The ACT has reported that Hispanic students display significantly less measured and expressed interest in STEM disciplines

compared to their White peers (ACT, 2014). The information reported by the ACT demonstrates areas of opportunity that can be leveraged to increase Hispanic student success in STEM disciplines. Improved STEM college preparation and STEM career counseling could be used to increase Hispanic student STEM participation and college success.

Gateway STEM Courses

One of the most difficult hurdles for an undergraduate STEM major is succeeding in a set of fundamental science courses called “Gateway” STEM courses. These courses have a high failure and withdrawal rate, and they are often called “weed-out courses” (Mervis, 2011). Due to the adverse effects these STEM gateway courses have on student success in the STEM pipeline, this study will focus on these courses that negatively affect minority student success and hamper diversity in the STEM disciplines (Mervis, 2011).

The researcher chose General Chemistry I (CHEM 2045) and Calculus I (MAC 2311) as the STEM gateway courses to be included in this investigation because every STEM major at the five universities being studied must take either CHM 2045 or MAC 2311 as a STEM gateway course to graduate.

Literature Review. Gateway courses, otherwise known as gatekeeper, weed-out, or barrier courses, are introductory courses usually taken in the freshman and sophomore year of college that have very high withdrawal and failure rates. While gateway courses may well be found in any discipline, most of the research is in STEM disciplines. A general search of “Gateway” courses results in a variety of publications which include chemistry, biology, physics, pre-med, pre-vet, pre-pharmacy, mathematics, and engineering. While gateway courses do not

necessarily dictate a STEM discipline, the gateway course mentality is overwhelmingly specific to STEM departments (Epstein, 2006). Gateway STEM courses are usually fast-paced lectures with a significant amount of information to cover which are intended to be gateways to rewarding STEM careers (Seymour & Hewitt, 1997). The truth is that these courses are serving as gatekeepers which are blocking STEM majors from achieving success and ultimately graduating with STEM degrees (Scott, McNair, Lucas, & Land, 2017). Director of the American Association for the Advancement of Sciences, Daryl Chubin articulates the “Gateway” STEM course attitude as, “The culture of science says , ‘Not everyone is good enough to cut it, and we’re going to make it hard for them, and the cream will rise to the top” (Epstein, 2006). There is widespread belief among STEM faculty that gateway courses should be difficult and should be used to weed out students (Epstein, 2006). This widespread STEM faculty belief bolsters the idea that “Scientists are born, not made” (Tobias, 1990, p. 11).

Fifty percent of STEM majors change to non-STEM majors within the first two years of college and less than 50% of entering freshman STEM majors graduate within 6 years of enrollment (Chang, Cerna, Han, Saenz, 2008). The national need for qualified STEM graduates has increased significantly in the past several decades and this trend is projected to continue into the foreseeable future (Carnevale, Smith, & Strohl, 2010). Due to current and projected national employment trends towards STEM fields, the high attrition rate in undergraduate STEM disciplines is a major concern.

As previously stated in this investigation, Hispanic Americans are the youngest and fastest growing demographic of the U.S. population and they are disproportionately represented in STEM degree attainment (Massey, Durand, & Malone, 2003; Pew, 2017). A study conducted

by Chang et al. reported that Hispanic STEM students have the highest attrition rate in STEM disciplines (Chang et al., 2008). A 2009 study conducted by Alexander, Chen, & Grumbach reported that STEM gateway courses disproportionately affect female and underrepresented minority students where Hispanic students received significantly lower grades than White students in STEM gateway courses (2009). Alexander, Chen, & Grumbach described an average achievement gap of 30% when comparing the % of Hispanic students receiving an A or B compared to White peers in gateway courses in biology, general chemistry, organic chemistry, calculus, and physics (2009).

Due to the severity of attrition in STEM majors, primarily due to gateway STEM courses, there has been a variety of research on how to increase student success in STEM gateway courses. Most of the research in the past decade has focused on class size, professor pedagogy, professor teaching style, professor attitude, and student engagement.

In 2007, Suresh investigated the relationship between gateway STEM courses and persistence in engineering (2007). Suresh reaffirms that most of the attrition in engineering occurs in the freshman and sophomore year via withdrawal and/or failure in gateway STEM courses (2007). The study reported that gateway course difficulty is intensified by the difficulty of the transition from high school to college and STEM faculty belief and practice of “weed-out” culture (Suresh, 2007). The difficulty of gateway courses, adjustment issues, and professors’ attitudes are all prominent factors that resulted in poor grades and resulting high attrition rates in engineering (Suresh, 2007).

A study by Gasiewski, Eagan, Garcia, Hurtado, & Chang observed that instructors play a major role in sustaining engagement in STEM courses, which in turn can increase student

success and retention (2011). The study stated “that a professors demeanor and attitude signal implicit and explicit messages that influence whether or not students feel engaged in class, and the professors that use humor, exhibit care, or showed a real passion for their subject matter are more likely to be viewed by students as the most engaging” (Gasiewski, Eagan, Garcia, Hurtado, & Chang, 2011, p. 251). With the use of student and faculty surveys this study was able to offer recommendations on how to increase student engagement in STEM gateway courses via exploiting “Engaging” professor attributes and minimizing “Gatekeeper” professor qualities. Based on student/faculty surveys and interviews STEM professors are categorized into two main groups, “Engaging” and “Gatekeeper”. “Engaging” professors increase STEM gateway course success via use of active learning, creating a cooperative and collaborative learning atmosphere, increased student-faculty interaction, humor, enthusiasm, and discussion of real-world applications of class material (Gasiewski et al., 2011). The “Gatekeeper” professor utilizes passive instructor-centered pedagogies (PowerPoint slides or chalk & talk), does not allow questions during lecture, does not appeal to different learning styles, makes content seem difficult and intimidating to learn, and is inaccessible via office hours and email. The “Gatekeeper” professor is not engaging and may prompt students to question their choice of discipline (Gasiewski et al., 2011).

In 2017, Scott et al. released a study that addressed class size, student engagement, student achievement, and completion of STEM gateway biology courses (2017). In this study students in a STEM gateway biology course are separated into two main groups based on their class size; small class size and large class size. The study revealed that students in smaller classes are more engaged, earned better grades, and had a higher completion rate than students

from the larger classes (Scott et al., 2017). This study demonstrated that smaller class sizes for STEM gateway courses may be an effective strategy for increasing student success and retention.

In 2019, Ferrare released a study that demonstrates the greatest obstacle to increasing student engagement and hence student success in STEM gateway courses. Ferrare addressed STEM gateway instructors' opinions on vital topics/skills students must learn in their respective STEM gateway courses and best practices for student learning (2019). The faculty views on student mastery of concepts/skills and best practices for teaching are cross-referenced with the practical way these beliefs are displayed in their classrooms (Ferrare, 2019). The study revealed that to increase student success in STEM gateway courses most STEM faculty believe active learning is the best student-centered pedagogy (Ferrare, 2019). When the classes are observed, 75% of STEM faculty used instructor-centered practices via chalk & talk and/or PowerPoint slides. A clear obstacle in increasing STEM gateway course success is that although STEM faculty believe that the use of engaging pedagogy and active learning teaching styles demonstrate best practices in STEM gateway course teaching, most of the faculty do not use these practices in their classrooms (Ferrare, 2019).

Studies on the topic of STEM gateway courses have demonstrated that using student-centered active learning, increasing student engagement inside and outside of the classroom, and smaller class sizes may increase STEM gateway course success. The research has also revealed that adjustment issues, faculty "weed-out" attitudes and practices, and the use of faculty-centered practices in the classroom may decrease student engagement and success in STEM gateway courses. It is also important to note that faculty "weed-out" attitudes and resulting practices are specific to STEM disciplines.

Hispanic Serving Institutions

In the 1960s through the 1990s, there was a considerable increase in the Hispanic population in the United States (Massey, Durand, & Malone, 2003). The national population surge eventually created a critical mass of Hispanic people who successfully organized a movement to fight their way out of poverty (Massey, Durand, & Malone, 2003). This effort was seen in protests for equality, including access to higher education (Massey, Durand, & Malone, 2003). The impetus for the HSI designation in the United States' higher education system was the growth in the Hispanic population. The factors that allowed the Hispanic population to grow so quickly have their roots in the 1960s.

The 1960s saw the first mail-out United States Census (1960), the 1964 Civil Rights Act, the 1965 Voting Rights Act, the 1965 Higher Education Act (HEA), and the 1965 Immigration and Nationality Act (INA). The social, educational, and political aspects of these Acts overlapped and were founded, due to the Civil Rights movement, geopolitical pressure, and the United States' desire to show global ideological, moral, and technological superiority.

Before 1965, the United States federal government had strict immigration policies that used a quota system that favored Europeans over Hispanic and African immigrants (Bankston, 2013). The quota systems were based on the number of immigrants who had arrived during previous years. Since most of the earlier immigration was from northern and western Europe, these policies favored such immigrants (Bankston, 2013).

On the heels of the Civil Rights Act of 1964, the Immigration and Nationality Act (INA) of 1965 was signed into law by President Johnson and was the first considerable modification to the United States immigration quota policy (Bankston, 2013). This act altered the ethnic makeup

of immigrants entering the United States and prompted a massive increase in Hispanic immigration from Latin American countries (Bankston, 2013). President Kennedy and President Johnson explained the INA as a way to reunite families and as a continuation of the Civil Rights movement (Bankston, 2013). The INA was commonly referred to as “The Civil Rights Revolution Comes to Immigration Law,” and politicians supported this idea (Fitzgerald & Cook-Martin, 2015).

While reuniting families, importing skilled labor, and continuing the Civil Rights Movement were contributing factors to the INA, the Act was also a result of pressures resulting from decades of unfair immigration policies. Arguments were made that ethnically prejudiced policies damaged United States’ foreign policy (Fitzgerald & Cook-Martin, 2015). The U.S. was accused by Africans, Latin Americans, and the Japanese of excluding Japanese immigrants, establishing Nazi-like immigration policies, and viewing Latin Americans as inferior (Fitzgerald & Cook-Martin, 2015).

The first modern census began on April 1st, 1960. The 1960 census data revealed that Hispanic peoples accounted for 3.6% of the U.S. population (USCB, 2016). After the INA was signed into law, the Hispanic population increased dramatically. The immigration of Latin Americans caused a 25% increase in the Hispanic American population from 1960 to 1970, a 42% increase from 1970 to 1980, and a 41% increase from 1980 to 1990 (USCB, 2016).

As the Hispanic population grew, it was apparent that Hispanic people were disproportionately represented with regard to employment, economic achievement, and educational attainment. In 1973, the unemployment rate of Hispanics was approximately double that of Whites (Labor Force Statistics, 2014). In 1973, the poverty rate of Hispanics was 62%

higher than Whites (Labor Force Statistics, 2014). In 1974, only 37% of Hispanics age 25 and older had a high school diploma compared to 63% of the White population (USCB, 2016). In 1974, only 6% of Hispanics, age 25 and older, held a bachelor's degree or higher compared to 14% of the White population (USCB, 2016). The skewed educational attainment only slightly decreased in the 1980s and was cause for great concern (USCB, 2016). Even though all these factors revealed the need for the HSI designation, it was the critical mass of the Hispanic population that led to the ability to transform Hispanic concerns into legislative agenda items via increased governmental participation.

In 1965, President Johnson passed the Higher Education Act (HEA) through Congress. The HEA offered financial assistance for students in higher education, and it also served to revitalize Historically Black Colleges and Universities (HBCUs) (Laden, 2001). A 1992 reauthorization of this Act authorized the development of HSIs and appropriated governmental financial support for such institutions (Laden, 2001).

There are many political milestones that lead to the 1992 Reauthorization of the Higher Education Act, which included HSIs in Title III of the Act. The first organized broad-based coalition that spotlighted Hispanic education issues was the Hispanic Higher Education Coalition, formed in 1978, it fought for federal funding under Title III of the Higher Education Act to be allocated for institutions with a large percent of Hispanic enrollment (Mendez, 2015).

In 1979, representatives of the coalition testified to the House Post-Secondary Committee and Senate seeking to expand Title III of the Higher Education Act to include HSIs (Mendez, 2015). The testament was important because it was the first organized attempt to expand Title

III and, therefore, laid groundwork for all subsequent Hispanic advocacy (Mendez, 2015). This testimony turned a social issue into an agenda item.

In 1982, Representative Simon sponsored the Hispanic Access to Higher Education hearings in the House of Representatives (Mendez, 2015). These are the first hearings focused solely on Hispanic higher education and provided a platform for Hispanic congressional members to lend support (Mendez, 2015). While these hearings did increase awareness of issues with Hispanic higher education, no funding was allocated (Mendez, 2015).

In 1984, the hearings for the reauthorization of the Higher Education Act took place. There, Rep. Simon sponsored H.R. 5240, which would define institutions with a 40% or higher enrollment of Hispanic students as a Hispanic Serving Institution (Mendez, 2015). During the hearings, the HHEC recommended that Hispanic Serving Institutions should have at least 30% Hispanic enrollment, be located near large Hispanic populations, have significant Hispanic staffing, and have special academic and campus programs for Hispanic students (Mendez, 2015). This hearing is of importance because it was the first attempt to define HSIs and demonstrates that the percent of Hispanic students enrolled was never designed to be the major defining factor in the HSI designation. It is important to note these points because “closeted” HSIs are receiving federal funding based solely on the percent of Hispanic student enrollment (Contreras & Contreras, 2015). Closeted HSIs are HSIs that do not include Hispanic student success as a public institutional priority, but they may use federal funds for student success in general as opposed to targeted interventions for Hispanic students.

In 1986, Congress amended Title III of the HEA to recognize institutions with 20% or more Hispanic enrollment as eligible for Title III funding (Mendez, 2015). In 1986, the Hispanic

Association of Colleges and Universities (HACU) was formed and is currently the leading voice for HSIs (Mendez, 2015). HACU coined the term HSI in 1991 and recommended that the percent enrollment be increased to 25% (Mendez, 2015). Congress passed HSI legislation in an amendment to Title III of the HEA in 1992 that defined an HSI as an accredited, degree granting institution, public or private, non-profit college or university that enrolled at least 25% Hispanic students (Mendez, 2015).

The HEA reauthorization of 1992 moved HSIs to Title V under the developing HSIs program. The reauthorization also directed that 50% of the Hispanic enrollment must be low-income to qualify for Title V funding (Mendez, 2015).

In 2008, the College Cost Reduction and Access Act was passed. This act set aside \$200 million dollars in funding intended for HSIs for articulation and STEM programs (Mendez, 2015). In 2010, the Student Aid and Responsibility Act mandated 10 more years of the Act at \$100 million dollars of funding per year (Mendez, 2015).

As of the 2016 academic year, there were 429 HSIs in the U.S., not including Puerto Rico (Excelencia, 2018). In 2018, 15% of higher education institutions had a HSIs designation, and served approximately 65% of the Hispanic higher education population (Excelencia, 2018). While 44% of HSIs are public two-year colleges, only 24% are public four-year colleges (Excelencia, 2018). The state of Florida currently has 25 HSIs serving a considerable percentage of the U.S. Hispanic student population (Excelencia, 2018).

While continued funding to HSIs under Title V of the Higher Education Act has greatly increased access to higher education for Hispanic students, the critical conversation has now shifted from access to success. HSI designation is a product of population demographics, but it

does not guarantee institutional programs targeting Hispanic student success. Many HSIs are “closeted” with regards to their designation, yet they are accepting federal funds with no intention of developing programs geared towards the Hispanic student population.

Florida State University System

History

The State University System of Florida (SUSF), based in Tallahassee, is comprised of 12 public universities (SUSF, 2018). As of the fall of 2017, the system had an enrollment of approximately 350,000 students, employed roughly 60,000 faculty and staff members, and had a yearly operating budget of approximately \$11 billion dollars (SUSF, 2018).

In 2003, a desire to centralize and standardize the state higher education system led to the formation of the 17-member Florida Board of Governors comprised of 14 members appointed by the Florida Governor and confirmed by the Florida Senate for a seven-year term (SUSF, 2018). The other three members are the president of the Advisory Council of the Faculty Senate, the Commissioner of Education, and the chair of the Florida Student Association. The chancellor is elected by the Board of Governors and serves as the chief executive and administrative officer for the SUSF (SUSF, 2018).

The prodigious diversity in the state of Florida is the impetus for the student diversity in the SUSF. As seen in Table 7 (page 48), the population of Florida is significantly more diverse than the United States as a whole and is a substantial contributor to the Hispanic population demographics for the country (USCB, 2018; 2018a).

Table 7

Population Demographics for the United States of America and the State of Florida

Ethnicity	United States	Florida
Hispanic	18.1%	25.6%
White	60.7%	54.1%
Black	13.4%	16.9%

Note. Data collected from the USCB, 2018; 2018a

As seen in Table 8, the SUSF has significantly more diversity in its student population in comparison to the rest of the country. The enrollment of Hispanic students in higher education in Florida accounts for 8.2% of Hispanic student enrollment nationwide and is only surpassed by California (31%) and Texas (17%) (NCES, 2016).

Table 8

Fall Enrollment in Degree-granting Higher Education Institutions for the United States of America and the State of Florida by Ethnicity

Ethnicity	United States	Florida
Hispanic	16.5%	25.0%
White	54.7%	45.7%
Black	13.4%	18.4%

Note. Data collected from NCES, 2016

The Florida student population is very diverse and minority students attending Florida institutions of higher learning significantly surpass 6-year graduation rates compared to the nation (See Table 9, page 49) (NCES, 2016a).

Table 9

Six Year Graduation Rates for the United States and the State of Florida

Ethnicity	United States	Florida
Hispanic	46%	73%
White	58%	75%
Black	39%	62%

Note. Data collected from NCES, 2016a

However, one of the most serious deficits the SUSF has encountered with regard to diversity is the lack of minority full-time faculty. As seen in Table 10, the SUSF trails national public university faculty diversity (NCES, 2015). This situation is especially critical in the underemployment of Hispanic faculty. Although Florida has the third highest Hispanic student enrollment, the employment of full-time Hispanic faculty lags behind the national average.

Table 10

Percent of Full-time Faculty at State University System of Florida Universities and United States Public Universities

Ethnicity	United States	State University System of Florida
Hispanic	9%	6%
White	65%	70%
Black	7%	8%

Note. Data collected from NCES, 2015

Summary

The student population in the State University System of Florida is very diverse, making it the third highest in Hispanic student enrollment in the nation (NCES, 2016). This diversity is, without a doubt, due to the huge immigration of Hispanic people to the State of Florida in the past three decades. Florida boasts the largest HSI in the nation and is one of the main contributors to the education of Hispanic students (SUSF, 2018a).

While Florida universities have shown great promise in Hispanic 6-year graduation rates and overall diversity of its student population, it trails behind national averages for full-time Hispanic faculty. The necessary success of the SUSF cannot be overstated, as it is on the front-line of the struggle against the underserving of minorities in higher education.

The researcher selected five Florida State universities for this study based on similar acceptance rates, freshman SAT and ACT scores, and student enrollment. The researcher made a concerted effort to choose universities based on similar entering freshman class academic achievement, in order to minimize validity issues in the statistical analysis. To have the ability to compare HSIs to non-HSIs, two universities of each kind were chosen.

Theoretical Framework

Latin Critical Theory (LatCrit) will be the theoretical framework for this study on Hispanic student success in STEM courses. Latin Critical Theory was derived from Critical Race Theory (CRT), but since its inception, it has blossomed into a complementary theory that is used as a supplement to CRT (Delgado-Bernal, 2002). The foundation of Latin Critical Theory can be found in CRT. Therefore, a brief history of CRT, and the relationship between CRT and LatCrit, is vital in understanding the application of LatCrit.

Critical Race Theory

Critical Race Theory is a direct result of the work of progressive legal scholars to account for the role of racism in the United States legal system (Delgado & Stefancic, 2001). CRT is critical of conventional approaches to racism and oppression (Delgado & Stefancic, 2001; Solorzano & Yosso, 2001; Stefancic, 1997). The impetus for this theory was the prevalent institutional racism and subordination of minorities (Delgado & Stefancic, 2001).

CRT was developed within the legal field, but it has been implemented very successfully in studies focused on higher education (Dixson & Rousseau, 2006). Dixson and Rousseau have discussed the following six main elements of the theory.

1. Critical race theory recognizes that racism is endemic in American life.
2. Critical race theory expresses skepticism towards dominant legal claims for neutrality, objectivity, colorblindness, and meritocracy.
3. Critical race theory challenges ahistoricism and insists on a contextual/historical analysis of the law [...] Critical race theorists [...] adopt a stance that presumes that racism has contributed to all contemporary manifestations of group advantage and disadvantage.
4. Critical race theory insists on recognition of experiential knowledge of people of color and our communities of origin in analyzing law and society, which in turn develops counterstories.
5. Critical race theory is interdisciplinary.
6. Critical race theory works toward the end of eliminating racial oppression as part of a broader goal of ending all forms of oppression. (2006)

While CRT advanced the discussion of racism, it also received an abundance of criticism for failing to capture the Latino experience (Stefancic, 1997).

Latin Critical Theory

Latin Critical Theory (LatCrit) began as a way to direct attention to the marginalized Latino experience and the specific issues Latino Americans face (Stefancic, 1997). LatCrit was developed in 1995 during a colloquium on representing Latina/o communities. The name of the colloquium was Critical Race Theory and Practice. It was held by the Law Professors Section of the Hispanic National Bar Association in October of 1995 (Valdes, 1996). The colloquium was sponsored by the University of Miami School of Law and co-sponsored by the La Raza Law Journal (Valdes, 1996).

LatCrit theory builds upon Critical Race Theory to allow Hispanic voices to be heard (Delgado & Stefancic, 2012). It maintains that the voice of Hispanic peoples is multilayered and contains numerous identities within the group based on their life experiences as Americans, multilingual speakers, immigrants, males, females, etc. (Nunez, 2014; Trucios-Hayes, 2000).

A review of the literature suggests that there are five defining elements that form the core of LatCrit. These elements include a focus on race and racism, contesting dominant ideologies, a focus on social justice, recognition of experiential knowledge, and a focus on historical context (Gonzalez & Morrison, 2015; Nunez, 2014; Villalpando, 2004).

Focus on Race and Racism. The most basic premise of Latin Critical Theory is that race and racism are defining characteristics of American society and are embedded in the structures, discourses, and policies of college campuses (Taylor, 1999). While race and racism are central paradigms in higher education, LatCrit proposes an intersectionality with other Hispanic identifying factors such as language, class, generation status, and sexuality (Valdes,

1996). Gender, class, race, and sexual orientation are examples of different types of oppression and discrimination that Hispanic students may encounter.

It becomes obvious that any one of these factors can be subject to varied acts of oppression and subordination (Villalpando, 2004). LatCrit argues that varied types of oppression and discrimination do not operate in isolation and that there is an exponential effect to these types of oppression, not merely a cumulative one (Villalpando, 2004). LatCrit exposes the importance of studying how race, racism, gender, class, and sexual orientation affect the experiences of Hispanic students and how these might be subject of different forms of discrimination or marginalization in higher education (Solorzano & Villalpando, 1999).

Employing Latin Critical Theory to subvert racism and discrimination in higher education has led to several publications on the topic. Research by Smith (2002) and Villalpando (2003) demonstrated that student service professionals and faculty members can significantly affect Hispanic students' perception of racism on campus. While overt racial hostility may be uncommon, subtle racial microaggressions are common and greatly affect Hispanic students (Solorzano, 1998). It is unusual for student service professionals and faculty members to be trained in recognizing and dealing with racism on campus; therefore, they may not be equipped to deal with such situations (Villalpando, 2004). LatCrit offers recommendations that include direct dialogue with the Hispanic student population to educate institutional agents on the racism and discrimination these students experience.

Contesting Dominant Ideologies. Latin Critical Theory challenges the claims of higher education to impartiality, meritocracy, color blindness, race neutrality, and equal opportunity. Specifically, LatCrit reveals how the dominant ideology of color blindness and race neutrality

can act as a sort of camouflage for the egocentricity, supremacy, and privilege of dominant groups in America (Calmore, 1992; Delgado, 1989). An example of institutional discrimination can be seen in the college admission process. While colleges and universities proclaim that minority students, including Hispanic students, have an equal opportunity for college acceptance and success, there are some admission practices that do not conform to race neutral practices. At a time when race-sensitive admission criteria are being attacked as discriminatory against White students, institutions refuse to abandon alumni legacy status as an admission criterion. Legacy status clearly favors White students because data on college graduation rates show that White alumni far outnumber Hispanic alumni (Villalpando, 2004). These are the types of dominant ideologies of color-blind fairness and race neutral meritocracy that must be studied through a LatCrit lens.

The Latin Critical Theory lens can be used by student support service members to create holistic programs and services specifically targeted for Hispanic students. When race specific programs are initiated, the dominant ideology may label such programs as applying reverse discrimination. LatCrit articulates that race specific programs and services are not examples of reverse discrimination because of the acknowledged historical legacy of exclusion and the desire to promote a culturally relevant response to increase Hispanic student success (Villalpando, 2004). LatCrit also states that the use of the dominant ideologies of color blindness and race neutrality in the development and implementation of programs, policies, and practices benefits White students, while concurrently disadvantaging Hispanic students (Villalpando, 2004).

Focus on Social Justice. One of the essential elements of Latin Critical Theory is to work toward attaining social justice (Villalpando, 2004). While social justice may have several

definitions, LatCrit considers social justice to be the genuine struggle to eradicate all forms of subservience based on race, gender, language, generation status, sexuality, and class (Matsuda, 1996). While student support service professionals are expected to strive to ensure educational equality for all students, the LatCrit focus on social justice promotes the development and use of programs and services specifically designed to eliminate subordination based on race, gender, language, generation status, sexuality, and class (Villalpando, 2004). Developing such programs and services can be labeled as holistic student development but viewing these programs through LatCrit lens allows for targeted interventions for specific groups with an explicit social justice purpose (Villalpando, 2004).

Recognition of Experiential Knowledge. Experiential knowledge is knowledge gained through generational storytelling, family histories, biographies, and narratives (Delgado, 1995). Latin Critical Theory recognizes and respects the fact that experiential knowledge possessed by Hispanic students is legitimate, and an understanding of this experiential knowledge is imperative to understand racial inequality (Villalpando, 2004). LatCrit posits that the experiential knowledge of Hispanic students should be viewed as “an asset, a form of community memory, a source of empowerment and strength, and not as a deficit” (Villalpando, 2004, p.46).

It is common for Hispanic students to be considered lacking, because of their racial and/or ethnic identity, class, gender, immigration status, or language aptitude (Villalpando, 2004). LatCrit dispels the myth that Hispanic students are inherently less competent due to their culture or race. Instead, it places the brunt of the blame on the education system that does not place value on their experiential knowledge (Villalpando, 2004).

Experiential knowledge of Hispanic students should be integrated in the process of developing responsive and culturally relevant programs and services (Villalpando, 2004). When devising Hispanic students' experiential knowledge programs and services, student service professionals are validating the discrimination Hispanic students may have faced; thus placing value on their cultural identity (Villalpando, 2004).

Focus on Historical Context. One of the fundamental principles of Latin Critical Theory is that ahistoricism in higher education research, policy, and practice must be challenged in order to understand how historical context affects Hispanic students (Delgado, 1995). LatCrit denotes that to fully understand Hispanic students, one must know the historical context experienced before college. A large percentage of Hispanic students attend substandard secondary schools, are pushed into non-college majors, and may be advised to attend community colleges in lieu of universities (Villalpando, 2004). The combination of educational tracking and substandard secondary school education has resulted in an alarmingly high Hispanic attendance at community colleges in lieu of bachelor's degree granting institutions (NCES, 2016d; Villalpando, 2004).

Latin Critical Theory suggests that student service professionals advance their interpretation of the historical and current experiences of the Hispanic communities (Villalpando, 2004). The significance of their historical context can help student service professionals develop programs and services that target Hispanic students. The Hispanic population is heterogeneous, and programs and services should target these diverse groups based on the historical and regional differences between them (Villalpando, 2004).

Latin Critical Theory identifies white supremacy within our society and the privilege of one race over others (Gonzalez, 2010). Hispanic students may experience a less favorable college environment because of an institution's narrow perceptions of race and ethnic identity (Gloria & Castellanos, 2012). LatCrit recognizes institutional discussions of race may be based on a Black/White binary paradigm, and this may be used to silence minority groups who do not fit into this system (Trucios-Haynes, 2000). When applying a LatCrit lens to a discussion of race, it is important to engage in an expanded conversation that dissects and contextualizes dominant American understandings and emphasizes a Latino perspective (Gonzalez & Morrison, 2015).

A Latin Critical lens should always be applied in a study of Hispanic student success in American higher education. Even though the Hispanic population does have unifying elements such as Spanish language, family bonds, and community networks, it is imperative to understand that they constitute a heterogeneous demographic (Torres, 2004). When analyzing data, it is central to recognize the different groups within the Hispanic populace. These groups may vary based on country of origin, history, social class, immigration, and citizen status (Gonzalez & Morrison, 2015). Unfortunately, available student data does not include countries of origin; therefore, the label "Hispanic" will be a self-identifying characteristic, and it will not be divided into its constituents.

Conclusion

There is great diversity in the American higher education student population. While access to overlooked populations has increased in the last several decades, degree attainment for these groups has lagged behind their White peers (NCES, 2016). Hispanic students are

inadequately represented regarding bachelor's, master's, and doctoral degree attainment (NCES, 2016e; 2016f; 2016g). This education gap is considerably more substantial when examining STEM degree attainment (NCES, 2016h).

In 2010, it was recognized that National STEM employment requirements would continue to increase as the American economy shifts predominately towards STEM fields (Carnevale, Smith, & Stohl, 2010). The STEM employment trend is demonstrated in the comparison of STEM occupation growth (10.5%) and non-STEM occupation growth (5.2%) between 2009 and 2015 (Fayer, Lacey, & Watson, 2017). STEM gateway courses are considerable hurdles for Hispanic students, and success in these gateway courses is a key predictor of STEM degree attainment (UNM, 2012; 2013).

While HSIs serve the majority of Hispanic students, little research has been completed regarding HSIs in the Florida State University System (Excelencia, 2018). Meanwhile, a significant number of Florida State universities are designated as HSIs and emerging HSIs (Excelencia, 2018).

Latin Critical Theory is a theoretical framework that offers a unique approach to understanding the needs of Hispanic students through a focus on race, racism, social justice, and historical context. LatCrit can be used by student service professionals to produce and promote more responsive and comprehensive outreaches, interventions, programs, and practices. This study will use Latin Critical Theory to explore Hispanic student success in STEM gateway courses within the Florida State University System, to provide recommendations that may lead to targeted interventions to increase Hispanic student success.

CHAPTER THREE: METHOD

Introduction

The purpose of this study is to compare the success of Hispanic students at five Florida state institutions (University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida Atlantic University) in gateway STEM courses (General Chemistry I and Calculus I) with the success of their White peers. The second goal of this study is to compare Hispanic student performance in gateway STEM courses at Florida state HSIs (University of Central Florida, Florida International University, and Florida Atlantic University) with their performance in these courses at non-HSIs (University of West Florida and Florida Gulf Coast University) to identify whether there is a relationship between Hispanic student success in gateway STEM courses and the type of Florida state institution the students attend.

As of 2018, Hispanic Americans are the fastest growing and youngest population in America, yet Hispanic students are inversely represented in STEM degree attainment (Massey, Durand, & Malone, 2003; USCB, 2018a; NCES, 2016a; 2016h). This disproportionality is a critical issue to equality and future employment trends in STEM fields. The Florida State University System educates a large portion of Hispanic Americans, is the number one producer of Hispanic student STEM degrees, and is home to several HSIs (Excelencia, 2018; Heithaus, 2015). Yet, while past research has concentrated on access, the current focus must be on success. Thus, the results of this study should be able to serve as a foundation for future research in increasing Hispanic student success in STEM disciplines.

This chapter outlines the methods and procedures used in this study. The research questions and null hypotheses are presented, along with the research design, setting, population and participants, sample, sampling technique, data collection methods, procedure and instrumentation, validity and analysis of methods, and, finally, the possible limitations and delimitations of this study.

Research Questions

The following research questions are proposed to guide this study of students across the time from 2014 to 2018:

1. Is there a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
2. Is there a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
3. Is there a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?
4. Is there a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?

Null and Alternative Hypotheses

For Research Question One, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

For Research Question Two, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University

For Research Question Three, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University,

University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

For Research Question Four, the null and alternative hypotheses are as follows:

H_o – There will be no statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

H_a – There will be a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University.

Research Design

This study will use a nonexperimental quantitative research model. Creswell explained that quantitative research is a method used to test objective theories by exploring the relationship between the variables (Creswell, 2014). The variables to be used in the quantitative research model are measured by instruments, which in turn, provide numerical data. The data is then analyzed using statistical procedures (Creswell, 2014). An independent variable is a variable that causes, influences, or impacts the outcomes of the study (Creswell, 2014). A dependent variable is a variable which depends on the independent variable (Creswell, 2014). For the purpose of this study, causal comparative research will be used. According to Salkind (2010),

causal comparative design seeks to find relationships between independent and dependent variables after the action or event has already occurred. For this reason, causal comparative research is also called *ex post facto research* (Salkind, 2010). In causal comparative research, two or more groups of individuals are compared to determine whether the independent variable affected the outcome (Salkind, 2010).

When comparing causal comparative research to correlational and experimental research, there can be significant similarities and variances. Causal comparative and correlational research studies are analogous because their aim is to determine relationships among variables. They are both useful when experimental research is not possible or is deemed unethical (Salkind, 2010). Neither causal comparative nor correlational research allows for actual manipulation of the variables; therefore, they cannot state whether a true cause and effect relationship occurred between the variables (Salkind, 2010). The main difference between the causal comparative and correlational models is that only one group of subjects is studied in correlation studies while two or more groups are studied in causal comparative research (Salkind, 2010). In causal comparative and experimental studies, subjects are typically divided into groups on the foundation of the independent variable to determine what effect the independent variable may have on the dependent variable (Salkind, 2010). The main differences between causal comparative and experimental research is that causal comparative studies are done *ex post facto*, therefore true random sampling is not possible for causal comparative studies (Salkind, 2010). Experimental research is based on manipulating variables to gauge outcomes, whereas causal comparative research is based on a retrospective study of causation (Salkind, 2010).

Descriptive statistics will be used to analyze the data gathered for all research questions. Independent t-tests will be used to answer Research Questions One and Two where determination of the statistical significance between ethnicity and STEM gateway course success will be studied. An analysis of variance, ANOVA, will be used to answer Research Questions Three and Four, where determination of the statistical significance between the type of institution attended by Hispanic students and STEM gateway course success will be studied. For Research Questions One and Two and Research Questions Three and Four, the independent variables that will be used are the ethnicity of the participants and the type of institution attended, respectively. For all Research Questions, the dependent variable will be student course grades in specific STEM gateway courses.

Setting

Data for this study will be obtained from five Florida State universities. The State University System of Florida (SUSF), which is based in Tallahassee, is comprised of twelve public universities (SUSF, 2018) and accredited through the Southern Association of Colleges and Schools' Commission on Colleges (SUSF, 2018).

Although there are twelve Florida state universities, five were chosen based on their HSI or non-HSI designations, similar acceptance rate, and similar freshman SAT & ACT scores. In order to minimize validity issues in the statistical analysis, universities were chosen based on similar academic achievement of their freshman classes.

University of West Florida

University of West Florida (UWF) is a public 4-year university located in Pensacola, was established in 1967 (SUSF, 2019). It has an annual enrollment of about 13,000 students and grants associate's, bachelor's, master's, and doctoral degrees (SUSF, 2019). In the Fall 2018 semester, UWF had an undergraduate enrollment of 9,700 and a graduate enrollment of 3,300. Sixty five percent of the undergraduates identified as White, 9% Hispanic, and 12% Black (NCES, 2019).

In 2018, the six-year graduation rate indicated that 45% White, 40% Hispanic, and 37% Black students graduated within 150% of normal time (four years) to completion (NCES, 2019). In 2018, the overall six-year graduation rate was 43% at University of West Florida, with 14.6% of bachelor's degrees and 15.7% of graduate degrees conferred in STEM disciplines (NCES, 2019). UWF's six-year graduation rate of 43% is significantly less than the national six-year graduation rate of 58.6% for all public four-year colleges (NCES, 2016a).

In 2018, 42% of the students who applied to UWF were accepted (NCES, 2019). The average SAT and ACT scores for the 2017 freshman class at UWF were 1165 and 25, respectively (NCES, 2019). As of 2018, West Florida was not considered an HSI, nor an emerging HSI (Excelencia, 2018a).

Florida Gulf Coast University

Florida Gulf Coast University (FGCU), formally opened its doors in 1997 in Fort Myers (SUSF, 2019a). It grants associate's, bachelor's, master's, and doctoral degrees with an annual enrollment of approximately 15,000 students (SUSF, 2019a). In the Fall 2018 semester, FGCU had an undergraduate enrollment of 13,877 students and a graduate enrollment of 1,157 (NCES,

2019a). In 2018, the undergraduate student population at FGCU identified as 63% White, 21% Hispanic, and 7% Black (NCES, 2019a).

In 2018, the six-year graduation rate statistics indicated that 49% White, 44% Hispanic, and 47% Black students graduated within 150% of normal time (four years) to completion (NCES, 2019a). In 2018, the overall six-year graduation rate was 48%, a graduation rate significantly lower than the 58.6% 6-year graduation rate for all public four-year institutions (NCES, 2016a). In 2018, 26% of bachelor's degrees and 37.4% of graduate degrees that were conferred at FGCU were in STEM disciplines (NCES, 2019a).

In 2018, 65% of the students who applied to FGCU were accepted (NCES, 2019a). Average SAT and ACT scores for the 2018 freshman class at FGCU were 1135 and 23, respectively (NCES, 2019a). As of 2017, FGCU was considered an emerging Hispanic serving institution (Excelencia, 2018a).

University of Central Florida

University of Central Florida (UCF), which is in Orlando, was founded as Florida Technological University and opened its doors in 1968 (SUSF, 2019b). UCF is the largest Florida State University, with an annual enrollment of approximately 68,000 students (SUSF, 2019b). UCF grants associate's, bachelor's, master's, and doctoral degrees. In the fall of 2018, UCF had an undergraduate enrollment of 58,821 and a graduate enrollment of 9,654 (NCES, 2019b). The undergraduate student population identified as 47% White, 27% Hispanic, and 11% Black (NCES, 2019b). Also, in 2018, the six-year graduation rate statistics indicated that 73% White, 72% Hispanic, and 70% Black students graduated within 150% of normal time (four years) to completion (NCES, 2019b). In 2018, UCF's overall six-year graduation rate was 73%

(NCES, 2019b), far exceeding the national average of 58.6% for all four-year public colleges (NCES, 2016a).

In 2018, 43% of the students who applied to UCF were accepted (NCES, 2019b). Average SAT and ACT scores for the 2018 freshman class at UCF were 1250 and 27, respectively (NCES, 2019b). In 2019, UCF received its designation as an HSI from the federal government (Kruckemyer, 2019).

Florida Atlantic University

Florida Atlantic University (FAU), was established in 1961 and formally opened its doors in 1964 in Boca Raton (SUSF, 2018a). It grants associate's, bachelor's, master's, and doctoral degrees and is the 6th largest Florida state university, with an annual enrollment of approximately 30,000 students (SUSF, 2018a). In the Fall 2017 semester, Florida Atlantic had an undergraduate enrollment of 25,402 students and a graduate enrollment of 5,139 (NCES, 2018). In 2017, the undergraduate student population at FAU identified as 42% White, 26% Hispanic, and 20% Black (NCES, 2018).

In 2017, the six-year graduation rate statistics indicated that 49% White, 52% Hispanic, and 56% Black students graduated within 150% of normal time (four years) to completion (NCES, 2018). In 2017, the overall six-year graduation rate was 51% at FAU with 26.3% of bachelor's degrees and 14.5% of graduate degrees conferred in STEM disciplines (NCES, 2016h; 2018), a graduation rate slightly lower than the 58.6% 6-year graduation rate for all public four-year institutions (NCES, 2016a).

In 2017, 60% of the students who applied to FAU were accepted (NCES, 2018). Average SAT and ACT scores for the 2017 freshman class at FAU were 1160 and 23, respectively

(NCES, 2018). In 2017, FAU received its designation as an HSI from the federal government (SUSF, 2018a), and as of 2017, FAU was ranked 31st in “The 50 Top Ethnically Diverse Colleges in America” by Best College Reviews (Best College Reviews, 2017).

Florida International University

Florida International University (FIU), was established in 1969 as a public four-year university located in Miami (SUSF 2018b). It grants associate’s, bachelor’s, master’s, and doctoral degrees and is the 2nd largest Florida State University, with an annual enrollment of approximately 55,000 students (SUSF, 2018b). In Fall 2017, FIU had an undergraduate enrollment of 45,856 and graduate enrollment of 9,147 (NCES, 2018a). That semester, the undergraduate student population identified as 9% White, 67% Hispanic, and 12% Black (NCES, 2018a). In 2017, the six-year graduation rate statistics indicated that 44% White, 61% Hispanic, and 41% Black students graduated within the 150% of normal time (four years) to completion (NCES, 2018a). In 2017, the overall six-year graduation rate was 57% at FIU with 19.1% of bachelor’s degrees and 18% of graduate degrees conferred in STEM disciplines (NCES, 2018a).

FIU’s six-year overall graduation rate is comparable to the national average, but the 61% graduation rate for Hispanic students is significantly higher than the national average of 46%. In 2017, 54% of the students who applied to FIU were accepted (NCES, 2018a). Average SAT and ACT scores for the 2017 freshman class at FIU were 1175 and 25, respectively (NCES, 2018a).

FIU is the largest HSI in the United States, and it is the largest producer of STEM degrees in the national Hispanic student population (Heithaus, 2015). Florida International University is unique, in that an argument could be made that it is a historical HSI (Guzman, 2016). While the majority of HSIs are a result of population migration and geography, FIU was

specifically founded to serve the large Latino and Caribbean population in Miami (Guzman, 2016).

Table 11 provides a summary of the pertinent institutional data for the five universities selected for this study. The information in this table includes undergraduate enrollment, percent acceptance, average freshman SAT and ACT scores, and institutional HSI designation. These five universities were chosen from the 12 Florida State universities, based on similar freshman SAT and ACT scores, percent acceptance and HSI designation.

Table 11

Institutional Summary of Enrollment Data

Institution	Enrollment	Acceptance	Average Freshman SAT Score	Average Freshman ACT Score	HSI
UWF	13,000	42%	1165	25	No
FGCU	15,000	65%	1135	23	No
UCF	68,000	43%	1250	27	Yes
FAU	30,000	60%	1160	23	Yes
FIU	55,000	54%	1175	25	Yes

Note. Data retrieved from SUSF, 2018a; 2018b; 2019; 2019a0 & NCES 2018; 2018a; 2019; 2019a; 2019b

Population and Participants

A *population* is a statistical term used to denote the entire group being studied (Fowler, 2009; Sapsford, 2007). The population of this study will be Florida State University students who earned a grade in General Chemistry I or Calculus I. The participants will be undergraduate

students who earned a grade in the designated STEM gateway courses at UWF, FGCU, UCF, FAU, or FIU between 2014 to 2018.

Sample

A *sample* is a small group of the population that closely resembles the population to be studied (Fowler, 2009; Sapsford, 2007). Data requests for two sets of data will be made to UWF, FGCU, UCF, FAU, and FIU to acquire a random sample of the population. The first data request will be for a random sample of grades earned between 2014 and 2018 in General Chemistry I by 150 White and 150 Hispanic students. The second set of data will be for a random sample of grades earned between 2014 and 2018 in Calculus I by 150 White and 150 Hispanic students. Both appeals will request student ethnicity and numerical course grade. This study is not splitting the data by gender, so it will not request such information.

Sampling Techniques

Purposive sampling will be used, which relies on the researcher's knowledge or expertise within the field (Groves, 2011) to select the sample of the population that will yield the most information about the characteristic of interest (Guarte & Barrios, 2006). In this study, this sampling technique is quasi-random since the population is already grouped because of the *ex post facto* research model explained previously (Salkind, 2010).

More specifically, homogeneous purposive sampling will be used in this study as is appropriate when the main goal of the research is to focus on a characteristic of a specific group of interest (Laerd, 2012). The researcher for this study is a veteran STEM professor at a Hispanic Serving Institution. Based on her academic and professional credentials, skills,

research, and experience, she is well-informed regarding the area of STEM and Hispanic student success in higher education.

Data Collection Methods

Data will be queried from UWF, FGCU, UCF, FAU, and FIU's offices of institutional research. Data will be retrieved from the university's student databases, SAS, using a SQL. The data will be formatted in an Excel spreadsheet that has columns for ethnicity and numerical course grade.

Procedure

The researcher requested the data from the Directors of Institutional Research from UWF, FGCU, UCF, FAU, and FIU in the Fall 2019 term. First, the researcher sent an introductory email to the respective directors, requesting the data (APPENDIX A). Second, the researcher sent a thank-you email after the responses were received from the institutions (APPENDIX B). Finally, the researcher wrote a reminder email to send if the requested data was not received within two weeks (APPENDIX C).

Instrumentation

The researcher will input the raw data into SPSS for statistical analysis. For Research Questions One and Two, the researcher chose to use independent t-tests since the goal was to examine if there was a mean difference between two independent groups in which the measurement level for the dependent variable (course grade) is interval in scale, and the independent variable of ethnicity is nominal in scale (Lomax & Hahs-Vaughn, 2012).

The independent t-test is based on the assumptions of normality, homogeneity of variance, and the independence of the observations (Stevens, 2007), although it has been reported that independent t-tests are robust and are not significantly affected by non-normality (Lomax & Hahs-Vaughn, 2012). Although Type I error cannot be eliminated from the results of independent t-tests, the odds of rejecting the null hypothesis when it is in fact true, can be minimized by setting the level of significance (α) to .05 (Stevens, 2007). In this study there will be a five percent chance of Type I error occurring.

For Research Questions Three and Four, an ANOVA test will be used since the goal will be to examine whether there is a mean difference between five independent groups in which the measurement level for the dependent variable (course grade) is interval in scale and the independent variable of institutional type is nominal in scale (Lomax & Hahs-Vaughn, 2012). The ANOVA test is based on the assumptions of normality, homogeneity of variance, and the independence of the observations (Stevens, 2007). When using ANOVA tests, Type I error cannot be eliminated, but the odds of rejecting the null hypothesis, when it is in fact true, can be minimized by setting the level of significance (α) to .05 (Stevens, 2007). In this study there will be a five percent chance of Type I error occurring.

Reliability and Validity

Although the independent t-test has been studied extensively and is a robust statistical analysis (Lomax & Hahs-Vaughn, 2012), there are six assumptions that data must adhere to in order to produce a valid result (Laerd, 2018). To adhere to the six assumptions, the dependent variable must be measured at the interval level on a continuous scale and illustrate normal distribution (Laerd, 2018). Other assumptions related to the t-test include homogeneity of

variance and the use of two independent groups, and the data cannot have significant outliers within the data set (Laerd, 2018).

Deviations from these six assumptions can lead to considerable type I and type II errors and nullify statistical results (Stevens, 2007). Fortunately, it is relatively simple to check data for the six assumptions, either by SPSS or by hand (Laerd, 2018). The analysis process for this study will include checking each assumption. If an assumption is violated, a different statistical analysis will be employed.

Although the ANOVA test has been studied extensively and is a robust statistical analysis, there are three assumptions that data must adhere to for a valid result to be produced (Laerd, 2018a). The three assumptions include normal distribution of the dependent variable, homogeneity of variance, and a lack of relationship between the observations of each group (Laerd, 2018).

Deviations from these three assumptions can lead to considerable Type I and Type II error and nullify statistical results (Stevens, 2007). Fortunately, it is relatively simple to check data for the three assumptions, either by SPSS or by hand (Laerd, 2018). The analysis process for this study will include checking each assumption. If an assumption is violated, a different statistical analysis will be employed.

ANOVA test results will indicate if there is an overall difference between the groups analyzed, but it will not indicate which groups differ (Stevens, 2007). If the ANOVA test confirms that there is an overall difference between the groups, a *post hoc* test will be needed to identify which groups differed (Laerd, 2018a). *Post hoc* tests are called *posteriori* tests, because they are performed after the study (Laerd, 2018a). Due to equivalent group sample sizes and

data adherence to normality, homogeneity of variance, and independence of observations, Tukey’s HSD *post hoc* test will be used in this study (Lomax & Hahs-Vaughn, 2012).

Alignment of Research Questions to Data Collection

Table 12 illustrates the research questions and corresponding sources of data that will be analyzed for this study.

Table 12

Research Questions and Source Information

Research Question	Source of Data
1. Is there a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research
2. Is there a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research
3. Is there a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research

4. Is there a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research
---	---

Analysis Methods

SPSS will be used to analyze the data collected for this study. Descriptive statistics, such as measures of central tendency and spread, will be used for all research questions; see Table 13 (page 76) (Laerd, 2018b).

The inferential statistic used in Research Question One and Two will be the independent t-test. According to Laerd (2018), an independent t-test is used when the dependent variable is measured on a continuous scale, the independent variable is comprised of two independent groups, the dependent variable is normally distributed, and there is a homogeneity of variance. For Research Question One and Two, the dependent variable will be overall course grades in General Chemistry I and Calculus I, and the independent variable will be ethnicity.

The inferential statistic used in Research Question Three and Four will be the ANOVA test. According to Laerd (2018a), an ANOVA test is used when the dependent variable is normally distributed, the independent variable is comprised of three or more independent groups, and there is a homogeneity of variance. For Research Question Three and Four, the dependent variable will be overall course grades in General Chemistry I and Calculus I, and the independent variable will be the type of institution attended (HSI or non-HSI).

Table 13

Data Analysis Distribution of Research Questions

Research Question	Source of Data	Analysis
1. Is there a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research	Descriptive statistics & Independent t-test
2. Is there a statistically significant difference in mean Calculus I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research	Descriptive statistics & Independent t-test
3. Is there a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University Offices of Institutional Research	Descriptive statistics, ANOVA test, & Tukey's HSD
4. Is there a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida,	University of West Florida, Florida Gulf Coast University, University of Central Florida,	Descriptive statistics, ANOVA test,

Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida International University?	Florida International University, and Florida International University Offices of Institutional Research	& Tukey's HSD
---	--	---------------

Limitations and Delimitations of the Study

There are several types of threats to the validity of any research project, which can be grouped into two main categories: external and internal threats (Creswell, 2014). The external threats, referred to as limitations, consist of aspects of the research that are not under the control of the researcher (BCPS, 2017; Creswell, 2014; Lomax & Hahs-Vaughn, 2012). Some common limitations are instruments used, time constraints, the sample, and the nature of the reporting (BCPS, 2017; Creswell, 2014; Lomax & Hahs-Vaughn, 2012). Within this study, the researcher will try to mitigate the limitations of the sample. The five universities, University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida International University, and Florida Atlantic University were chosen based on similar acceptance rates, freshman SAT and ACT scores, and student enrollment. While similar freshman class academic achievement was used as a basis for the choice of universities, there could be unexpected variations between the student populations that could affect the results of the study. Another limitation that was encountered when selecting the universities was that two universities had to have a federal HSI designation, while two could not. This criterion limited the number of possible universities that could be used for this study.

The internal threats, termed delimitations, consist of aspects of the research that are under the control of the researcher (BCPS, 2017; Creswell, 2014; Lomax & Hahs-Vaughn, 2012). Some common delimitations are the boundaries set by the researcher, regarding what and who is

being studied and the methods chosen (BCPS, 2017; Creswell, 2014; Lomax & Hahs-Vaughn, 2012). Purposive sampling will be used in this study to gain knowledge of a very particular group of students-State of Florida university undergraduate students who earned a grade in General Chemistry I or Calculus I. This type of sampling relies on the researcher's knowledge within the field being studied (Groves, 2011). This type of sampling is considered quasi-random due to the *ex post facto* research model (Salkind, 2010).

Results from this study will not be able to be generalized beyond the State of Florida University System. They should, instead, be used as a genesis for the pursuit of future studies. As previously stated, Florida has a very diverse population and student body, a significant number of HSIs, and the results of this study will be unique to the Florida higher education system.

CHAPTER FOUR: FINDINGS

Sample Description

The researcher requested data between the years of 2014-2018 from the departments of institutional research at the University of West Florida (UWF), Florida Gulf Coast University (FGCU), University of Central Florida (UCF), Florida Atlantic University (FAU), and Florida International University (FIU). Each university supplied two sets of data; a sample of 150 White and 150 Hispanic students who earned a grade in General Chemistry I (CHM 2045), and a sample of 150 White and 150 Hispanic students who earned a grade in Calculus I (MAC 2311). The data sets included course number (CHM 2045 or MAC 2311), ethnicity (White or Hispanic), and course letter grade.

Research Question One, which examined the statistical significance in mean CHM 2045 grades between White and Hispanic students at UWF, FGCU, UCF, FAU, and FIU, included four inferential statistical analyses. Owing to the non-parametric nature of the dependent variable, the researcher performed Mann-Whitney U tests in lieu of independent t-tests to determine statistical significance in mean CHM 2045 grades based on ethnicity. For each Mann-Whitney U test, the researcher used 150 White and 150 Hispanic students for a total sample size of 300 students.

Research Question Two, which examined the statistical significance in mean MAC 2311 grades between White and Hispanic students at the five universities, included four inferential statistical analyses. Owing to the non-parametric nature of the dependent variable, the researcher performed Mann-Whitney U tests in lieu of independent t-tests to determine statistical significance

in mean MAC 2311 grades based on ethnicity. For each Mann-Whitney U test, the researcher used 150 White and 150 Hispanic students for a total sample size of 300 students.

As stated in Chapter Three, Laerd addressed the six assumptions that data must adhere to for independent t-test and Mann-Whitney U test results to be valid (2018). Table 14 displays the assumptions, corresponding data characteristics and the tests that are used, and finally the results or plan to adhere to the assumptions.

Table 14

Assumptions for Research Questions One and Two

Assumption	Data	Result
Dependent variable measured at the interval level.	Numerical grade data is measured at the interval level.	Assumption met
Dependent variable must be measured on a continuous scale.	Numerical grade data is measured on a continuous scale.	Assumption met
Dependent variable must have normal distribution.	Numerical grade data will be analyzed using descriptive statistics for normality.	If data has normal distribution–independent t-test will be used. If data has skewed distribution–Mann-Whitney U test will be used.
Comparison groups must have homogeneity of variance.	Numerical grade data will be analyzed using Levene’s test of equality of variance.	If data adheres to homogeneity of variance–independent t-test will be used. If data does not adhere to homogeneity of variance–Mann-Whitney U test will be used.
Two independent groups must be used.	Groups used are independent.	Assumption met
Data cannot include significant outliers.	Numerical grade data will be analyzed using Q-Q and box plots.	If significant outliers exist, they will be omitted.

Research Question Three, determined whether there was a statistically significant difference among the five universities in mean CHM 2045 grades among Hispanic students, included two inferential statistical analyses. Due to the non-parametric nature of the dependent variable, the researcher performed a Kruskal-Wallis test in lieu of an ANOVA, to determine statistical significance in mean CHM 2045 grades as a function of the university the students attended. The researcher implemented a subsequent pairwise comparison to ascertain which of the CHM 2045 grades differed significantly based on the university the students attended.

As stated in Chapter Three, Laerd addressed the assumptions data must adhere to for ANOVA or Kruskal-Wallis test results to be valid (2018). Table 15 displays the assumptions, corresponding data characteristics and tests that are used, and finally the results or plan to adhere to the assumptions.

Table 15
Assumptions for Research Questions Three and Four

Assumption	Data	Result
Dependent variable must have normal distribution.	Numerical grade data will be analyzed using descriptive statistics for normality.	If data has normal distribution–ANOVA and Tukey’s HSD will be used. If data has skewed distribution–Kruskal-Wallis test will be used with a subsequent pairwise comparison.
Comparison groups must have homogeneity of variance.	Numerical grade data will be analyzed using Levene’s test of equality of variance.	If data adheres to homogeneity of variance–ANOVA and Tukey’s HSD will be used. If data does not adhere to homogeneity of variance–Kruskal-Wallis test will be used with a subsequent pairwise comparison.
Two independent groups must be used.	Groups used are independent.	Assumption met

Research Question Four, which explored the statistical significance in mean MAC 2311 grades between Hispanic students at UWF, FGCU, UCF, FAU, and FIU, included two inferential statistical analyses. Due to the non-parametric nature of the dependent variable, the researcher performed a Kruskal-Wallis test in lieu of an ANOVA, to determine the statistical significance in mean MAC 2311 grades as a function of the university attended by the students. Due to the non-parametric nature of the dependent variable, a Kruskal-Wallis test was used to determine the statistical significance in mean MAC 2311 grades based on the university. A subsequent pairwise comparison was used to ascertain which of the MAC 2311 grades differed significantly by university.

As stated in Chapter Three, Laerd addressed the assumptions that data must adhere to for ANOVA or Kruskal-Wallis test results to be valid (2018). Table 15 displays the assumptions, corresponding data characteristics and tests used, and finally the results or plan to adhere to the assumptions.

Research Question One

The first research question of this investigation is: *Is there a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University?* The investigation will examine the following null and alternative hypothesis. The null hypothesis is—there will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the five universities. The alternative hypothesis is—there

will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at each of the five universities.

University of West Florida

For the results of an independent t-test to be valid, six assumptions must be met as seen in Table 14 (page 80). Note that the dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 3, page 84). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 3, page 84), where the skewness is -.370 with a standard error of .141 and the kurtosis is -.843 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .694$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid, the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

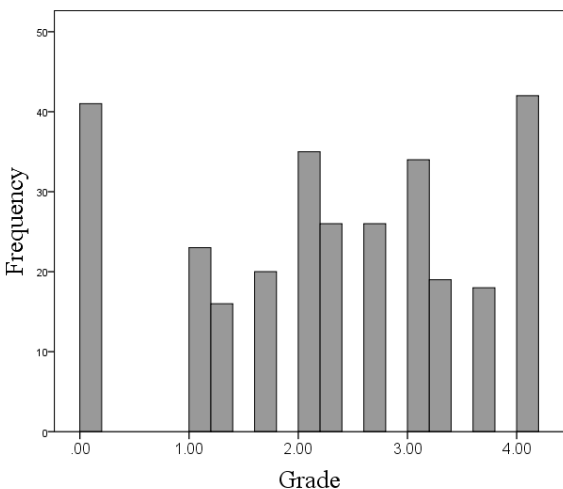


Figure 3. Histogram of dependent variable for Research Question One, UWF

As seen in Table 16, the mean course grade for White students in General Chemistry I is 2.3957 with a standard deviation of 1.27364, and the mean for Hispanic students is 2.1177 with a standard deviation of 1.24083.

Table 16

Group Statistics for Research Question One, UWF

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.3957	1.27364	.10399	160.33
Hispanic	150	2.1177	1.24083	.10131	140.67

The Mann-Whitney U test results reveal that there is a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .049$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is less than .05, the difference in means is statistically significant and therefore the null hypothesis must be rejected

(2012). The effect size for this statistical analysis is .11 and, as stated by Cohen, is a small effect size (1988). The effect size resulted in a power of .50, or a 50% chance of finding a difference when one is present.

The researcher must reject the null hypothesis (H_0 = There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at UWF) and fail to reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at UWF). As seen in Table 16 (page 84), White students earned statistically significant higher grades with a mean of 2.3957 (mean rank of 160.33) compared to Hispanic students who earned a mean of 2.1177 (mean rank of 140.67) in CHM 2045 at UWF.

Florida Gulf Coast University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 4, page 86). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 4, page 86), where the skewness is -.383 with a standard error of .161 and the kurtosis is -.633 with a standard error of .320. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality

of variance resulted in a p value of less than .05 ($p = .044$), which Lomax and Hahs-Vaughn indicate represents non-homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

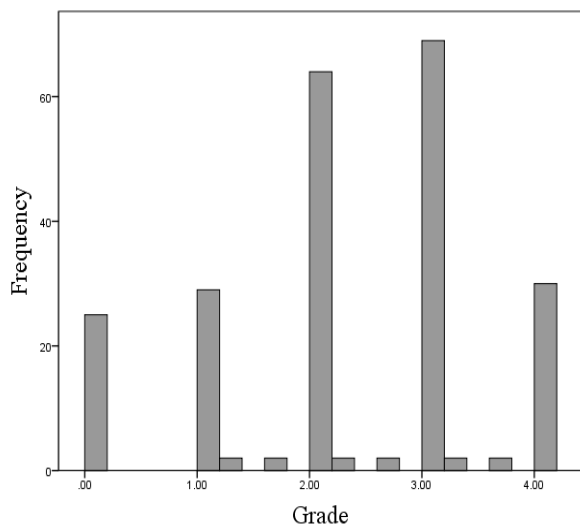


Figure 4. Histogram of dependent variable for Research Question One, FGCU

As seen in Table 17 (page 87), the mean course grade for White students in General Chemistry I is 2.4175 with a standard deviation of 1.24149, and the mean for Hispanic students is 2.0929 with a standard deviation of 1.09947.

Table 17

Group Statistics for Research Question One, FGCU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	107	2.4175	1.24149	.12002	125.14
Hispanic	122	2.0929	1.09947	.09954	106.11

The Mann-Whitney U test results reveal that there is a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .026$) in CHM 2045. As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is less than .05, the difference in means is statistically significant and therefore the null hypothesis must be rejected (2012). The effect size for this statistical analysis is .15 and, as stated by Cohen, is a small effect size (1988). The effect size resulted in a power of .55, or a 55% chance of finding a difference when one is present.

The researcher must reject the null hypothesis ($H_0 =$ There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FGCU) and fail to reject the alternative hypothesis ($H_a =$ There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FGCU). As seen in Table 17, White students earned higher grades that are statistically significant, with a mean of 2.4175 (mean rank of 125.14) compared to Hispanic students who earned a mean of 2.0929 (mean rank of 106.11) in CHM 2045 at FGCU.

University of Central Florida

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of dependent variable (Figure 5, page 89). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 5, page 89), where the skewness is -.295 with a standard error of .141 and the kurtosis is -.867 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .507$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid, the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

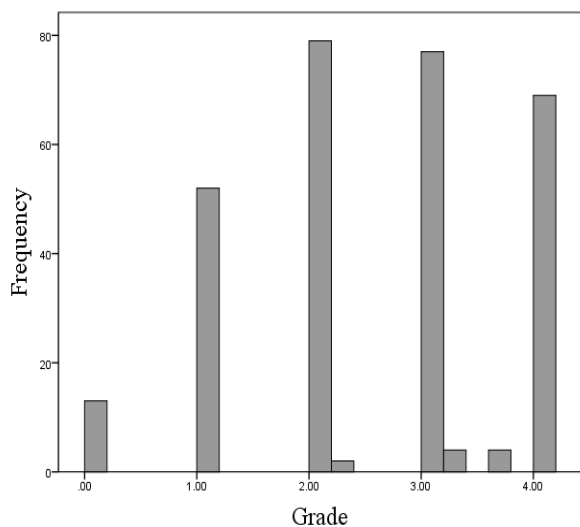


Figure 5. Histogram of dependent variable for Research Question One, UCF

As seen in Table 18, the mean course grade for White students in General Chemistry I is 2.6489 with a standard deviation of 1.12975, and the mean for Hispanic students is 2.3489 with a standard deviation of 1.16971.

Table 18

Group Statistics for Research Question One, UCF

Ethnicity	N	Mean Grade	Std. Deviation	Std. Error Mean	Mean Rank
White	150	2.6489	1.12975	.09224	161.62
Hispanic	150	2.3489	1.16971	.09551	139.38

The Mann-Whitney U test results illustrate that there is a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .023$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is less than .05, the difference in means is statistically significant and therefore the null hypothesis must be

rejected (2012). The effect size for this statistical analysis is .13 and, as stated by Cohen, is a small effect size (1988). The effect size resulted in a power of .62, or a 62% chance of finding a difference when one is present.

The researcher must reject the null hypothesis (H_0 = There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at UCF) and fail to reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at UCF). As seen in Table 18 (page 89), White students earned higher grades that are statistically significant, with a mean of 2.6489 (mean rank of 161.62), compared to Hispanic students who earned a mean of 2.3489 (mean rank of 139.38) in CHM 2045 at UCF.

Florida Atlantic University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 6, page 91). The Shapiro-Wilk test of normality resulted in a p value of .000 and, as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 6, page 91), where the skewness is -1.078 with a standard error of .141, and the kurtosis is -.121 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is more extreme than a normal distribution (2012). The Levene's test for

equality of variance resulted in a p value of less than .05 ($p = .022$), which Lomax and Hahs-Vaughn indicate represents non-homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid, the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

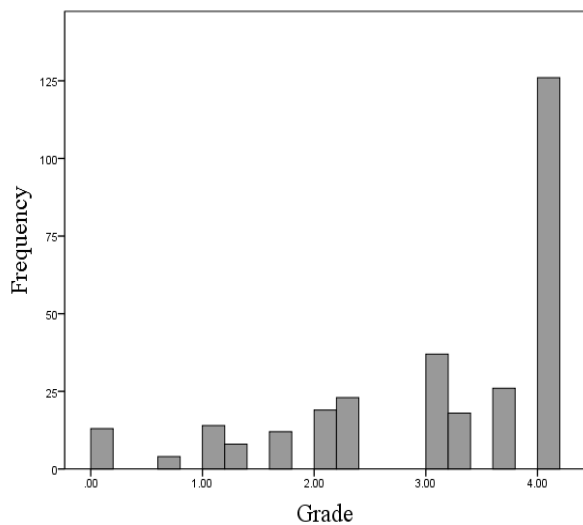


Figure 6. Histogram of dependent variable for Research Question One, FAU

As seen in Table 19 (page 92), the mean course grade for White students in General Chemistry I is 3.1332 with a standard deviation of 1.07243, and the mean for Hispanic students is 2.9289 with a standard deviation of 1.24896.

Table 19

Group Statistics for Research Question One, FAU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	3.1332	1.07243	.08756	156.19
Hispanic	150	2.9289	1.24896	.10198	144.81

The Mann-Whitney U test results demonstrate that there is no statistically significant difference in mean course grades earned by Hispanic and White students ($p = .237$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is greater than .05, the difference in means is not statistically significant and therefore the null hypothesis must not be rejected (2012). The effect size for this statistical analysis is .068 and, as stated by Cohen, is a negligible effect size (1988). The effect size resulted in a power of .33, or a 33% chance of finding a difference when one is present.

The researcher must fail to reject the null hypothesis ($H_0 =$ There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FIU) and reject the alternative hypothesis ($H_a =$ There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FIU). As seen in Table 19, White students earned slightly higher grades with a mean of 3.1332 (mean rank of 156.19) compared to Hispanic students who earned a mean of 2.9289 (mean rank of 144.81) in CHM 2045 at FAU.

Florida International University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as seen in the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 7, page 94). The Shapiro-Wilk test of normality resulted in a p value of .000 and, as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 7, page 94), where the skewness is $-.784$ with a standard error of $.141$ and the kurtosis is $-.005$ with a standard error of $.281$. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .833$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

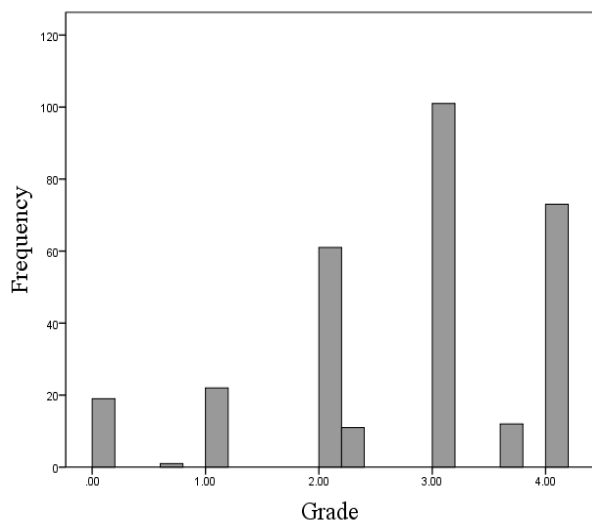


Figure 7. Histogram of dependent variable for Research Question One, FIU

As seen in Table 20, the mean course grade for White students in General Chemistry I is 2.7778 with a standard deviation of 1.11790, and the mean for Hispanic students is 2.6178 with a standard deviation of 1.13879.

Table 20

Group Statistics for Research Question One, FIU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.7778	1.11790	.09128	156.49
Hispanic	150	2.6178	1.13879	.09298	144.51

The Mann-Whitney U test results demonstrate that there is no statistically significant difference in mean course grades earned by Hispanic and White students ($p = .217$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is greater than .05, the difference in means is not statistically significant and therefore the null hypothesis must

not be rejected (2012). The effect size for this statistical analysis is .071 and, as stated by Cohen, is a negligible effect size (1988). The effect size resulted in a power of .23, or a 23% chance of finding a difference when one is present.

The researcher must fail to reject the null hypothesis (H_0 = There will be no statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FIU) and reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean General Chemistry I grades between Hispanic and White students at FIU). As seen in Table 20 (page 94), White students earned slightly higher grades with a mean of 2.778 (mean rank of 156.49) compared to Hispanic students who earned a mean of 2.6178 (mean rank of 144.51) in CHM 2045 at FIU.

Research Question Two

The second research question of this study is: *Is there a statistically significant difference in mean Calculus I grades between Hispanic and Caucasian students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University?* The investigation will examine the following null and alternative hypothesis. The null hypothesis—there will be no statistically significant difference in mean Calculus I grades between Hispanic and Caucasian students at each of the following universities: University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University. The alternative hypothesis is—there will be a statistically significant difference in mean Calculus I grades between Hispanic and Caucasian students at each of the universities.

University of West Florida

For the results of an independent t-test to be valid six assumptions must be met, as seen in Table 14 (page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 8, page 97). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 8, page 97) where the skewness is -.478 with a standard error of .141 and the kurtosis is -.750 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .938$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

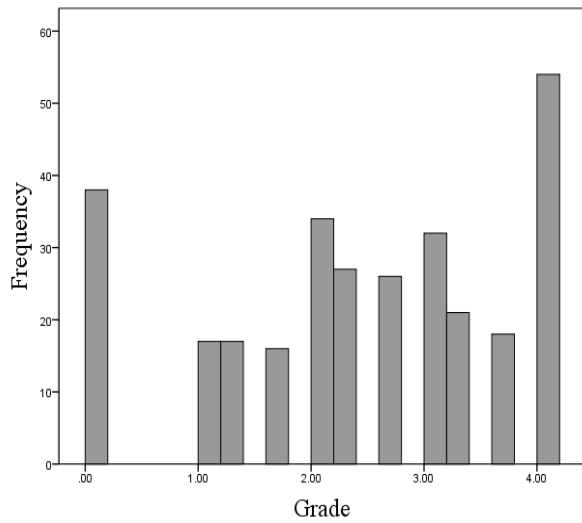


Figure 8. Histogram of dependent variable for Research Question Two, UWF

As seen in Table 21, the mean course grade for White students in Calculus I is 2.6329 with a standard deviation of 1.24366, and the mean for Hispanic students is 2.1288 with a standard deviation of 1.25391.

Table 21

Group Statistics for Research Question Two, UWF

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.6329	1.24366	.10154	168.25
Hispanic	150	2.1288	1.25391	.10238	132.75

The Mann-Whitney U test results illustrate that there is a statistically significant difference in mean course grades earned by Hispanic and White students ($p = 3.6 \times 10^{-4}$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is less than .05, the difference in means is statistically significant and therefore the null hypothesis must

be rejected (2012). The effect size for this statistical analysis is .21 and, as stated by Cohen, is a small effect size (1988). The effect size resulted in a power of .99, or a 99% chance of finding a difference when one is present.

The researcher must reject the null hypothesis (H_0 = There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at UWF) and fail to reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at UWF). As seen in Table 21 (page 97), White students earned statistically significant higher grades with a mean of 2.6329 (mean rank of 168.25) compared to Hispanic students who earned a mean of 2.1288 (mean rank of 132.75) in MAC 2311 at UWF.

Florida Gulf Coast University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 9, page 99). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 9, page 99) where the skewness is -.542 with a standard error of .150 and the kurtosis is -.746 with a standard error of .299. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality

of variance resulted in a p value of more than .05 ($p = .658$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

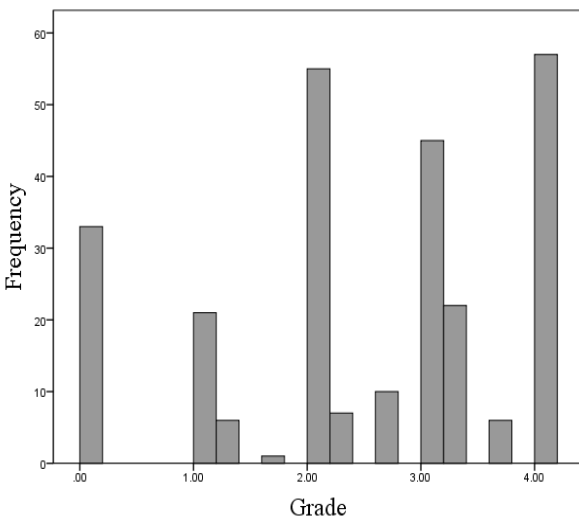


Figure 9. Histogram of dependent variable for Research Question Two, FGCU

As seen in Table 22 (page 100), the mean course grade for White students in Calculus I is 2.6437 with a standard deviation of 1.29669, and the mean for Hispanic students is 2.2364 with a standard deviation of 1.26315.

Table 22

Group Statistics for Research Question Two, FGCU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	132	2.6437	1.29669	.11286	145.12
Hispanic	131	2.2364	1.26315	.11036	118.78

The Mann-Whitney U test results demonstrate that there is a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .004$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is less than .05, the difference in means is statistically significant and therefore the null hypothesis must be rejected (2012). The effect size for this statistical analysis is .18 and, as stated by Cohen, is a small effect size (1988). The effect size resulted in a power of .73, or a 73% chance of finding a difference when one is present.

The researcher must reject the null hypothesis ($H_0 =$ There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at FGCU) and fail to reject the alternative hypothesis ($H_a =$ There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at FGCU). As seen in Table 22, White students earned statistically significant higher grades with a mean of 2.6437 (mean rank of 145.12) compared to Hispanic students who earned a mean of 2.2364 (mean rank of 118.78) in MAC 2311at FGCU.

University of Central Florida

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of dependent variable (Figure 10, page 102). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 10, page 102) where the skewness is -.630 with a standard error of .141 and the kurtosis is -.615 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .658$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

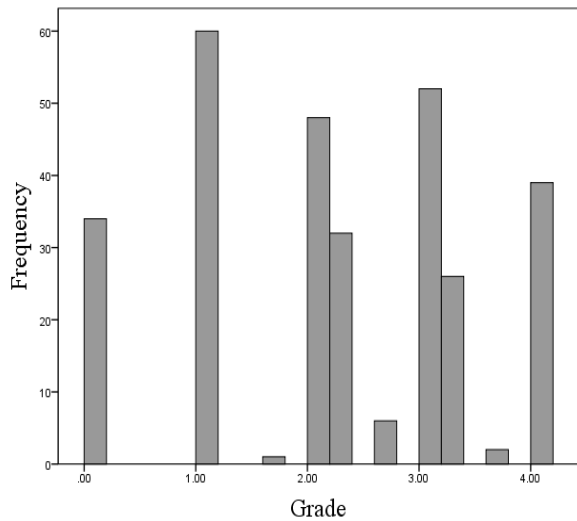


Figure 10. Histogram of dependent variable for Research Question Two, UCF

As seen in Table 23, the mean course grade for White students in Calculus I is 2.1439 with a standard deviation of 1.19593, and the mean for Hispanic students is 2.2172 with a standard deviation of 1.26535.

Table 23

Group Statistics for Research Question Two, UCF

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.1439	1.19593	.09765	147.34
Hispanic	150	2.2172	1.26535	.10332	153.66

The Mann-Whitney U test results demonstrate that there is not a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .524$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is greater than .05, the difference in means is not statistically significant and therefore the null hypothesis

must not be rejected (2012). The effect size for this statistical analysis is .037 and, as stated by Cohen, is a negligible effect size (1988). The effect size resulted in a power of .081, or an 8.1% chance of finding a difference when one is present.

The researcher must fail to reject the null hypothesis (H_0 = There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at UCF) and reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at UCF). As seen in Table 23 (page 102), Hispanic students earned slightly higher grades with a mean of 2.2172 (mean rank of 153.66) compared to White students who earned a mean of 2.1439 (mean rank of 147.34) in MAC 2311 at UCF.

Florida Atlantic University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 11, page 104). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 11, page 104), where the skewness is -.383 with a standard error of .141 and the kurtosis is -1.081 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012).

The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .347$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

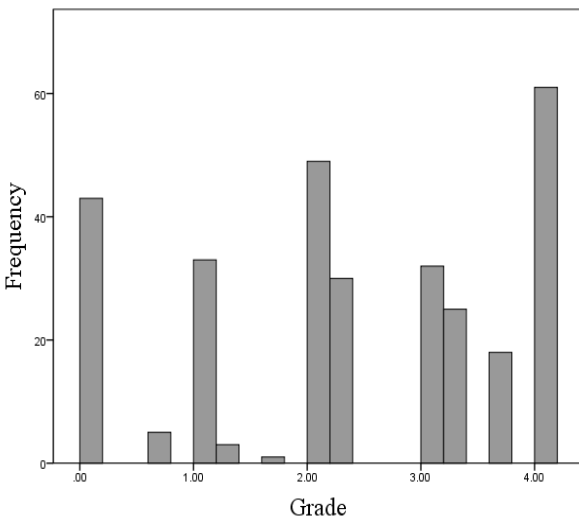


Figure 11. Histogram of dependent variable for Research Question Two, FAU

As seen in Table 24 (page 105), the mean course grade for White students in Calculus I is 2.4018 with a standard deviation of 1.33127, and the mean for Hispanic students is 2.2597 with a standard deviation of 1.39652.

Table 24

Group Statistics for Research Question Two, FAU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.4018	1.33127	.10870	154.77
Hispanic	150	2.2597	1.39652	.11403	146.23

The Mann-Whitney U test results illustrate that there is not a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .389$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is greater than .05, the difference in means is not statistically significant and therefore the null hypothesis must not be rejected (2012). The effect size for this statistical analysis is .050 and, as stated by Cohen, is a negligible effect size (1988). The effect size resulted in a power of .15, or a 15% chance of finding a difference when one is present.

The researcher must fail to reject the null hypothesis ($H_0 =$ There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at FAU) and reject the alternative hypothesis ($H_a =$ There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at FAU). As seen in Table 24, White students earned slightly higher grades with a mean of 2.4018 (mean rank of 154.77) compared to Hispanic students who earned a mean of 2.2597 (mean rank of 146.23) in MAC 2311 at FAU.

Florida International University

Again, for the results of an independent t-test to be valid, six assumptions must be met (Table 14, page 80). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 12, page 107). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 12, page 107), where the skewness is -.269 with a standard error of .141 and the kurtosis is -1.198 with a standard error of .281. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .267$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

The Mann-Whitney U test is a non-parametric analog of the parametric independent t-test and therefore has fewer assumptions to which it must adhere. For Mann-Whitney U test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 14 (page 80) have been met.

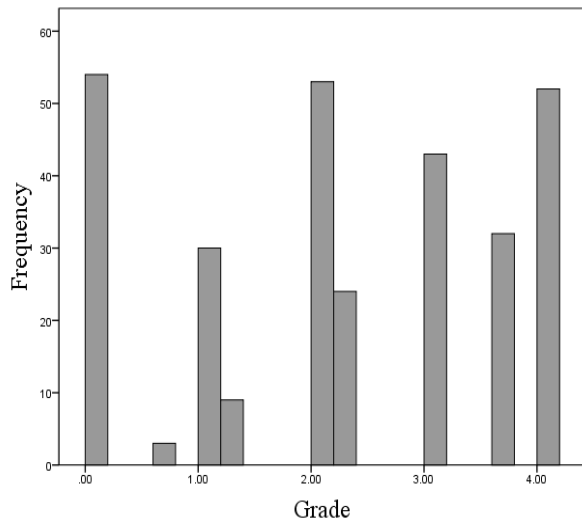


Figure 12. Histogram of dependent variable for Research Question Two, FIU

As seen in Table 25, the mean course grade for White students in Calculus I is 2.3088 with a standard deviation of 1.44332, and the mean for Hispanic students is 2.0935 with a standard deviation of 1.35160.

Table 25

Group Statistics for Research Question Two, FIU

Ethnicity	N	Mean Grade	Standard Deviation	Standard Error Mean	Mean Rank
White	150	2.3088	1.44332	.11785	158.63
Hispanic	150	2.0935	1.35160	.11036	142.37

The Mann-Whitney U test results illustrate that there is not a statistically significant difference in mean course grades earned by Hispanic and White students ($p = .101$). As stated by Lomax and Hahs-Vaughn, when the resulting p value in a Mann-Whitney U test is greater than .05, the difference in means is not statistically significant and therefore the null hypothesis

must not be rejected (2012). The effect size for this statistical analysis is .095 and, as stated by Cohen, is a negligible effect size (1988). The effect size resulted in a power of .27, or a 27% chance of finding a difference when one is present.

The researcher must fail to reject the null hypothesis (H_0 = There will be no statistically significant difference in mean Calculus I grades between Hispanic and White students at FIU) and reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean Calculus I grades between Hispanic and White students at FIU). As seen in Table 25 (page 107), White students earned slightly higher grades with a mean of 2.3088 (mean rank of 158.63) compared to Hispanic students who earned a mean of 2.0935 (mean rank of 142.37) in MAC 2311 at FIU.

Research Question Three

The third research question of this study is: *Is there a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University?* The null hypothesis is—there will be no statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University. The alternative hypothesis is—there will be a statistically significant difference in mean General Chemistry I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University.

For the results of an ANOVA to be valid three assumptions must be met, as seen in Table 15 (page 81). The dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 13). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 13), where the skewness is $-.444$ with a standard error of $.091$ and the kurtosis is $-.739$ with a standard error of $.182$. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .126$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

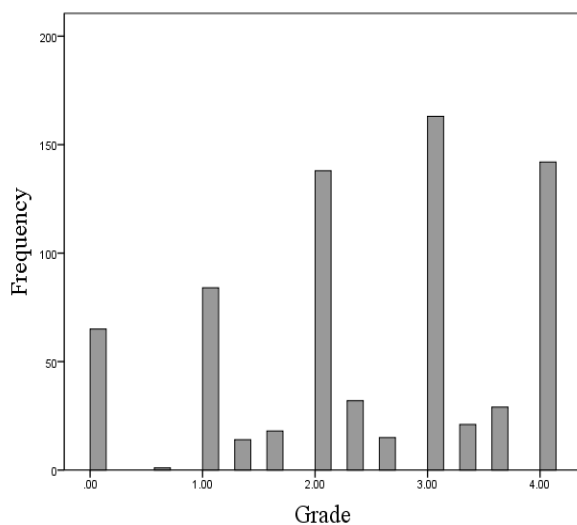


Figure 13. Histogram of dependent variable for Research Question Three

The Kruskal-Wallis test is a non-parametric analog of the parametric ANOVA and therefore has fewer assumptions to which it must adhere. For Kruskal-Wallis test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 15 (page 81) have been met.

As seen in Table 26, the mean for course grades for Hispanic students in General Chemistry I are 2.1177, 2.0929, 2.3489, 2.9289, and 2.6178 for UWF, FGCU, UCF, FAU, and FIU respectively. The mean rank for course grades for Hispanic students in general chemistry I are 309.21, 298.50, 341.91, 453.92, and 392.20 for UWF, FGCU, UCF, FAU, and FIU respectively.

Table 26

Group Statistics for Research Question Three

University	N	Mean	Mean Rank
UWF	150	2.1177	309.21
FGCU	122	2.0929	298.50
UCF	150	2.3489	341.91
FAU	150	2.9289	453.92
FIU	150	2.6178	392.20

The Kruskal-Wallis test results illustrate that there is a statistically significant difference in mean CHM 2045 course grades earned by Hispanic students attending UWF, FGCU, UCF, FAU, and FIU ($p = 1.82 \times 10^{-11}$). As stated by Lomax and Hahs-Vaughn, if the resulting p value

in a Kruskal-Wallis test is less than .05 there is a statistically significant difference in means and the null hypothesis must be rejected (2012). The effect size resulted in a power of 1.00, or a 100% chance of finding a difference when one is present.

The researcher must reject the null hypothesis (H_0 = There will be no statistically significant difference in mean General Chemistry I grades between Hispanic students at UWF, FGCU, UCF, FAU, and FIU) and fail to reject the alternative hypothesis (H_a = There will be a statistically significant difference in mean General Chemistry I grades between Hispanic students at UWF, FGCU, UCF, FAU, and FIU).

As seen in the pairwise comparison table (Table 27, page 112), there is a statistically significant difference in mean CHM 2045 grades between Hispanic students attending FIU and UWF ($p = .005$), FIU and FGCU ($p = .002$), FAU and UWF ($p = .000$), FAU and FGCU ($p = .000$), and FAU and UCF ($p = .000$). The relative effect sizes are .20, .23, .35, .38, and .27 for FIU and UWF, FIU and FGCU, FAU and UWF, FAU and FGCU, and FAU and UCF pairwise comparisons respectively. As stated by Cohen, effect sizes between .20 and .39 demonstrate small effect sizes (1988).

As seen in Table 26 (page 110) and 27 (page 112), the students that attended FIU earned statistically significant higher grades than the students attending UWF and FGCU in CHM 2045. As seen in Table 26 (page 110) and 27 (page 112), the students at FAU earned statistically significant higher grades than the students attending UWF, FGCU, and UCF. There is not a statistically significant difference in mean CHM 2045 grades earned by Hispanic students in a comparison of UWF and FGCU, UWF and UCF, FGCU and UCF, UCF and FIU, and FIU and FAU (Table 27, page 112).

Table 27

Pairwise Comparison Results for Research Question Three

Sample	Test Statistic	Standard Error	Standard Test Statistic	Significance	Adjusted Significance	Effect Size
UWF-FGCU	10.711	25.061	.427	.669	1.000	.026
UWF-FAU	-144.717	23.736	-6.097	.000	.000	.35
UWF-FIU	-82.997	23.736	-3.497	.000	.005	.20
UWF-UCF	-32.703	23.736	-1.378	.168	1.000	.080
FGCU-FAU	-155.427	25.061	-6.202	.000	.000	.38
FGCU-FIU	-93.707	25.061	-3.739	.000	.002	.23
FGCU-UCF	-43.414	25.061	-1.732	.083	.832	.11
UCF-FAU	-112.013	23.736	-4.719	.000	.000	.27
UCF-FIU	-50.293	23.736	-2.119	.034	.341	.12
FAU-FIU	61.720	23.736	2.600	.009	.093	.15

Research Question Four

The fourth research question of this study is: *Is there a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University?* The null hypothesis is—there will be no statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida

International University. The alternative hypothesis is—there will be a statistically significant difference in mean Calculus I grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University.

For the results of an ANOVA to be valid three assumptions must be met, as seen in Table 15 (page 81). Note that the dependent variable, the course grade, is not normally distributed (non-parametric) as demonstrated by the Shapiro-Wilk test of normality and the histogram of the dependent variable (Figure 14, page 114). The Shapiro-Wilk test of normality resulted in a p value of .000, and as asserted by Lomax and Hahs-Vaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2012). A visual inspection of the histogram of the dependent variable further illustrates the non-normal distribution (Figure 14, page 114), where the skewness is -.286 with a standard error of .090 and the kurtosis is -1.032 with a standard error of .181. As described by Lomax and Hahs-Vaughn, negative values for skewness and kurtosis indicate that the tail on the left side of the distribution is longer than normal distribution and the tail distribution is less extreme than a normal distribution (2012). The Levene's test for equality of variance resulted in a p value of more than .05 ($p = .225$), which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2012).

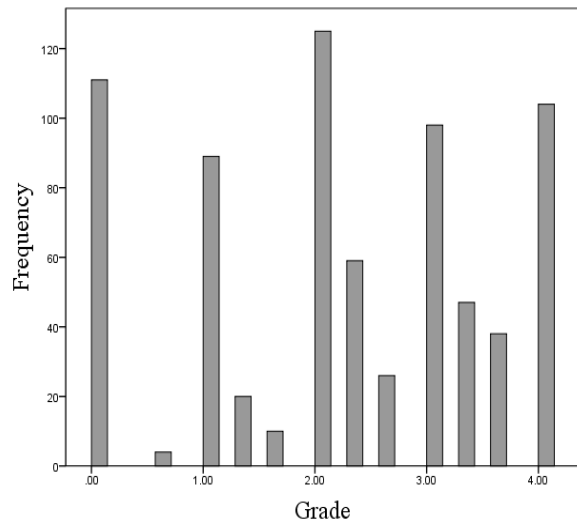


Figure 14. Histogram of dependent variable for Research Question Four

The Kruskal-Wallis test is a non-parametric analog of the parametric ANOVA and therefore has fewer assumptions to which it must adhere. For Kruskal-Wallis test results to be valid the samples must be independent of one another and randomly selected from the population. In addition, the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2012). The assumptions presented in Table 15 (page 81) have been met.

As seen in Table 28 (page 115), the mean for course grades for Hispanic students in Calculus I are 2.1288, 2.2364, 2.2172, 2.2597, and 2.0935 for UWF, FGCU, UCF, FAU, and FIU respectively. The mean rank for course grades for Hispanic students in Calculus I are 355.63, 371.51, 371.15, 381.40, and 351.00 for UWF, FGCU, UCF, FAU, and FIU respectively.

Table 28

Group Statistics for Research Question Four

University	N	Mean	Mean Rank
UWF	150	2.1288	355.63
FGCU	131	2.2364	371.51
UCF	150	2.2172	371.15
FAU	150	2.2597	381.40
FIU	150	2.0935	351.00

The Kruskal-Wallis test results illustrate that there is not a statistically significant difference in mean MAC 2311 course grades earned by Hispanic students attending UWF, FGCU, UCF, FAU, and FIU ($p = .712$). As stated by Lomax and Hahs-Vaughn, if the resulting p value in a Kruskal-Wallis test is more than .05 it signifies that there is not a statistically significant difference in means and the null hypothesis must not be rejected (2012).

The researcher must fail to reject the null hypothesis ($H_0 =$ There will be no statistically significant difference in mean Calculus I grades between Hispanic students at UWF, FGCU, UCF, FAU, and FIU) and reject the alternative hypothesis ($H_a =$ There will be a statistically significant difference in mean Calculus I grades between Hispanic students at UWF, FGCU, UCF, FAU, and FIU).

Summary

In this chapter, the researcher summarized the findings of the four research questions. Research Questions One and Two used SPSS to examine the statistical significance of ethnicity

on General Chemistry I and Calculus I grades using non-parametric Mann-Whitney U tests. Research Questions Three and Four used SPSS to examine the statistical significance of the university attended on the success of Hispanic students in General Chemistry I and Calculus I using non-parametric Kruskal-Wallis tests, and subsequent university comparisons. Chapter Five will include a discussion of the results, limitations, and recommendations for STEM faculty and administrators and for future research.

CHAPTER FIVE: CONCLUSION

Summary

In this quantitative research investigation, the researcher examined Hispanic student success in STEM gateway courses. The researcher accomplished this by comparing Hispanic student course grades in General Chemistry I (CHM 2045) and Calculus I (MAC 2311) to their White peers and comparing the grades as a function of the type of institution the students attended, HSI vs. non-HSI. Applying Latin Critical Theory (LatCrit), the researcher will discuss the possible causes and effects attending an HSI has on Hispanic student success in STEM gateway courses, CHM 2045 and MAC 2311.

Method Summary

The researcher completed this quantitative research investigation in the Fall 2019 semester. After the institutional review board approved this investigation, the researcher sent the email in Appendix A to the directors of institutional research at the five universities. The researcher used the data that was received from the directors of institutional research to answer the four research questions via descriptive and inferential statistics. Research Questions One and Two used Mann-Whitney U tests to determine if there is a statistically significant difference in mean CHM 2045 and MAC 2311 grades based on ethnicity (Hispanic vs. White). Research Questions Three and Four used Kruskal-Wallis tests and subsequent pairwise comparison tests to determine if there is a statistically significant difference in Hispanic student mean CHM 2045 and MAC 2311 grades based on the type of institution attended, HSI vs. non-HSI. The theoretical framework used in this investigation is the Latin Critical Theory.

Findings by Research Question

The researcher conducted data analysis for each of the four research questions using Mann-Whitney U tests for Research Questions One and Two, and Kruskal-Wallis tests for Research Questions Three and Four. The information provided in Chapter Four will be used in this section to analyze the results and answer the four research questions in this investigation. The Latin Critical Theory is used to deduce the importance of the findings and provide suggestions for future investigations.

Research Question One

The findings for Research Question One reveal that White students significantly outperformed Hispanic students at UWF, FGCU, and UCF, while there isn't a statistically significance difference in mean CHM 2045 grades at FIU and FAU (Table 29, page 119). It is important to note that even though White students outperformed Hispanic students at UCF, the mean Hispanic student grade in CHM 2045 at UCF (2.3489) is considerable higher than UWF (2.117) and FGCU (2.0929). In general, White students earned statistically significant higher grades in CHM 2045 at UWF, FGCU, and UCF compared to their Hispanic peers.

When applying Latin Critical Theory (LatCrit) to the findings in Research Question One, each of the five defining elements of LatCrit must be considered. UWF and FGCU are non-HSIs, while FIU, FAU, and UCF are currently designated as HSIs. It is important to note that UCF became an HSI in February 2019, and that at the time of data collection, UCF was an emerging HSI. The researcher will consider FIU to be a historically Hispanic university, FAU to be a Hispanic -serving university, and UCF to be an emerging Hispanic-serving university.

Table 29

Summary of Mann-Whitney U Test Results for Research Question One

Institution	Mann-Whitney U Test	Effect Size	Standard Effect Size
University of West Florida	Statistically significant	.11	.22
Florida Gulf Coast University	Statistically significant	.15	.28
University of Central Florida	Statistically significant	.13	.26
Florida Atlantic University	Not statistically significant		
Florida International University	Not statistically significant		

There are several potential explanations as to why White students outperformed Hispanic students at non-HSIs but did not at HSIs. Using LatCrit as a lens in exploring the findings in Question One, it is apparent that students at HSIs encounter fewer barriers to success than do Hispanic students who attend a non-HSI.

The most basic principle of LatCrit, a focus on race and racism, states that race and racism are defining characteristics in American society and therefore its institutions (Taylor, 1999). Hispanic students who attend primarily White institutions (PWI) or institutions that were initially PWIs, encounter discrimination and marginalization based on their race. At a historically Hispanic institution (FIU), in which the institutional structures, discourses, and policies were originally designed for Hispanic students, it is logical to conclude that the incidence of discrimination and marginalization based on ethnicity would be much less prevalent than at PWIs. For HSIs that were initially PWIs (FAU and UCF), in which the institutional structures, discourses, and policies were originally intended for White students, it is expected

that Hispanic students encounter less racism than at PWIs (UWF and FGCU), but more than at historically Hispanic institutions (FIU).

In general, then, Hispanic students at Hispanic serving institutions encounter less racism, an increased focus on social justice and historical context, and recognition of Hispanic experiential knowledge. It is reasonable to assume that if Hispanic students encounter less stress via racism and more institutional focus on issues that are specific to their ethnicity, success in gateway STEM courses will increase.

Using LatCrit as a lens, two contributing factors that affect Hispanic student success, the proportion of Hispanic enrollment and the proportion of Hispanic faculty, can be seen in Table 30 (page 121). The demographics of the student population at the HSIs (FAU and FIU) and emerging HSI (UCF) have a much higher percentage of Hispanic students, 26%, 61%, and 27% respectively, compared to the non-HSIs (UWF, 9% and FGCU, 21%). As the percent of the Hispanic student population increases, the acculturation stress decreases, which may lead to an increase in Hispanic student success (Hurtado, 2001). As stated previously, the presence of Hispanic faculty increases Hispanic student success, retention, and graduation rates (Hurtado, 2001) and as seen in Table 30, the percentage of Hispanic faculty at FIU, FAU, and UCF is significantly higher than at UWF (4%) and FGCU (8.1%). The increase in the Hispanic faculty demographic at FAU, UCF, and FIU may result in an increase in Hispanic student success.

Table 30

Percent of Hispanic Students and Faculty at UWF, FGCU, UCF, FAU, and FIU

School	Hispanic Students	Hispanic Faculty
UWF	9%	4%
FGCU	21%	8.1%
UCF	27%	15.5%
FAU	26%	11.7%
FIU	61%	47.3%

Note. Data collected from Faculty Diversity, 2019, 2019a, 2019b, 2019c, 2019d; NCES, 2018, 2018a, 218b, 2019, 2019a, 2019b

In conclusion, Hispanic students at UWF, FGCU, and UCF earned significantly lower grades in CHM 2045 compared to their White peers, while there is no statistically significant difference at FAU and FIU. Reviewing the findings of Research Question One, through the lens of LatCrit, has provided possible explanations as to why White students are outperforming Hispanic students in CHM 2045 at UWF, FGCU, and UCF, but are not at FAU and FIU.

Research Question Two

The findings for Research Question Two reveal that White students significantly outperformed Hispanic students at UWF and FGCU, while there isn't a statistically significant difference in mean MAC 2311 grades at UCF, FAU, and FIU (Table 31, page 122). In general, White students earned statistically significant higher grades in CHM 2045 at non-HSIs (UWF and FGCU), but did not at the emerging HSI (UCF) or the HSIs (FAU and FIU).

When applying Latin Critical Theory (LatCrit) to the findings in Research Question Two, each of the five defining elements of LatCrit must also be considered. UWF and FGCU are non-

HSIs, while FIU, FAU, and UCF are currently designated as HSIs. It is important to note that UCF became an HSI in February 2019, and that when the data was collected UCF was an emerging HSI.

Table 31

Summary of Mann-Whitney U Test Results for Research Question Two

Institution	Mann-Whitney U Test	Effect Size	Standard Effect Size
University of West Florida	Statistically significant	.20	.40
Florida Gulf Coast University	Statistically significant	.18	.32
University of Central Florida	Not statistically significant		
Florida Atlantic University	Not statistically significant		
Florida International University	Not statistically significant		

As stated in the summary for Research Question One, attending an HSI decreases discrimination, marginalization, and acculturation stress via an increased proportion of Hispanic student enrollment and increased Hispanic faculty presence (Table 30, page 121).

In conclusion, Hispanic students at UWF and FGCU earned significantly lower grades in MAC 2311 compared to their White peers, while there is no statistically significant difference at UCF, FAU, and FIU. Reviewing the findings of Research Question Two, through the lens of LatCrit (see Research Question One summary) has provided possible explanations as to why White students are outperforming Hispanic students in MAC 2311 at UWF, FGCU (non-HSIs) but not at UCF, FAU and FIU (HSIs).

Research Question Three

In Research Question Three, the researcher examined if there is a statistically significant difference in mean General Chemistry I (CHM 2045) grades for Hispanic students at the University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University. The researcher performed a Kruskal-Wallis test where the dependent variable is the student course grades (on a four-point scale) in CHM 2045 and the independent variable is the type of institution attended (HSI or non-HSI).

The Kruskal-Wallis test resulted in a statistically significant difference in mean CHM 2045 course grades. A subsequent pairwise comparison revealed statistically significant differences in Hispanic student mean CHM 2045 grades between the historical HSI (FIU) and the non-HSIs (UWF and FGCU), between the HSI (FAU) and non-HSIs (UWF and FGCU), and between the HSI (FAU) and the emerging HSI (UCF). Hispanic students earned significantly higher grades in CHM 2045 at the HSIs versus the non-HSIs.

When applying Latin Critical Theory (LatCrit) to the findings in Research Question Three, each of the five defining elements of LatCrit must be considered. UWF and FGCU are non-HSIs, while FIU, FAU, and UCF are currently designated as HSIs. It is important to note that UCF became an HSI in February 2019, and that when the data was collected UCF was an emerging HSI.

As stated in the summary for Research Question One, attending an HSI decreases discrimination, marginalization, and acculturation stress via increased percent Hispanic student enrollment and increased Hispanic faculty presence (Table 30, page 121).

In conclusion, Hispanic students at the HSIs (FAU and FIU) earned significantly higher grades in CHM 2045 compared to the Hispanic students at non-HSIs (UWF and FGCU).

Reviewing the findings of Research Question Three through the lens of LatCrit (see Research Question One summary) has provided possible explanations as to why Hispanic students at the HSIs are outperforming Hispanic students at the non-HSIs in MAC 2311.

Research Question Four

In Research Question Four, the researcher examined if there is a statistically significant difference in mean Calculus I (MAC 2311) grades for Hispanic students at University of West Florida, Florida Gulf Coast University, University of Central Florida, Florida Atlantic University, and Florida International University. The researcher performed a Kruskal-Wallis test where the dependent variable is the student course grades (on a four-point scale) in MAC 2311 and the independent variable is the type of institution attended (HSI or non-HSI).

The Kruskal-Wallis test resulted in no statistically significant difference in Hispanic student mean MAC 2311 course grades between the HSIs (UCF, FAU, and FIU) and the non-HSIs (UWF and FGCU).

Limitations

The researcher identified several limitations during this investigation. The limitations are categorized as data-related limitations, geographical-demographic limitations, and statistical limitations.

Data Related Limitations

The first limitation is data acquisition from the four original universities chosen to be included in this study: University of North Florida, University of South Florida, Florida Atlantic University, and Florida International University. The director of institutional research at University of North Florida declined to participate in the study. The researcher contacted University of South Florida via email and phone, but did not receive a reply. At this point, the researcher contacted the directors of institutional research at the University of West Florida and Florida Gulf Coast University; fortunately, they agreed to participate in the study. The director of institutional research at Florida Atlantic University requested direct correspondence from my major professor, Dr. Thomas Cox, who graciously agreed. FAU also requested verification through their IRB to approve the study. FAU's IRB approved the release of the information. About the same time, the researcher learned that UCF had attained its HSI designation and, therefore, the researcher decided to request data from UCF as a possible substitute for FAU. Eventually the researcher did receive the data from FAU, but decided to include UCF in the study. The researcher chose to do this, so the researcher had the opportunity to compare FIU, FAU, and UCF as a function of the duration of HSI designation. In this study the researcher considered FIU to be a historically Hispanic university, FAU to be a Hispanic serving university, and UCF to be an emerging Hispanic serving university.

Another data related limitation that the researcher encountered was that FGCU did not have 150 Hispanic students who earned a grade in MAC 2311 between the years of 2014 and 2018. To collect a sample size of 150 Hispanic students, the researcher included the years of 2010 to 2018.

When the researcher received the data from UWF, it included the entire population of White and Hispanic students who earned a grade in CHM 2045 and MAC 2311 between 2014 to 2018. The researcher used SPSS to take a random sample of 150 White and 150 Hispanic students who earned a grade in each course.

The data that the researcher received from FGCU included withdrawal grades. The researcher deleted all “W” grades, which resulted in reduced sample sizes. When calculating the effect size, the researcher used Hedges’s g in lieu of Cohen’s D due to differing sample sizes.

The data received from UCF included NC grades. Upon further research, the researcher learned that UCF uses NC grades as a substitute for D+, D, and D- grades for several high failure rate courses. After much thought, the researcher decided to use a grade of D for all NC grades.

Geographical-Demographical Limitations

It is expected that recommendations made on how to increase Hispanic student success in gateway STEM courses in this study can be used universally, but it is important to note that the unique diversity in the state of Florida is not represented nationally and therefore recommendations may be specific to Florida Hispanic students.

The state of Florida has a very diverse population that is embodied in few other states. Florida has the third largest Hispanic population in the U.S. and this demographic is not homogenously spread throughout the state (USCB, 2016). As seen in Table 32 (page 127), the Hispanic population varies greatly in the five counties where the universities in this study are located.

Table 32

State of Florida Hispanic Demographics by County

School	County	% Hispanic
UWF	Escambia	5.1%
FGCU	Lee	19.2%
UCF	Orange	28.3%
FAU	Palm Beach	20.2%
FIU	Miami-Dade	64.7%

Note. Data retrieved from Stats, 2019

Another limitation of this study is the use of the ethnic identifier “Hispanic.” Currently, demographic data collected from students upon enrollment in college do not disaggregate the Hispanic ethnicity into its constituents. Even though Florida is home to more than five million Hispanic Americans, the constituents within the Hispanic umbrella are not homogenously spread throughout the state. As seen in Table 33 (page 128), Orange County (UCF) Hispanics are largely Puerto Rican; Palm Beach County (FAU) Hispanics are mainly Mexican, Puerto Rican, and Cuban Americans; and Miami-Dade County (FIU) is overwhelmingly Cuban (Vogel, 2013). The disaggregated groups within the Hispanic umbrella have unique characteristics and qualities,

which may necessitate specific targeted interventions to increase success in STEM gateway courses.

Table 33

State of Florida Hispanic Disaggregated Demographic by County

University County	Mexican	Puerto Rican	Cuban	Nicaraguans	Columbian
UCF Orange	12%	48%			
FAU Palm Beach	19%	16%	17%		
FIU Miami-Dade			53%	6%	7%

Note. Data retrieved from Vogel, 2013

Statistical Limitations

Type I and Type II error are the most common constraints to inferential statistical analyses. Type I error, otherwise known as the level of significance (α), occurs when the null hypothesis is falsely rejected (Stevens, 2007). Type II error occurs when the null hypothesis is falsely accepted (Stevens, 2007). Note that Type I and Type II error are inversely proportional, as one increases the other decreases (Stevens, 2007). To minimize the probability of Type I and Type II error in this study, the researcher set the significance level to .05 and used large sample sizes.

Power is the probability of detecting a difference when it is present and in most cases a power of .70, or a 70% chance of finding a difference when it is present, is adequate (Stevens, 2007). There are several factors that can affect the power of an experiment including the α level, the sample size, and the effect size (Stevens, 2007). As previously stated, the researcher set the α level to .05, to minimize Type I error. To mitigate Type II error and to ensure a power of at least .70, large sample sizes are used. The researcher could not predict or alter the resulting effect sizes of each statistical analysis. Unfortunately, the mean CHM 2045 and MAC 2311 grades are so similar that the resulting effect sizes are very small. In many instances the small effect size decreased the power to below .70.

The researcher performed Mann-Whitney U tests for Research Question One and Two, in lieu of independent t-tests, due to the non-parametric nature of the dependent variable. In general, non-parametric analogues are less powerful than parametric tests (Zimmerman, 1999). The Mann-Whitney U test has 95% of the independent t-tests statistical power and is one of the most powerful non-parametric tests (Landers, 1981). Robert and Casella determined that Mann-Whitney U tests may result in inflated Type I error when the independent samples have the same mean, but different variances (2004). The alpha significance level for the Mann-Whitney U tests in this study are .05, which correlates to a 5% chance of Type I error occurring. Using the Mann-Whitney U test could increase the likelihood of Type I error but considering the samples did not have equivalent means, an increased incidence of Type I error should not be appreciable.

The researcher performed Kruskal-Wallis tests for Research Question Three and Four, in lieu of ANOVA tests, due to the non-parametric nature of the dependent variable. As stated previously, non-parametric analogues are less powerful than parametric tests (Zimmerman,

1999). Liu demonstrated that the Kruskal-Wallis test can significantly increase the incidence of Type I error when compared to the parametric ANOVA (2015). The increase in Type I error can be mitigated with an increase in sample size to 40 or greater, and when the samples have unequal means (Liu, 2015). The alpha significance level for the Kruskal-Wallis tests in this study are .05, which correlates to a 5% chance of Type I error occurring. Using the Kruskal-Wallis test could increase the likelihood of Type I error but considering the large sample sizes used in this study and the fact that the sample means are not equal, an increase in Type I error is not likely.

Recommendations for Practice

The literature review and results of this investigation revealed several recommendations that have the capacity to increase Hispanic student success in gateway STEM courses: increasing Hispanic student enrollment in STEM disciplines, increasing Hispanic STEM faculty presence, increasing non-debt incurring financial aid, decreasing class size, increasing student engagement via student-centered pedagogies, and elimination of the “weed-out” STEM faculty mindset.

This investigation revealed that there is a direct relationship between Hispanic student success in STEM gateway courses and the proportion of Hispanic student enrollment. To increase Hispanic student enrollment in STEM disciplines the researcher recommends to design and implement targeted recruitment programs. Recruitment programs to K-12 schools which have a high percent of Hispanic enrollment may include access to information pertaining to the opportunities in STEM careers, a comprehensive guide on what it takes to succeed in STEM disciplines from high school to graduate school, and the presence of well-educated support service professionals. Similar link-programs in Texas have made great strides in providing a

“college-going culture” in K-12 schools, which has led to increased Hispanic college enrollment (Yamamura, Martinez, & Saenz, 2010).

As previously discussed, Hurtado reported that Hispanic faculty have a positive effect on Hispanic student success (2001). This investigation further illustrates a direct relationship between Hispanic student success in STEM gateway courses and the proportion of Hispanic faculty. To expand the pool of qualified Hispanic faculty candidates, the number of Hispanic students attaining STEM undergraduate and graduate degrees must also increase. Ponjuan revealed that cultivating Hispanic graduate student socialization via mentorship programs could improve professional and personal socialization into the STEM discipline and department, consequently increasing persistence (2011). Another recommendation is to educate faculty search committees on the importance of diversity in the professorate and the resulting positive effect diversity can have on student success.

As previously discussed in Chapter Two, Paulsen and St. John revealed that a significant percent of Hispanic students are from low socio-economic families, are averse to debt-incurring financial aid, and are more likely to drop-out if they do not receive adequate grant aid (2002). To increase Hispanic student persistence and degree attainment in STEM disciplines, the researcher recommends to increase non-debt incurring financial aid via grants for Hispanic STEM majors.

As discussed in Chapter Two, Scott, et al., observed that students in smaller STEM gateway classes are more engaged, earned better grades, and had a higher completion rate than students from larger classes (2017). The average class size in CHM 2045 and MAC 2311 for the Fall 2019 term for the universities included in this investigation is 241 and 128 students,

respectively. The standard class size for STEM gateway courses at universities is typically between 200 and 300 students. To promote Hispanic student success in gateway STEM courses the researcher recommend to decrease class size to 72 students or fewer. This reduction would encourage Hispanic student engagement with faculty, peers, and the material.

In 2011, Gasiewski et al. reported that engaging professors increase STEM gateway course success via the use of active learning and student engagement. To increase Hispanic student success in STEM gateway courses the researcher recommends to implement active learning via group work, which creates a cooperative and collaborative learning atmosphere. Other attributes of an engaging professor that could be leveraged to increase Hispanic student success in STEM gateway courses are faculty accessibility inside and outside of the classroom, humor, enthusiasm, and the use of real-world examples of course material.

As discussed in Chapter Two, although the majority of STEM faculty members believe that student-centered active learning pedagogies increase STEM gateway course success, most of the faculty members do not use these techniques (Ferrare, 2019). Additionally, a significant percentage of STEM faculty believe that gateway STEM courses should be used to weed out students (Epstein, 2006). The use of faculty-centered pedagogies coupled with the “weed-out” approach disproportionately affects minority students (Ferrare, 2019). Even though the majority of STEM faculty members agree that student-centered pedagogies are better than faculty-centered pedagogies, they do not adopt student-centered techniques. Perhaps they do not know how to incorporate active learning into their teaching style. It is recommended that examples and discussion of the practical applications of student-centered active learning be included in professional development in the STEM disciplines. The shift from faculty-centered to student-

centered pedagogies may alter faculty attitude from “gatekeeper” to “gateway,” which may ultimately diminish the practice of using STEM gateway courses to weed-out students.

Recommendations for Future Research

During this investigation several recommendations for future research in the field of Hispanic student success in STEM gateway courses became apparent. The following recommendations are categorized as method recommendations and content recommendations.

Method Recommendations

The researcher used a nonexperimental quantitative research model as the method for this investigation. In Research Question One and Two, Mann Whitney U tests are used to examine the difference in mean CHM 2045 and MAC 2311 grades between Hispanic and White students at UWF, FGCU, UCF, FAU, and FIU. While the results of these tests did answer the questions posed in Research Question One and Two, the small effect sizes adversely affected the power of the statistical analyses. The researcher recommends increasing the sample sizes, which would also increase the power of the statistical analysis.

In Research Question Three and Four, Kruskal-Wallis tests are used to examine the difference in the mean CHM 2045 and MAC 2311 grades of Hispanic students based on the type of university attended, HSI (UCF, FAU, and FIU) vs. non-HSI (UWF and FGCU). While the results of these tests did answer the questions posed in Research Question Three and Four, the small effect sizes adversely affected the power of the statistical analysis. The researcher recommends increasing the sample sizes, which would also increase the power of the statistical analysis.

Stevens states that using unequal sample sizes can decrease the power of a statistical analysis, therefore all precautions should be taken to ensure equal sample sizes (2007). The researcher designed this investigation to have equal sample sizes but the inclusion of withdrawal grades from FGCU, which had to be deleted, decreased some of the sample sizes. In future investigations, the researcher recommends using equal sample sizes.

The researcher did not expect the use of NC grades at UCF. UCF uses NC grades as a replacement for D+, D, and D- grades. In this study the researcher chose to use a grade of D for all NC grades. This substitution may not have accurately represented mean grades and therefore affected the outcome of the statistical tests. In future investigations, the researcher recommends using schools with similar grading schemes.

Content Recommendations

Even though Florida is home to the third largest population of Hispanic Americans in the U.S., the choices of Florida HSI universities to study are limited. There are far more Florida HSI community colleges than universities, and, consequently, the researcher recommends an investigation of Hispanic student success in STEM gateway courses at the community college level.

Another possible issue is that the majority of HSIs have received their HSI designation in the past several years. These newly designated HSIs have not had proper time to apply for Title V grants or to devise Hispanic student-centered interventions. To avoid this situation in the future, the researcher suggests investigating HSIs that have had their HSI designation for at least ten years and have received at least one Title V grant under the developing Hispanic-serving

institution program. To accomplish this a national investigation of HSIs would need to be designed.

The Hispanic umbrella used in student enrollment data assumes that the Hispanic population is homogeneous. The Hispanic ethnic group contains many identities and countries of origin, each with its own characteristics. To devise targeted interventions for the constituent groups within the Hispanic umbrella, the researcher recommends disaggregating the Hispanic umbrella in future investigations. To accomplish such a project, it would be necessary to secure a funded multi-year mixed method investigation at the specific HSI to which the researcher has access.

Conclusion

In this investigation, the researcher explored Hispanic student success in STEM gateway courses. The foundation of this investigation is prior literature on the changing demographics and employment opportunities in the U.S. and on Hispanic student success in the STEM pipeline, gateway STEM courses, and the Latin Critical Theory.

Gonzalez and Morrison (2015) along with Nunez (2014) and Villalpando (2004) provided the basis for the research questions explored in this investigation via the Latin Critical Theory. The researcher explored Hispanic student success in STEM gateway courses as a function of ethnicity and the type of institution attended (HSI vs. non-HSI). The researcher collected data from three HSIs (UCF, FAU, and FIU) and two non-HSIs (UWF and FGCU).

The results of this study are intended to evaluate Hispanic student success in STEM gateway courses compared to their White peers and based on attendance at an HSI. The findings

of this investigation are intended to be the foundation for future study that could lead to targeted interventions to increase Hispanic student success in STEM gateway courses.

Based on previous literature and my experience as a STEM gateway professor, the researcher expected that the White students would outperform the Hispanic students at the non-HSIs and that Hispanic students attending an HSI would outperform Hispanic students attending a non-HSI. My original hypothesis is that attending an HSI has a positive effect on Hispanic student success in STEM gateway courses.

My investigation revealed that White students outperformed Hispanic students in CHM 2045 at UWF (non-HSI), FGCU (non-HSI), and UCF (emerging HSI) and in MAC 2311 at UWF (non-HSI) and FGCU (non-HSI). Although the results slightly deviate from the anticipated outcome, this result may be because UCF is a newly designated HSI and, at the time of data collection, was considered an emerging HSI. This situation may explain why White students outperformed Hispanic students in CHM 2045 at UCF.

The investigation also revealed that Hispanic students attending an HSI (FAU and FIU) outperformed Hispanic students at non-HSIs (UWF and FGCU) in CHM 2045. Hispanic students attending Florida Atlantic University (HSI) outperformed Hispanic students at UCF (emerging HSI) in CHM 2045, but no statistically significant difference in mean CHM 2045 grades between Hispanic students at UCF and FIU (HSI) occurred. Again, this may be because UCF was an emerging HSI at the time of data collection.

There is no statistically significant difference in Hispanic student mean course grades in MAC 2311 between Hispanic students that attended an HSI vs. a non-HSI. Although this result deviates from the anticipated findings, it is important to note that all the mean MAC 2311 course

grades are significantly lower than the CHM 2045 course grades. In other words, most students earned poor grades in MAC 2311.

In general, this investigation revealed that White students at non-HSIs earn significantly higher grades than their Hispanic peers in CHM 2045 and MAC 2311, while there is no statistically significant difference in mean CHM 2045 and MAC 2311 between White and Hispanic students at HSIs.

In general, this investigation revealed that Hispanic students who attend an HSI earn statistically significant higher grades than their Hispanic peers at non-HSIs in CHM 2045. Unfortunately, there is no statistically significant difference in Hispanic student mean MAC 2311 course grades based on the type of institution attended, HSI vs, non-HSI.

This investigation of Hispanic student success in STEM gateway courses, based on ethnicity and the type of institution the students attend, has revealed that attending an HSI has a positive effect on Hispanic student success in CHM 2045 and MAC 2311.

Thus, future research should focus on possible HSI characteristics other than proportion of Hispanic student enrollment, that can be leveraged via targeted interventions to increase Hispanic student success in STEM gateway courses at U.S. institutions of higher learning.

APPENDIX A – INTRODUCTION EMAIL

Subject: Undergraduate Student Data for Dissertation Study on Hispanic Student Success

Date:

Dear Director of Institutional Research

I am currently working on my dissertation at the University of Central Florida under Dr. Thomas Cox, Thomas.Cox@ucf.edu where my focus is on Hispanic student success in STEM courses at Florida public universities. The goal of my research is to be able to provide suggestions for targeted interventions to increase Hispanic student success in STEM disciplines at Florida public universities.

I am planning on performing statistical analysis comparing mean course grades for General Chemistry I and Calculus I based on ethnicity and type of public institution attended. The first data request below is for a random sampling of 150 Hispanic and 150 White undergraduate students that earned a grade in General Chemistry I between the fall 2014 and fall 2018 semester. The second data request below is for a random sampling of 150 Hispanic and 150 White undergraduate students that earned a grade in Calculus I between the fall 2014 and fall 2018 semester.

The data that I need is listed below. It would be very helpful if your institutional research staff could supply the data in excel format within two weeks. I will contact you with a reminder email if I do not receive the data within two weeks.

Data request 1: General Chemistry I (CHM 2045)

01	Ethnicity of student	1 = White 2 = Hispanic
02	Course Grade in General Chemistry I	4.00 = A 3.67 = A- 3.33 = B+ 3.00 = B 2.33 = C+ 2.0 = C 1.67 = C- 1.33 = D+ 1.00 = D 0.67 = D- 0.00 = F

Data request 2: Calculus I (MAC 2311)

01	Ethnicity of student	1 = White 2 = Hispanic
02	Course Grade in Calculus I	4.00 = A 3.67 = A- 3.33 = B+ 3.00 = B 2.33 = C+ 2.00 = C 1.67 = C- 1.33 = D+ 1.00 = D 0.67 = D- 0.00 = F

Please contact me if you have any questions. I am including my contact information below.

Thank you for your time and your assistance in providing the data needed for this study.

Sincerely,

Renee Y. Becker
Doctoral Student
University of Central Florida
Rbecker2@valenciacollege.edu

APPENDIX B – THANK YOU EMAIL

Subject: Thank you for your timely assistance

Date:

Dear Director of Institutional Research

I recently received the data that I requested for my dissertation study comparing Hispanic student success in STEM courses at Florida public universities. The data that you provided will add to the literature on Hispanic student success in STEM courses.

When the statistical analysis is concluded I will be happy to share my findings. If you would like an electronic copy of the findings, please reply to this email with such a request. If you have any questions or concerns, please do not hesitate to contact me.

Thank you for your time and your assistance in providing the data needed for this study.

Sincerely,

Renee Y. Becker
Doctoral Student
University of Central Florida
Rbecker2@valenciacollege.edu

APPENDIX C – REMINDER EMAIL

Subject: Undergraduate Student Data for Dissertation Study on Hispanic Student Success

Date:

Dear Director of Institutional Research

Recently I contacted you pertaining to a data request for my dissertation at the University of Central Florida. The research study is on Hispanic student success in STEM courses at Florida public universities. While I fully understand that your time is valuable, I am sending this reminder and forwarding the original email, to expedite the process.

Thank you for your time and your assistance in providing the data needed for this study within one week.

Sincerely,

Renee Y. Becker
Doctoral Student
University of Central Florida
Rbecker2@valenciacollege.edu

APPENDIX D – IRB APPROVAL



UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA0000351
IRB0001138
Office of Research
12201 Research Parkway
Orlando, FL 32826-3248

NOT HUMAN RESEARCH DETERMINATION

November 22, 2019

Dear Renee Becker:

On 11/22/2019, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	A COMPREHENSIVE INVESTIGATION OF HISPANIC STUDENT SUCCESS IN GATEWAY STEM COURSES AT FOUR STATE OF FLORIDA INSTITUTIONS
Investigator:	Renee Becker
IRB ID:	STUDY00000202
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Becker, Renee HRP 251 Dr. Cox, Category: Faculty Research Approval; • Clarification, Category: Other; • HRP 250 Becker, Renee, Category: IRB Protocol;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Racine Jacques, Ph.D.
Designated Reviewer

REFERENCES

- ACT. (2014). The Condition of STEM 2014. *National STEM report*. Retrieved from <http://www.act.org/content/dam/act/unsecured/documents/National-STEM-Report-2014.pdf>
- ACT. (2015). The condition of college and career readiness 2015. National career readiness report. Retrieved from <https://www.act.org/content/dam/act/unsecured/documents/CCCR15-NationalReadinessRpt.pdf>
- Alexander, C., Chen, E., & Grumbach, K. (2009). How leaky is the health career pipeline? Minority student achievement in college gateway courses. *Academic Medicine*, 84(6), 797–802. <https://doi.org/10.1097/ACM.0b013e3181a3d948>
- ASHE. (2011). Factors that influence success among racial and ethnic minority college students in the STEM circuit. *ASHE Higher Education Report*, 36(6), 53-85. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=eft&AN=58687899&site=eds-live&scope=site>
- Ayala, M. (2017). Number of Hispanic-serving institutions in U.S. increases, reflects growing student enrollment. *Excelencia*. Retrieved from <https://www.hacu.net/images/hacu/Newsrel/2017/HSI-2015-16Lists-MediaFinalRelease.pdf>

- Bailey, M., & Dynarski, S. (2011). Inequality in postsecondary education. In G. Duncan and R. Murnane (Eds.), *Whither opportunity? Rising inequality, schools, and children's life chances* (pp. 117-132). New York, NY: Russell Sage.
- Bankston, C. I. (2013). Immigration and Nationality Act of 1965. *Salem Press Encyclopedia*. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=ers&AN=89551364&site=eds-live&scope=site>
- BAYER. (2012). A view from the gatekeepers--STEM department chairs at America's top 200 research universities on female and underrepresented minority undergraduate STEM students. *Journal of Science Education and Technology*, (3), 317. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsgao&AN=edsgcl.288685694&site=eds-live&scope=site>
- BCPS: BCPS independent research seminar. (2017). Online research framework. Baltimore County Public Schools. Retrieved from <https://www.bcps.org/offices/lis/researchcourse/steps.html>
- Best College Reviews. (2017). The 50 most ethnically diverse colleges in America. Retrieved from <https://www.bestcollegereviews.org/features/top-ethnically-diverse-colleges/>
- Bianchini, J. A. (2013). Expanding underrepresented minority participation: America's science and technology talent at the crossroads. *Science Education*, 97(1), 163-166. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1002/sce.21032>

- BLS: Bureau of Labor Statistics. (2017). Unemployment rate and employment-population ratio vary by race and ethnicity. Retrieved from <https://www.bls.gov/opub/ted/2017/unemployment-rate-and-employment-population-ratio-vary-by-race-and-ethnicity.htm>
- Bush, G. W. (2006). State of the union address. Speech delivered to a joint session of the United States Congress, January 31, 2006. Retrieved from <https://georgewbush-whitehouse.archives.gov/stateoftheunion/2006/>
- Bush, G.W. (2007). America Competes Act. Retrieved from <https://georgewbush-whitehouse.archives.gov/news/releases/2007/08/20070809-6.html>
- Carnevale, A. P., Smith N., & Strohl, J. (2010). Help wanted: Projections of jobs and education requirements through 2018. Georgetown University Center on Education and the Workforce. Retrieved from ERIC database. (ED524310)
- Carnevale, A., Smith, N., & Strohl, J. (2013). The road to recovery. *Community College Journal*, 84(3), 27-29. Retrieved from ERIC database. (EJ1092535)
- Calmore, J. (1992). Critical race theory, Archie Shepp, and fire music: Securing an authentic intellectual life in a multicultural world. *Southern California Law Review*, (5), 2129-2231. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsgao&AN=edsgcl.12720652&site=eds-live&scope=site>
- Carter, D. F. (1999). The impact of institutional choice and environments on African-American and White students' degree expectations. *Research in Higher Education*, (1), 17.

Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsgao&AN=edsgcl.160596473&site=eds-live&scope=site>

Carter, D. F. (2006). Key issues in the persistence of underrepresented minority students. *New Directions for Institutional Research*, (130), 33–46. Retrieved from ERIC database.

(EJ760609)

Castellanos, J., Gloria, A. M., & American Association of Hispanics in Higher Education (AAHHE). (2007). Research considerations and theoretical application for best practices in higher education: Latina/os achieving success. *American Association of Hispanics in Higher Education*. Retrieved from ERIC database. (ED571005)

Castillo, L. G., Conoley, C. W., & Choi-Pearson, C. (2006). University environment as a mediator of Latino ethnic identity and persistence attitudes. *Journal of Counseling Psychology*, 53(2), 267–271. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1037/0022-0167.53.2.267>

Chang, M., Cerna, O., Han, J., & Sàenz, V. (2008). The contradictory roles of institutional status in retaining underrepresented minorities in biomedical and behavioral science majors, 31(4), 433–464. Retrieved from <https://doi.org/10.1353/rhe.0.0011>

Chen, X., & Carroll, C. D. (2005). First-generation students in postsecondary education: A look at their college transcripts. Postsecondary education descriptive analysis report. *National Center for Education Statistics*, 2005-171. Retrieved from ERIC database. (ED485756)

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.)*. Hillsdale, NJ: Erlbaum.

- Contreras, F., & Contreras, G. J. (2015). Raising the bar for Hispanic serving institutions: An analysis of college completion and success rates. *Journal of Hispanic Higher Education*, 14(2), 151-170. Retrieved from ERIC database. (EJ1054360)
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage.
- Darling, R., & Smith, M. (2007). *First-generation college students: First year challenges*. Retrieved from <https://www.nacada.ksu.edu/portals/0/Clearinghouse/AdvisingIssues/documents/firstgen.pdf>
- Delgado-Bernal, D. (2002). Critical race theory, Latino critical theory, and critical race-gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative Inquiry*, 8(1), 105-126. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1177/1077800402008001007>
- Delgado, R. (1989). Storytelling for oppositionists and others: A plea for narrative. *Michigan Law Review*, 87, 2411-2441. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.2307/1289308>
- Delgado, R. (1995). *The Rodrigo chronicles: Conversations about America and race*. New York, NY: New York University Press.
- Delgado, R. & Stefancic, J. (2001). *Critical race theory: An introduction* (1st ed.). New York, NY: New York University Press.
- Delgado, R., & Stefancic, J. (2012). *Critical race theory: An introduction* (2nd ed.). New York, NY: New York University Press.

- Dickson, P. (2001). *Sputnik: The shock of the century*. New York, NY: Walker & Co.
- Dixson, A. D., & Rousseau, C. K. (2006). And we are still not saved: Critical race theory in education ten years later. In A. D. Dixson & C. K. Rousseau (Eds.), *Critical race theory in education: All god's children got a song* (pp. 31-54). New York, NY: Routledge.
- Ehrenberg, R. (1991). The demographic distribution of American doctorates. In C. Clotfelter, R. Ehrenberg, M. Getz, and J. Siegfried (Eds.), *Economic challenges in Higher Education* (pp. 211–232). Chicago, IL: University of Chicago Press.
- Epstein, D. (2006). So that's why they're leaving. Inside Higher Education. Retrieved from <https://www.insidehighered.com/news/2006/07/26/so-that's-why-theyre-leaving>
- Excelencia. (2018). Hispanic-serving institutions. Retrieved from <https://www.edexcelencia.org/media/710>
- Excelencia, (2018a). Emerging Hispanic-serving institutions. Retrieved from <https://www.edexcelencia.org/media/699>
- Faculty Diversity. (2019). UWF faculty diversity. Retrieved from <https://www.collegefactual.com/colleges/the-university-of-west-florida/student-life/diversity/chart-faculty-ethnic-diversity.html>
- Faculty Diversity. (2019a). FGCU faculty diversity. Retrieved from <https://www.collegefactual.com/colleges/florida-gulf-coast-university/student-life/diversity/chart-faculty-ethnic-diversity.html>

Faculty Diversity. (2019b). UCF faculty diversity. Retrieved from

<https://www.collegefactual.com/colleges/university-of-central-florida/student-life/diversity/chart-faculty-ethnic-diversity.html>

Faculty Diversity. (2019c). FAU faculty diversity. Retrieved from

<https://www.collegefactual.com/colleges/florida-atlantic-university/student-life/diversity/chart-faculty-ethnic-diversity.html>

Faculty Diversity. (2019d). FIU faculty diversity. Retrieved from

<https://www.collegefactual.com/colleges/florida-international-university/student-life/diversity/chart-faculty-ethnic-diversity.html>

Fayer, S., Lacey, A., & Watson, A. (2017). STEM occupations: Past, present, and future. *States News Service*. Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsggr&AN=edsgcl.477451941&site=eds-live&scope=site>

Ferrare, J. J. (2019). A multi-institutional analysis of instructional beliefs and practices in gateway courses to the sciences. *CBE - Life Sciences Education*, 18(2). Retrieved from

<https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1217736&site=eds-live&scope=site>

Fitzgerald, D. S. & Cook-Martin, D. (2015). *The democratic origins of racist immigration policy in the Americas*. Cambridge, MA: Harvard University Press.

Fowler, F. J. (2009). *Survey research methods*. Thousand Oaks, CA: Sage.

- Frey, W. (2018). The US will become 'minority white' in 2045, Census projects. Retrieved from <https://www.brookings.edu/blog/the-avenue/2018/03/14/the-us-will-become-minority-white-in-2045-census-projects/>
- Fry, R. (2004). *Latino Youth Finishing College: The Role of Selective Pathways*. Pew Hispanic Center. Pew Hispanic Center. Retrieved from ERIC database. (ED485329)
- Fuertes, J. & Sedlacek, W. (1994). Predicting the academic success of Hispanic college students using SAT scores. *College Student Journal*, 28, 350-352. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=psyh&AN=1995-12011-001&site=eds-live&scope=site>
- Garcia, M. (2008). Strategies that contribute to academic success of first-semester Hispanic community college students. *Dissertation Abstracts International Section A*, 68, 4150. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=psyh&AN=2008-99070-233&site=eds-live&scope=site>
- Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2011). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in Higher Education*, 53, 229-261. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.79C99540&site=eds-live&scope=site>

- Gasman, M., Nguyen, T., & Conrad, C. F. (2015). Lives intertwined: A primer on the history and emergence of minority serving institutions. *Journal of Diversity in Higher Education*, 8(2), 120-138. doi:10.1037/a0038386
- Gloria, A. M., & Castellanos, J. (2012). "Desafios y Bendiciones": A multiperspective examination of the educational experiences and coping responses of first-generation college Latina students. *Journal of Hispanic Higher Education*, 11(1), 82-99. Retrieved from <http://dx.doi.org/10.1177/1538192711430382>
- Gloria, A. M., Castellanos, J., Lopez, A. G., & Rosales, R. (2005). An examination of academic nonpersistence decisions of Latino undergraduates. *Hispanic Journal of Behavioral Sciences*, 27(2), 202–223. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=sw&AN=76930&site=eds-live&scope=site>
- González, K. P. (2003). Campus culture and experiences of Chicano students in a predominantly White university. *Urban Education*, 37(2), 193-218. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1177/0042085902372003>
- Gonzalez, M. (2010). Latina/o (public/legal) intellectuals, social crises, and contemporary social movements. *American University Journal of Gender, Social Policy & the Law*, 18(3), 787. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsgao&AN=edsgcl.256731678&site=eds-live&scope=site>

- Gonzalez, R. G., & Morrison, J. (2015). Culture or no culture? A Latino critical research analysis of Latino persistence research. *Journal of Hispanic Higher Education*, 15(1), 87-108. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1177/1538192715579460>
- Groves, R. (2011). Three eras of survey research. *Public Opinion Quarterly*, 75(5), 861-871. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsggr&AN=edsgcl.278560532&site=eds-live&scope=site>
- Guarte, J., & Barrios, E. (2006). Estimation under purposive sampling. *Communications in Statistics: Simulation & Computation*, 35(2), 277-284. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=msn&AN=MR2227270&site=eds-live&scope=site>
- Guzman, A. (2016). "Founding a historically Latino/Caribbean-serving institution: An archival study on Florida International University". *LSU Doctoral Dissertations*. 2706. Retrieved from http://digitalcommons.lsu.edu/gradschool_dissertations/2706
- Heithaus, M. (2015). Testimony of Dr. Michael Heithaus. Research innovations from our nation's agricultural colleges and universities. Retrieved from https://agriculture.house.gov/uploadedfiles/ag_heithaustestimony.pdf
- Hurtado, S. (2001). "Linking diversity and educational purpose: How diversity affects the classroom environment and student development." In *Diversity challenged: Evidence on*

- the impact of affirmative action. Harvard Educational Publishing Group. Retrieved from ERIC database. (ED456199)
- Ishitani, T. T. (2003). A longitudinal approach to assessing attrition behavior among first-generation students: Time-varying effects of pre-college characteristics. *Research in Higher Education*, 44(4), 433-449. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1023/A:1024284932709>
- Jarsky, K. M., McDonough, P. M., & Nunez, A. (2009). Establishing a college culture in secondary schools through P-20 collaboration: A case study. *Journal of Hispanic Higher Education*, 8(4), 357-373. Retrieved from ERIC database. (EJ858188)
- Kiyama, J. M., Museus, S. D., & Vega, B. E. (2015). Cultivating campus environments to maximize success among Latino and Latina college students. *New Directions for Higher Education*, 2015(172), 29–38. Retrieved from <https://doi.org/10.1002/he.20150>
- Kruckemyer, G. (2019). U.S. Department of Education designates UCF as a Hispanic serving institution. Retrieved from <https://www.ucf.edu/news/u-s-department-education-designates-ucf-hispanic-serving-institution/>
- Labor Force Statistics. (2014). Unemployment and poverty rates. Retrieved from <https://www.bls.gov/cps/lfcharacteristics.htm>
- Laden, B.V. (2001). Hispanic-serving institutions: Myths and realities. *Peabody Journal of Education*, 73(1). Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.1493006&site=eds-live&scope=site>

- Laden, B. V. (2004). Hispanic-serving institutions: What are they? Where are they?. *Community College Journal of Research and Practice*, 28(3), 181-198. Retrieved from ERIC database. (EJ682210)
- Laerd: Laerd Dissertation. (2012). Purposive sampling. Retrieved from <http://dissertation.laerd.com/purposive-sampling.php>
- Laerd: Laerd Dissertation. (2018). Independent t-test using SPSS. Retrieved from <https://statistics.laerd.com/spss-tutorials/independent-t-test-using-spss-statistics.php>
- Laerd: Laerd Dissertation. (2018a). One-way ANOVA. Retrieved from <https://statistics.laerd.com/statistical-guides/one-way-anova-statistical-guide-2.php>
- Laerd: Laerd Dissertation. (2018b). Descriptive and inferential statistics. Retrieved from <https://statistics.laerd.com/statistical-guides/descriptive-inferential-statistics.php>
- Landers, J. (1981). *Quantification in history, topic 4: Hypothesis testing II-differing central tendency*. Oxford, England: All Souls College.
- Liu, H. (2015). *Comparing Welch's ANOVA, a Kruskal-Wallis test and traditional ANOVA in case of heterogeneity of variance* (Master's thesis, Virginia Commonwealth University). Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.B089F8DB&authtype=shib&site=eds-live&scope=site>
- Lohfink, M.M., & Paulsen, M.B. (2005). Comparing the determination of persistence for first-generation and continuing-generation students. *Journal of College Student Development*, 46(4), 409-428. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1353/csd.2005.0040>

- Lomax, R. G., & Hahs-Vaughn, D. L. (2012). *Statistical concepts: A second course.*, (4th ed.). New York, NY: Routledge/Taylor & Francis Group.
- London, H. B. (1992). Transformations: Cultural challenges faced by first-generation students. In L. S. Zwerling & H. B. London (Eds.), *First-generation students: Confronting the cultural issues* (pp. 5-12) San Francisco, CA: Jossey-Bass.
- Lowe, M., Byron, R., Ferry, G., & Garcia, M. (2013). Food for thought: Frequent interracial dining experiences as a predictor of students' racial climate perceptions. *Journal of Higher Education*, (4), 569. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1353/jhe.2013.0023>
- Massey, D. S., Durand, J., & Malone, N. J. (2003). *Beyond smoke and mirrors: Mexican immigration in an era of economic integration*. New York, NY: Russell Sage Foundation.
- Matsuda, M. (1996). *Where is your body? Essays on race, gender and the law*. Boston, MA: Beacon Press.
- Mendez, J. P. (2015). *Hispanic-serving institutions in American higher education: Their origin, and present and future challenges*. Sterling, VA: Stylus Publishing.
- Mervis, J. (2011). Weed-out courses hamper diversity. *Science*, (6061), 1333. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1126/science.334.6061.1333>
- Moller, S., Banerjee, N., Bottia, M. C., Stearns, E., Mickelson, R. A., Dancy, M., Wright, E., & Valentino, L. (2015). Moving Latino/a students into STEM majors in college: The role of teachers and professional communities in secondary schools. *Journal of Hispanic Higher Education*, 14(1), 3-33. Retrieved from ERIC database. (EJ1046655)

Museus, S. D. (2011). *Using cultural perspective to understand the role of ethnic student organizations in Black students' progress to the end of the pipeline*. In D. E. Evensen & C. D. Pratt (Eds.), *The end of the pipeline: A journey of recognition for African Americans entering the legal profession* (pp. 162-172). Durham, NC: Carolina Academic Press.

Museus, S. D., Ravello, J. N., & Vega, B. E. (2012). The campus racial culture: A critical race counterstory. In S. D. Museus & U. M. Jayakumar (Eds.), *Creating campus cultures: Fostering success among racially diverse student populations* (pp. 28-45). New York, NY: Routledge Press.

NCES: National Center for Education Statistics. (2012). Digest of Education Statistics 2012. Retrieved from <https://nces.ed.gov/pubs2014/2014015.pdf>

NCES: National Center for Education Statistics (2013). Percentage of full-time, full-year undergraduates who received financial aid, by source of aid and race/ethnicity: 2011–12. Retrieved from https://nces.ed.gov/programs/raceindicators/indicator_rec.asp

NCES: National Center for Education Statistics (2013a). Digest of Education Statistics 2013. Retrieved from <https://nces.ed.gov/pubs2015/2015011.pdf>

NCES: National Center for Education Statistics (2014). Number and percentage distribution of spring 2002 high school sophomores, by highest level of education completed, and socioeconomic status and selected student characteristics while in high school. Retrieved from https://nces.ed.gov/programs/digest/d14/tables/dt14_104.91.asp

NCES: National Center for Education Statistics. (2015). Employees in degree-granting postsecondary institutions, by race/ethnicity, sex, employment status, control and level of

institution, and primary occupation. Retrieved from

https://nces.ed.gov/programs/digest/d16/tables/dt16_314.40.asp

NCES: National Center for Education Statistics. (2016). Fall enrollment in degree-granting postsecondary institutions, by race/ethnicity of student and state or jurisdiction.

Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_306.60.asp

NCES: National Center for Education Statistics. (2016a). Graduation rate from first institution attended for first-time, full-time bachelor's degree-seeking students at 4-year postsecondary institutions, by race/ethnicity, time to completion, sex, control of institution, and acceptance rate: Selected cohort entry years, 1996 through 2009.

Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_326.10.asp

NCES: National Center for Education Statistics. (2016b). Estimates of resident population, by race/ethnicity and age group: Selected years, 1980 through 2016. Retrieved from

https://nces.ed.gov/programs/digest/d16/tables/dt16_101.20.asp

NCES: National Center for Education Statistics. (2016c). Total fall enrollment in degree-granting postsecondary institutions, by level of enrollment, sex, attendance status, and race/ethnicity of student: Selected years, 1976 through 2015. Retrieved from

https://nces.ed.gov/programs/digest/d16/tables/dt16_306.10.asp

NCES: National Center for Education Statistics. (2016d). Associate's degrees conferred by postsecondary institutions, by race/ethnicity and sex of student: Selected years, 1976-77 through 2014-15. Retrieved from

https://nces.ed.gov/programs/digest/d16/tables/dt16_321.20.asp

NCES: National Center for Education Statistics. (2016e). Bachelor's degrees conferred by postsecondary institutions, by race/ethnicity and sex of student: Selected years, 1976-77 through 2014-15. Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_322.20.asp.

NCES: National Center for Education Statistics. (2016f). Master's degrees conferred by postsecondary institutions, by race/ethnicity and sex of student: Selected years, 1976-77 through 2014-15. Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_323.20.asp.

NCES: National Center for Education Statistics. (2016g). Doctor's degrees conferred by postsecondary institutions, by race/ethnicity and sex of student: Selected years, 1976-77 through 2014-15. Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_324.20.asp.

NCES: National Center for Education Statistics. (2016h). Number and percentage distribution of science, technology, engineering, and mathematics (STEM) degrees/certificates conferred by postsecondary institutions, by race/ethnicity, level of degree/certificate, and sex of student: 2008-09 through 2014-15. Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_318.45.asp

NCES: National Center for Education Statistics. (2018). Florida Atlantic University. Retrieved from <https://nces.ed.gov/collegenavigator/?q=florida+atlantic+university&s=all&id=133669#enrolmt>

NCES: National Center for Education Statistics. (2018a). Florida International University.

Retrieved from

<https://nces.ed.gov/collegenavigator/?q=Florida+International+University&s=all&id=133951#enrolmt>

NCES: National Center for Education Statistics. (2018b). Percentage distribution of full-time faculty in degree-granting postsecondary institutions, by academic rank, race/ethnicity, and sex: Fall 2016. Retrieved from <https://nces.ed.gov/fastfacts/display.asp?id=61>

NCES: National Center for Education Statistics. (2019). University of West Florida. Retrieved from <https://nces.ed.gov/collegenavigator/?id=138354>

NCES: National Center for Education Statistics. (2019a). Florida Gulf Coast University.

Retrieved from

<https://nces.ed.gov/collegenavigator/?q=Florida+gulf+coast+university&s=all&id=433660>

NCES: National Center for Education Statistics. (2019b). University of Central Florida.

Retrieved from <https://nces.ed.gov/collegenavigator/?id=132903#general>

Nunez, A. M. (2014). Employing multilevel intersectionality in educational research: Latino identities, contexts, and college access. *Educational Researcher*, 43, 85-92. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.3102/0013189X17724740>

Pascarella, E. T., Pierson, C. T., & Wolniak, G. C. (2004). First-generation college students:

Additional evidence on college experiences and outcomes. *Journal of Higher Education*, 75(3), 249-284. Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost->

[com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.3838816&site=eds-live&scope=site](https://login.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.3838816&site=eds-live&scope=site)

Paulsen, M. B., & St. John, E. P. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *The Journal of Higher Education*, (2), 189. Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebscohost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.1558410&site=eds-live&scope=site>

Pell: Pell Institute Fact Sheet. (2011). Year attainment rates for students enrolled in a post-secondary institution. Retrieved from http://www.pellinstitute.org/fact_sheets.shtml

Pew: Pew Research Center. (2017). How the U.S. Hispanic population is changing. Retrieved from <http://www.pewresearch.org/fact-tank/2017/09/18/how-the-u-s-hispanic-population-is-changing/>

Ponjuan, L. (2011). Recruiting and retaining Latino faculty members: The missing piece to Latino student success. *Thought & Action*, (27), 99. Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebscohost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edo&AN=89443097&site=eds-live&scope=site>

Richardson, R. J., & Skinner, E. F. (1992). Helping first-generation minority students achieve degrees. *New Directions for Community Colleges*, (80), 29-43. Retrieved from ERIC database. (EJ460060)

Robert, C., & Casella, G. (2004). *Monte Carlo Statistical Methods*. New York, NY: Springer Verlag.

Salkind, N. (2010). Encyclopedia of research design volume 1. Retrieved from http://web.utk.edu/~ewbrewer/pdf/encyclopedia/Encyclopedia%20of%20Research%20Design_Volume%201.pdf

Sapsford, R. (2007). *Survey research*. London, England: Sage.

Santiago, D. A., Calderon, E., & Taylor, M. (2015). Finding your workforce: Latinos STEM. Excelencia. Retrieved from <https://www.edexcelencia.org/research/publications/finding-your-workforce-latinos-science-technology-engineering-and-math-stem>

SAT (2013). 2013 SAT report on college and career readiness. Retrieved from <http://research.collegeboard.org/programs/sat/data/archived/cb-seniors-2013>

SAT (2015). 2015 SAT Report on College and Career Readiness. Retrieved from <http://research.collegeboard.org/programs/sat/data/cb-seniors-2015>

Scott, A., McNair, D., Lucas, J., & Land, K. (2017). From gatekeeper to gateway: Improving student success in an introductory biology course. *Journal of College Science Teaching*, 46(4), 93. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=edsjsr&AN=edsjsr.44579919&site=eds-live&scope=site>

Scott-Clayton, J. (2015). The role of financial aid in promoting college access and success: Research evidence and proposals for reform. *Journal of Student Financial Aid*, 45(3). Retrieved from <https://publications.nasfaa.org/cgi/viewcontent.cgi?article=1586&context=jsfa>

- Seymour, E. & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Westview Press. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=cat00846a&AN=ucfl.022744610&site=eds-live&scope=site>
- Smith, W. A. (2002). Black faculty coping with racial battle fatigue: The campus racial climate in post-civil rights era. In D. Cleveland (Ed.), *Broken silence: Conversations about race by African Americans at predominantly White institutions*. New York: Peter Lang.
- Solórzano, D. G. (1998). Critical race theory, racial and gender microaggressions, and the experiences of Chicana and Chicano scholars. *International Journal of Qualitative Studies in Education*. 11, 121-136. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edb&AN=75559720&site=eds-live&scope=site>
- Solórzano, D. G., Ceja, M., & Yosso, T. J. (2000). Critical race theory, racial microaggressions, and campus racial climate: the experiences of African American college students. *Journal of Negro Education*, 69(1/2), 60–73. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=eft&AN=507739345&site=eds-live&scope=site>
- Solórzano, D. G., & Villalpando, O. (1999). Critical Race Theory, Marginality, and the experiences of students of color in higher education. In C. A. Torres and T. A. Mitchell

- (Eds.), *Sociology of Education: Emerging Perspectives*. New York: State University of New York Press.
- Solórzano, D. G., & Yosso, T. (2001). Critical race and LatCrit theory and method: Counter-storytelling. *Qualitative Studies in Education*, 14(4), 471-495. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1080/09518390110063365>
- Stats. (2019). Overview of Florida. Retrieved from <https://statisticalatlas.com/state/Florida/Overview>
- Stefancic, J. (1997). Latino and Latina critical theory: An annotated bibliography. *California Law Review*, (5), 1509. doi:10.2307/3481065.
- Stevens, J. (2007). *Intermediate Statistics: A modern approach*, (3rd ed.). New York, NY: Routledge.
- St. John, E. P., Paulsen, M. B., & Carter, D. F. (2005). Diversity, college costs, and postsecondary opportunity: An examination of the financial nexus between college choice and persistence for African Americans and Whites. *The Journal of Higher Education*, (5), 545. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.3838839&site=eds-live&scope=site>
- St. John, E. P., Paulsen, M. B., & Starkey, J. B. (1996). The nexus between college choice and persistence. *Research in Higher Education*, 37, 175-220. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1007/BF01730115>

- Sum, A., & Khatiwada, I. (2010). The Nation's underemployed in the "Great Recession" of 2007–09. *Monthly Labor Review*, 3. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsjsr&AN=edsjsr.monthlylaborrev.2010.11.003&site=eds-live&scope=site>
- Suresh, R. (2007). The relationship between barrier courses and persistence in engineering. *Journal of College Student Retention: Research, Theory & Practice*, 8(2), 215–239. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ744661&site=eds-live&scope=site>
- SUSF: State University System of Florida. (2018). About the state university system of Florida. Retrieved from <http://www.flbog.edu/about/>
- SUSF: State University System of Florida. (2018a). Florida Atlantic University. Retrieved from <https://www.flbog.edu/university/university-of-west-florida/>
- SUSF: State University System of Florida. (2018b). Florida International University. Retrieved from <http://www.flbog.edu/universities/fiu.php>
- SUSF: State University System of Florida. (2019). University of West Florida. Retrieved from <https://www.flbog.edu/university/university-of-west-florida/>
- SUSF: State University System of Florida. (2019a). Florida Gulf Coast University. Retrieved from <https://www.flbog.edu/university/florida-gulf-coast-university/>
- SUSF: State University System of Florida. (2019b). University of Central Florida. Retrieved from <https://www.flbog.edu/university/university-of-central-florida/>

- Swail, W. S., Cabrera, A. F., Lee, C., & Williams, A. (2005). From middle school to the workforce: Latino students in the educational pipeline. Latino students & the educational pipeline, Part I. *Online Submission*. Retrieved from ERIC database. (ED499872)
- Taylor, E. (1999). *Critical race theory and qualitative studies in education*. Boulder, CO: Westview Press.
- Ting, S. (1998). Predicting first-year grades and academic progress of college students of first-generation and low-income families. *Journal of College Admissions*, 158, 14-23. Retrieved from ERIC database. (EJ574905)
- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89-125. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebSCOhost.com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.1170024&site=eds-live&scope=site>
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago, IL: University of Chicago Press.
- Tobias, S. (1990). They're not dumb. They're different: A new "tier of talent" for science. *Change: The magazine of higher learning*, 22(4), 11-30. doi: 10.1080/00091383.1990.9937642
- Torres, V. (2004). The diversity among us: Puerto Ricans, Cuban Americans, Caribbean Americans, and Central and South Americans. *New Directions for Student Services*, (105), 5-16. doi:10.1002/ss.112

Trucios-Haynes, E. (2000). Why “race matters”: LatCrit theory and Latino racial identity. *La*

Raza Law Journal, 12, 1-455. Retrieved from

<https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost-com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=aph&AN=4148922&site=eds-live&scope=site>

UNM: University of New Mexico. (2012). STEM gateway course list details. Retrieved from

<http://stemgateway.unm.edu/documents/DefinitionCourseList.pdf>

UNM: University of New Mexico. (2013). STEM gateway. Retrieved from

<http://stemgateway.unm.edu/documents/Impact/2013SympResearch.pdf>

USCB: United States Census Bureau. (2010). *Hispanic origin*. Retrieved from

<https://www.census.gov/topics/population/hispanic-origin/about.html>

USCB: United States Census Bureau (2013). *American fact finder*. Retrieved from

<http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

USCB: United States Census Bureau (2014). *American fact finder*. Retrieved from

<https://www.census.gov/newsroom/press-releases/2015/cb15-tps05.html>

USCB: United States Census Bureau (2016). Demographic trends in the 20th century. Retrieved

from <https://www.census.gov/prod/2002pubs/censr-4.pdf>

USCB: United States Census Bureau. (2018). Quick facts Florida. Retrieved from

<https://www.census.gov/quickfacts/fact/table/fl/PST045217>

USCB: United States Census Bureau. (2018a). Quick facts United States. Retrieved from

<https://www.census.gov/quickfacts/fact/table/US/PST045217>

- Valdes, F. (1996). Latina/o ethnicities, critical race theory, and post-identity politics in postmodern legal culture: From practices to possibilities. Retrieved from <http://scholarship.law.berkeley.edu/blrlj/vol9/iss1/1>
- Valdes, F. (2002). Under construction: LatCrit consciousness, community, and theory. *LatCrit Primer, 1*, 260-286. Retrieved from <https://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1603&context=californialawreview>
- Villalpando, O. (2003). Self-segregation or self-preservation? A critical race theory and Latina/o critical theory analysis of a study of Chicana/o students. *International Journal of Qualitative Studies in Education, 16*(5), 619-646. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1080/0951839032000142922>
- Villalpando, O. (2004). Practical considerations of critical race theory and Latino critical theory for Latino college students. *New Directions for Student Services, 105*, 41-50. Retrieved from <https://doi-org.ezproxy.net.ucf.edu/10.1002/ss.115>
- Vilorio, D. (2014). STEM 101: Intro to tomorrow's jobs. *Occupational Outlook Quarterly*, Spring 2014. Retrieved from <https://www.bls.gov/careeroutlook/2014/spring/art01.pdf>
- Vogel, M. (2013). Hispanic diversity in Florida. *Florida Trend*. Retrieved from <https://www.floridatrend.com/article/15517/hispanic-diversity-in-florida-map>
- Warburton, E. C., Bugarin, R., & Nunez, A. (2001). Bridging the gap: Academic preparation and postsecondary success of first-generation students. (NCES 2001-153). Retrieved from <https://nces.ed.gov/pubs2001/2001153.pdf>

- Yamamura, E. K., Martinez, M. A., & Saenz, V. B. (2010). Moving beyond high school expectations: Examining stakeholders' responsibility for increasing Latina/o students' college readiness. *High School Journal*, 93(3), 126-148. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search-ebshost.com.ezproxy.net.ucf.edu/login.aspx?direct=true&db=edsggr&AN=edsgcl.234228299&site=eds-live&scope=site>
- Young, J. R., & Mattingly, M. J. (2016). Underemployment among Hispanics: the case of involuntary part-time work. *Monthly Labor Review*, 1–14. Retrieved from <https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=120773962&site=eds-live&scope=site>
- Zimmerman, D. W. (1999). Type I error probabilities of the Wilcoxon-Mann-Whitney test and Student t test altered by heterogeneous variances and equal sample sizes. *Perceptual and Motor Skills*, (2), 556. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=edsgao&AN=edsgcl.54828786&site=eds-live&scope=site>