

An Investigation of Comparative Hispanic Student Success in Calculus I at Four State of Florida Universities

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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 groups 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 an introductory STEM course, Calculus I, at two Florida HSI universities and two non-HSI universities, revealed 1) white students significantly outperformed Hispanic students in Calculus I at State of Florida non-HSIs and 2) white students did not outperform Hispanic students in Calculus I at State of Florida HSIs.

Keywords: Calculus I, Hispanic serving institutions, Hispanic student success, STEM, LatCrit

Introduction

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, 2013). 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. The economic recovery of the past decade has been accompanied by falling unemployment rates, but the Hispanic American unemployment rate still trails the White unemployment rate by 30% (BLS, 2020). The 2019 labor force statistics indicated that, while 90% of employed White and Black Americans have at least a high school diploma, only 77% of Hispanics have a high school diploma (BLS, 2020).

A concurrent challenge for America is access to higher education for minority populations. Hispanics account for about 60 million or 18.4% of the American population and have the highest growth rate of any ethnic group (USCB, 2020). However, only 3.4 million or 20% of American college students identify as Hispanic (NCES, 2020). Only 300,000 or 10% of postbaccalaureate students identify as Hispanic, demonstrating an even wider education gap than in undergraduate enrollment (NCES, 2021).

Comparing the overall American population data to degree attainment can be misleading and not representative of minority access to higher education. While 18.5% of Americans identify as Hispanic, 16% of this demographic is college-aged. In comparison, 60.1% of the American population is White, but only 11% of that demographic is college-aged (USCB, 2021). 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.

Hispanic student enrollment increased 48% between the years of 2009 and 2019 (NCES, 2021). Access to higher education has increased dramatically but Hispanic student success has not. A review of the latest data from the National Center for Education Statistics (2019) demonstrates a serious deficit in Hispanic student STEM graduation rates. As illustrated in Table 1, this disproportionality can be seen most dramatically with master's and doctoral degree attainment (NCES, 2019).

Table 1. STEM Graduation Rates by Race/Ethnicity & Level of Degree.

Ethnicity	Enrollment	Overall	Associate's	Bachelors'	Master's	Doctoral
White	376,806	61.5%	58%	62.2%	62.5%	72.6%
Hispanic	81,769	13.3%	18.8%	12.1%	9.2	6.9%

Note. Data collected from NCES, 2019

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.

Hispanic Serving Institutions (HSIs) serve a vital role in contributing to Hispanic student 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 (Excelencia, 2018). As a result, HSIs are in a unique position to improve student success in STEM disciplines.

While extensive research has been conducted on the efficacy of Texas and California HSIs, there is limited research regarding Florida HSIs. 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).

Other deficiencies in the literature include the lack of quantitative studies on Hispanic student success in specific introductory STEM 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 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).

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 nor 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.

This study will address the problem of the academic success of Hispanic students at two Florida State public non-HSIs (University A and University B) and two HSIs (University C and University D), in an introductory STEM course, Calculus I. Calculus I was chosen as the introductory STEM course to be studied because most STEM majors are required to take it as a pre-requisite to higher level STEM courses. Success in introductory STEM courses is a predictor of STEM degree attainment (UNM, 2012). This investigation will include a statistical analysis of whether there is a difference in student success in an introductory STEM course, Calculus I, based on race at all four institutions. Latin Critical Theory (LatCrit) will be the guiding framework for the genesis of the research question and the interpretation of the statistical results.

Literature Review

Hispanic Serving Institutions

In the 1960s through the 1990s, there was a substantial increase in the Hispanic population in the United States (Massey, Durand, & Malone, 2003). The influx of Hispanic peoples was mainly due to the Immigration and Nationality Act of 1965, which drastically increased the number of Latin American immigrants entering the United States (Bankston, 2013). 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.

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). 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.

Latin Critical Theory

Latin Critical Theory (LatCrit) is the theoretical framework for this study. LatCrit 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). LatCrit was devised 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 (Valdes, 1996).

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). LatCrit 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 LatCrit 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 disaggregated into its constituents.

Research Question

This investigation examines the following research question:

Is there a statistically significant difference in mean Calculus I grades between Hispanic and White students at Four State of Florida Universities, two non-HSIs (University A and B) and two HSIs (University C and D)?

Methodology

Research Design

This study implemented a nonexperimental quantitative research model via causal comparative research. 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). Descriptive statistics were used to analyze the data gathered and Mann-Whitney U tests were used to determine the statistical significance between ethnicity (independent variable) and Calculus I course grades (dependent variable).

Setting

The four universities chosen for this investigation are 4-year public universities which grant associate’s, bachelor’s, master’s, and doctoral degrees. Table 2 provides a summary of the pertinent institutional data for the four universities. The information in this table contains 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 2. Institutional Summary of Enrollment Data.

Institution	Enrollment	Acceptance	Average freshman SAT score	Average freshman ACT score	HSI
University A	13,000	42%	1165	25	No
University B	15,000	65%	1135	23	No
University C	30,000	60%	1160	23	Yes
University D	55,000	54%	1175	25	Yes

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

Sample

The population of this study is State of Florida University students who earned a grade in Calculus I. The participants are undergraduate students who earned a grade in Calculus I at University A, B, C, and D between 2014 to 2018. Data requests for two sets of data were made to the four universities to acquire a random sample of the population. The data is drawn from a random sample of grades earned between 2014 and 2018 in Calculus I by 150 White and 150 Hispanic students. The appeals requested student ethnicity and course grade.

Sampling Techniques

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

More specifically, homogeneous purposive sampling was 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 researchers for this study include a veteran STEM professor at a Hispanic Serving Institution and a professor of higher education with expertise in teaching and learning for student success. Based on their academic and professional credentials, skills, research, and experience, they are well-informed in the area of STEM and Hispanic student success in higher education. The researchers requested the data from the Directors of Institutional Research from the four universities in the Fall 2019 term.

Analysis Methods

The Statistical Package for the Social Sciences (SPSS) was used to analyze the data collected for this study. Descriptive statistics, such as measures of central tendency and spread were generated as well as the Mann-Whitney U test as the inferential statistic. The Mann-Whitney U test was employed due to the non-parametric nature of the dependent variable. The dependent variable is the overall course grade in Calculus I, and the independent variable is the student ethnicity.

Limitations and Delimitations

Within this study, the researchers attempted to mitigate the limitations of the sample. The four universities 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 chosen for this study.

Some common delimitations are the boundaries set by the researchers, regarding what and who is being studied and the methods chosen (BCPS, 2017; Creswell, 2014; Lomax & Hahs-Vaughn, 2013). Purposive sampling was 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 Calculus I. This type of sampling relies on the researcher's knowledge within the field being studied (Groves, 2011).

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.

Results

While the following includes the statistical results for the Research Question (Table 3 and 4) separated by university there are similarities between the four universities that must be addressed first. As previously stated, the dependent variable, the course grade, is not normally distributed (non-parametric). This is demonstrated by the Shapiro-Wilk test of normality ($p = .000$), and as asserted by Lomax and HahsVaughn, a p value of less than .05 indicates that the dependent variable is not normally distributed (2013). The Levene's test for equality of variance resulted in a p value of more than .05, which Lomax and Hahs-Vaughn indicate represents homogeneity of variance (2013).

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, and the dependent variable must be ordinal or interval in scale (Lomax and Hahs-Vaughn, 2013). These assumptions have been met for all universities.

As seen in Table 3, the mean course grade for White students in Calculus I at University A, B, C, and D is 2.6329, 2.6437, 2.4018, and 2.3088 respectively. The mean course grade for Hispanic students in Calculus I at University A, B, C, and D is 2.1288, 2.2364, 2.2597, and 2.0935 respectively.

Table 3. Group Statistics for Universities.

University	Ethnicity	N	Mean grade	Standard deviation	Standard error mean	Mean rank
A	White	150	2.6329	1.24366	.10154	168.25
	Hispanic	150	2.1288	1.25391	.10238	132.75
B	White	132	2.6437	1.29669	.11286	145.12
	Hispanic	131	2.2364	1.26315	.11036	118.78
C	White	150	2.4018	1.33127	.10870	154.77
	Hispanic	150	2.2597	1.39652	.11403	146.23
D	White	150	2.3088	1.44332	.11785	158.63
	Hispanic	150	2.0935	1.35160	.11036	142.37

The Mann-Whitney U test results seen in Table 4 illustrate that there is a statistically significant difference in mean course grades earned by Hispanic and White students at University A and B. Table

4 also indicates that there is not a statistically significant difference in mean course grades earned by Hispanic and White students at University C and D. 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 (2013). The effect sizes for the statistical analysis for University A and B are .21 and .18 respectively. As stated by Cohen, the values indicate a small effect size (1988). The effect sizes for University A and B resulted in powers of .99 and .73.

Table 4. Summary of Mann-Whitney U Test Results.

Institution	Mann-Whitney U test	Effect size	Standard effect size
University A	Statistically significant	.20	.40
University B	Statistically significant	.18	.32
University C	Not statistically significant		
University D	Not statistically significant		

Discussion

In this quantitative research investigation, the researchers examined Hispanic student success in Calculus I, an introductory STEM course. The researchers accomplished this by comparing Hispanic student course grades in Calculus I to their White peers and comparing the grades as a function of the type of institution the students attended, HSI vs. non-HSI. Applying LatCrit, the researchers will discuss the possible causes and effects attending an HSI has on Hispanic student success in Calculus I.

Findings

The findings for the Research Question reveal that White students significantly outperformed Hispanic students at University A and B, while there isn't a statistically significant difference in mean Calculus I grades at University C and D (Table 4). In general, White students earned statistically significant higher grades in Calculus I at non-HSIs (University A and B) but did not at HSIs (University C and D).

When applying LatCrit to the findings, each of the five defining elements of LatCrit must be considered. University A and B are non-HSIs, while University C and D are currently designated as HSIs. 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, 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 (University D), 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 (University C), 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 (University A and B), but more than at historically Hispanic institutions (University D).

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 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 5. The demographics of the student population at the HSIs (University C and D) have a much higher percentage of Hispanic students, 26% and 61% respectively, compared to the non-HSIs (University A, 9% and University B, 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 5, the percentage of Hispanic faculty at University C and D, is significantly higher than at University A (4%) and University B (8.1%). The increase in the Hispanic faculty demographic at University C and D may result in an increase in Hispanic student success.

Table 5. Percent of Hispanic Students and Faculty at the Four Universities.

School	Hispanic students	Hispanic faculty
University A	9%	4%
University B	21%	8.1%
University C	26%	11.7%
University D	61%	47.3%

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

In conclusion, Hispanic students at University A and B earned significantly lower grades in Calculus I compared to their White peers, while there is no statistically significant difference at University C and D. Reviewing the findings through the lens of LatCrit, has provided possible explanations as to why White students are outperforming Hispanic students in Calculus I at non-HSIs but are not at HSIs.

Recommendations for Practice (Teaching and Learning)

The literature review and results of this investigation revealed several recommendations that have the capacity to increase Hispanic student success in 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 courses and the proportion of Hispanic student enrollment. To increase Hispanic student enrollment in STEM disciplines the researchers recommend 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).

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 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.

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 researchers recommend increasing non-debt incurring financial aid via grants for Hispanic STEM majors.

Scott, McNair, Lucas, & Land observed that students in smaller STEM classes are more engaged, earned better grades, and had a higher completion rate than students from larger classes (2017). The average class size in Calculus I for the Fall 2019 term for the universities included in this investigation is 128 students. The standard class size for freshman STEM courses at universities is typically between 200 and 300 students. To promote Hispanic student success in STEM courses the researchers recommend decreasing class size to 72 students or fewer. This reduction would encourage Hispanic student engagement with faculty, peers, and the material.

In 2012, Gasiewski, Eagan, Garcia, Hurtado, & Chang reported that engaging professors increase STEM course success via the use of active learning and student engagement. To increase Hispanic student success in STEM courses the researchers recommend implementing 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 courses are faculty accessibility inside and outside of the classroom, humor, enthusiasm, and the use of real-world examples of course material.

Although most STEM faculty members believe that student-centered active learning pedagogies increase STEM course success, most of the faculty members do not use these techniques (Ferrare, 2019). Additionally, a significant percentage of STEM faculty believe that 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 most STEM faculty members agree that student-centered pedagogies are better than faculty-centered pedagogies, they do not adopt student-centered techniques. 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 courses to weed-out students.

Recommendations for Future Practice

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

Method Recommendations. The researchers used a nonexperimental quantitative research model as the method for this investigation. Mann Whitney U tests were used to examine the difference in mean Calculus I grades between Hispanic and White students at the four universities. While the results of these tests did answer the research question, the small effect sizes adversely affected the power of the statistical analyses. The researchers recommend 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 researchers designed this investigation to have equal sample sizes but the inclusion of withdrawal grades from University B, which had to be deleted, decreased the sample sizes. In future investigations, the researchers recommend using equal sample sizes.

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 researchers recommend an investigation of Hispanic student success in STEM 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 researchers suggest 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 presumes 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 researchers recommend disaggregating the Hispanic umbrella in future investigations.

Conclusion

In this investigation, the researchers explored Hispanic student success in Calculus I, an introductory STEM course. 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, STEM courses, and the Latin Critical Theory.

Gonzalez and Morrison (2015) along with Nunez (2014) and Villalpando (2004) provided the basis for the research question explored in this investigation via the Latin Critical Theory. The researchers explored Hispanic student success in a STEM course as a function of ethnicity and the type of institution attended (HSI vs. non-HSI). The researchers collected data from two non-HSIs (University A and B) and two HSIs (University C and D).

The results of this study are intended to evaluate Hispanic student success in an introductory STEM course, Calculus I, 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 courses.

This investigation revealed that White students at non-HSIs (University A and B) earn significantly higher grades than their Hispanic peers in Calculus I, while there is no statistically significant difference in mean Calculus I grades between White and Hispanic students at HSIs (University C and D). This investigation of Hispanic student success in Calculus I, 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 Calculus I. 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 courses at U.S. institutions of higher learning.

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