The Effects of Faculty Race, Rank, and Gender Characteristics on Institutional Retention and Graduation Rates

Dissertation

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By

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Abstract

In this study, I looked at the relationships between faculty diversity and institutional retention and graduation rates. I relied on a relatively unique way of measuring faculty diversity, which accounted for differences in faculty race, rank, and gender characteristics simultaneously. Using public data from the Integrated Postsecondary Education Data System, I constructed a panel dataset for four-year public and private nonprofit institutions spanning the academic years 2012-2013 through 2021-2022, generating a sample of 1,677 institutions per year. I ran multiple linear mixed-effects regression models on this dataset to determine whether within-institution changes in faculty diversity related to changes in two-year retention and four- and six-year graduation rates. I also conducted several robustness checks to test the sensitivity of the main results to issues such as student race and gender differences and changes over time. I grounded my paradigmatic approach in quantitative critical race theory. After controlling for several student and institutional characteristics, I found that faculty diversity positively associates with four- and six-year graduation rates, but not necessarily two-year retention rates. These findings hold implications for college and university faculty, administrators, and policymakers aiming to increase the racial and gender diversity of instructional staff at all faculty ranks.

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Chapter 1. Introduction

White men predominate the American professoriate. Their predominance dates back to the founding of Harvard College in 1636 and remains true today, almost four centuries later. Disparities across race, rank, and gender have prevented faculty diversity from reflecting the increasing diversity of college students specifically and the United States (U.S.) population generally (Davis & Fry, 2019; Matias et al., 2022). Despite some moderate advances in the ethno-racial and gender diversity of faculty over recent years, faculty diversification still trails behind the broadly growing U.S. population of color (Heilig et al., 2019), especially in full professorial positions. The share of women faculty and Faculty of Color decreases the higher their rank (Martinez et al., 2018; O'Connor, 2019), contributing to the persistent racial and gender imbalance in U.S. higher education. Numerous scholars have issued calls for a larger representation of women faculty (Cardell et al., 2020), Faculty of Color generally (Antonio, 2000; Griffin, 2020), and women Faculty of Color specifically (Fox Tree & Vaid, 2022) at all faculty ranks. The critical linkages between faculty diversity and access and success for underrepresented students, campus climate and intergroup relations, education and scholarship, and institutional viability help to amplify these calls (Smith & Schonfeld, 2000), demonstrating the benefit of diversity "for underrepresented students, students who represent other types of diversity, students in general, the institution, and society" (p. 17).

U.S. higher education leaders face pressure to expand access to higher education whilst maintaining high retention and graduation rates. Fittingly, Turner et al. (2009) found that racially and ethnically diverse faculty aid in the recruitment and retention of Students of Color. Specifically, Faculty of Color can help reduce the pervasive academic disparities for students of color that impede their academic performance (Fairlie et al., 2014). Moreover, White women

faculty, men Faculty of Color, and women Faculty of Color provide important mentorship to all students, but especially for students who hold minoritized identities (Bartels et al., 2021; Newman, 2015; Sandhu et al., 2022). These minoritized faculty members demonstrate as role models that similarly minoritized students belong and can succeed in higher education (Stewart & Valian, 2018), which is paramount in fields where women, Men of Color, and Women of Color are underrepresented such as biology, mathematics, and engineering (see McGee, 2020; Palid et al., 2024. These diverse faculty also strengthen the diversity and quality of ideas in research and decision-making (Antonio, 2000; Stewart & Valian, 2018).

Clearly, faculty diversity matters, especially for students. As Sandhu et al. (2022) surmise in their literature review of student perspectives on faculty diversity, students consistently emphasize the significance of building and maintaining a diverse faculty body, highlighting benefits such as exposure to different perspectives, role modeling, and improved learning experiences. The literature also indicates that faculty diversity positively impacts students from underrepresented groups (i.e., Students of Color, women), boosting their sense of belonging and academic success. However, challenges still exist, such as the underrepresentation of women faculty and Faculty of Color in U.S. higher education. In their review, Sandhu et al. underscore the need for college and university leadership across the country to prioritize diversity efforts and ensure that faculty reflect the diverse student body enrolled on their campuses, ultimately enhancing the educational experience for all students.

A roadblock to faculty diversification efforts includes the somewhat stagnant nature of U.S. higher education. al-Gharbi (2023) attributes this stagnation to three issues: Pipeline problems in PhD attainment along race and gender lines; bias and discrimination against White women faculty, men Faculty of Color, and women Faculty of Color; and the slow rate of faculty

turnover. Despite these issues, college and university faculty and administration must presently and continuously cope with the many changes in the academy brought about by the increasing diversity of their student bodies across race, gender, and other identities over time (Clauson & McKnight, 2018). Campus decision-makers are ill-prepared to respond to these changes and changing demographics due to the isomorphic nature of U.S. higher education (Kezar, 2005), which evokes resistance to such change (Caruth & Caruth, 2013). DiMaggio and Powell (1983) posit that structural change (e.g., faculty diversification) only occurs as the result of processes that make institutions more similar without necessarily making them more efficient, exhibiting isomorphism. Pointedly, U.S. higher education must be compelled to change. As Caruth and Caruth (2013) argue, "No amount of communication, training, or support from the top can substitute for a compelling reason for any change" (p. 15). The compelling reason for faculty diversity is student success, but few researchers have empirically established this connection (Barbera et al., 2020; Llamas et al., 2021)—and fewer still across multiple and intersecting dimensions of diversity (Cross & Carman, 2022).

Background

A growing coterie of scholars have explored and conceptualized the antecedents and outcomes of student attrition (e.g., McClain & Perry, 2017; Quaye et al., 2015; Tinto, 2006). These and other scholars suggest that fostering the academic and social integration of students will lead to higher graduation rates (Hurtado & Guillermo-Wann, 2013; Quaye et al., 2015; Scrivener et al., 2015), thus lowering student attrition rates in the process. Indeed, Tinto (1993) demonstrated in his "Model of Institutional Departure" how students needed to integrate into both formal and informal academic and social systems to persist through to graduation. In particular, informal interaction with both faculty (academic system) and peers (social system)

engendered better institutional integration, consequently improving student graduation rates. Pointedly, “Faculty positively impacted successful student environmental integration and effectively reduced student feelings of isolation and rejection by interacting with students” (Cross & Carman, 2022, p. 856), enhancing student outcomes. However, Museus (2014) noted how the model undervalued the importance of diversity and representation to student success.

Scholarship on the relationship between structural diversity, representation, and retention or graduation rates have yielded mixed results. Multiple studies have observed no statistically significant relationship between campus diversity and educational attainment (Birdsall, 2018; Chen, 2012; Ehrenberg & Zhang, 2005; Gross et al., 2013; Pike & Graunke, 2015; Pike & Robbins, 2020). A few found that increased diversity negatively affected retention and graduation rates at least for some student subgroups (see Toutkoushian, 2023; Webber & Ehrenberg, 2010). Though Pike and Robbins (2020) showed evidence that enrolling greater proportions of women students generally led to higher graduation rates, Webber and Ehrenberg (2010) found that the gender effect disappeared after controlling for major.

The aforementioned studies focused on student rather than faculty diversity. Faculty identity, specifically racial identity, plays into student academic and social integration and by extension student success (Hurtado et al., 1999). Yet again, results vary, depending on the level of analysis. For course-level studies, findings indicate that having a same-race instructor led to higher grades and persistence, especially for racially minoritized students (Fairlie et al., 2014; Llamas et al., 2021; Price, 2010). On the contrary, when examining the representation of instructors at the institutional level, research has typically found no substantial association with the outcomes of racially minoritized students (Griffith, 2010; Koch & Zahedi, 2019).

The existing corpus of work on the relationship between faculty diversity and student success almost exclusively considers one dimension of difference—i.e., race/ethnicity (see Bowman & Denson, 2022; Cross & Carman, 2022; Fairlie et al., 2014; Llamas et al., 2021; Stout et al., 2018; Taylor et al., 2022). Of these studies, two focus only on community colleges (Cross & Carman, 2018; Fairlie et al., 2014), one on selective colleges and university (Llamas et al., 2021), and one on the University of California and California State University system (Taylor et al., 2022), thereby limiting generalizations across the higher education sector. The two national studies (i.e., Bowman & Denson, 2022; Stout et al., 2018) confine their definition of degree completion to graduation rates within 150 percent (i.e., six years) rather than 100 percent of normal time (i.e., four years) for four-year institutions.

Faculty hold multifaceted and intersecting identities. Accordingly, Cross and Carman (2022) recommend that future studies expand their conceptualizations of diversity to include intersectional diversity categories like Black men, Latinx women, and other combinations to gain a deeper understanding of the effect of faculty diversity on students. Additional research would also benefit from looking at this effect within and across varying institutional types.

Problem Statement

The underlying problem, which gave rise to this inquiry, lies in connecting faculty diversity to student success. In 2022, U.S. President Joseph Biden received a letter written by an eclectic coalition of civil rights groups, education associations, think tanks, and other stakeholders with a strong interest in bolstering retention and graduation rates nationally. The letter ultimately called for a greater investment in evidence-based college completion initiatives (Association of Public and Land-Grant Universities, 2022). Indeed, U.S. higher education institutions face numerous pressures to improve their student outcomes, either to raise their

rankings in publications like *U.S. News and World Report* that rely on these metrics or to procure more money from states with performance-based funding models (Shin & Milton, 2004).

Several scholars have assessed and attempted to ascertain the impact of diversity on student success, including but not limited to Astin (1993), Gurin et al. (2002), and Espenshade and Radford (2009). Their collective corpus of work offers extensive evidence demonstrating the positive effect of diversity on all students, minoritized or otherwise (Fine & Handelsman, 2010). However, research also shows some resistance by students to the existence of multiple group identities on campus (i.e., diversity) and how institutions respond to these diverse identities (i.e., multiculturalism), particularly toward approaches that might evoke feelings of dissatisfaction, isolation, and marginalization (Bruch et al., 2007; Higbee et al., 2007). Other psychology studies have also concluded that greater diversity did not beget better student outcomes (Binning et al., 2020; Eagly, 2016). For example, Owens and Massey (2011) found that situational predicaments of students feeling at risk of conforming to stereotypes—otherwise known as stereotype threat—could have a significant negative effect on the academic performance of racially-minoritized students. Additionally, Richeson and Shelton (2003) showed that even students not subject to negative stereotypes—namely, White men for their study—experienced problems with cognitive performance due to interracial contact with other students. That said, research suggests students want to engage with institutionalized initiatives to foster a positive campus climate and respect for diversity, with faculty diversity representing one salient initiative (Mayhew et al., 2005).

A paucity of work looks at student perspectives on the diversity of the U.S. professoriate or examines the relationship between the college student experience and faculty diversity (Stout et al., 2018). One study explored the role of race in the interactions of Black undergraduate engineering and computer science majors with different-race faculty members, finding that

students prefer more interactions with same-race faculty members in their own department (Newman, 2015). Newman also noted the consequential negative impact unsupportive White faculty members may have on the academic trajectories and college success of Black students. These findings suggest that faculty diversity should at least reflect the student demographics of a given college or university, thus providing students (particularly minoritized students) with more opportunity to experience positive interactions with faculty from both similar and different social backgrounds. Moreover, faculty also benefit from having a more diverse student body. As Taylor et al. (2010) note, "faculty diversity is enhanced by student diversity" (p. 18), with the relationship appearing symbiotic. Despite their symbiotic relationship, shifts in faculty diversity have not kept pace with shifts in student diversity, especially across race and gender (National Center for Education Statistics [NCES] 2022, 2023; Williams & Wade-Golden 2007).

While some scholars argue that faculty diversity is improving moderately (e.g., Smith et al. 2012; Trejo, 2017), U.S. higher education still needs to do more to employ faculty who mirror their student bodies (Stout et al., 2018). Moreover, Bitar et al. (2022) examined faculty diversity relative to student diversity, and changes in faculty representation over time for Black and Latino faculty at public, four-year institutions. Bitar et al. spotlighted colleges and universities making meaningful progress on diversifying their faculties and those that have more work to do. The authors also showed that an overwhelming majority of public colleges and universities earned failing grades in having an even ratio of Faculty of Color to Students of Color on their campuses.

Matias et al. (2022) also call for greater and more accelerated action by U.S. higher education institutions to diversify their faculty. Their analysis of three national datasets predicts that at current rates, higher education faculty diversity will never attain racial parity with the U.S. as a whole. Due to the slow changing nature of higher education, faculty diversity will not

just increase as the nation's diversity increases (Gibbs et al., 2014). However, "colleges and universities could achieve parity by 2050 by diversifying their faculty at 3.5 times the current pace" (Matias et al., 2022, p. 1606). Such a drastic rate uptake would require massive investment from both the public and institutions. To secure this investment, researchers must establish that faculty diversity initiatives are, in fact, evidence-based college completion initiatives, a proposal that academe has yet to fully quantify or prove (Fincher et al., 2010; Stout et al., 2018).

Altogether, research shows that focusing on student diversity alone will not sufficiently address issues of student retention and graduation. In fact, Toutkoushian (2023) concludes that increases in student diversity, particularly around race/ethnicity and ability as measured by ACT scores, hamper institutional efforts to boost student outcomes. His findings comport with the concerns raised by Smith et al. (1997), Chang (1999, 2005), and Milem et al. (2005) that students may not necessarily benefit from a diverse student body in and of itself. Toutkoushian (2023) recommends that institutions pay more attention to diverse students currently enrolled than those seeking to enroll. Put differently, college and university leaders should place as much (if not more) emphasis on completion as they do with access.

One approach U.S. higher education executives use to prioritize completion includes highlighting the impact of the close relationship between faculty and students. A plethora of researchers have positively linked student-faculty interactions with increasing levels of overall college satisfaction, cognitive development, and persistence through graduation (Crisp & Cruz, 2009; Kuh & Hu, 2001; Pascarella & Terenzini, 2005). Yet, fewer researchers have explored the impact of student-faculty interactions across race, gender, and rank intersectionally, presenting a gap in research that my work seeks to fill.

Research Question and Methods

Using an institution-level panel dataset derived from the Integrated Postsecondary Education Data System (IPEDS), I endeavored to establish and explicate the relationship between faculty structural diversity and student success outcomes across varying institutional contexts. I also aimed to determine the moderating effect of student structural diversity on this relationship. To accomplish these goals, I drew upon multilevel regression modeling techniques (specifically, linear mixed-effects models) to determine the significance and effect sizes of my results. Specifically, I asked:

- What is the relationship between faculty diversity characteristics and undergraduate student retention and graduation rates at U.S. higher education institutions?

For this line of inquiry, I tested the following research (H_a) and null (H_o) hypotheses:

H_{a1}. That faculty diversity characteristics significantly relate to undergraduate student retention and graduation rates at U.S. higher education institutions, after accounting for level of faculty discrimination and other institutional characteristics.

H_{o1}. That faculty diversity characteristics do not significantly relate to undergraduate student retention and graduation rates at U.S. higher education institutions, after accounting for level of faculty discrimination and other institutional characteristics.

H_{a2}. That student diversity characteristics significantly moderate the effect of faculty diversity characteristics on undergraduate student retention and graduation rates at U.S. higher education institutions.

H_{o2}. That student diversity characteristics do not significantly moderate the effect of faculty diversity characteristics on undergraduate student retention and graduation rates at U.S. higher education institutions.

Significance

The main area of significance for this study revolves around providing guidance to institutional decision-makers for how to obtain faculty buy-in for diversification efforts. Institutions have always and will continue to face significant resistance to espousing diversity into their organizational structures and cultures (Aguirre & Martinez 2006; Williams 2013). In response, Adserias et al. (2017) identified and evaluated how different leadership styles contribute significantly to successful institutional change, especially in regard to implementing a diversity agenda. U.S. higher education executives are most likely to employ a transactional style of leadership, meaning these "leaders build relationships based primarily on the principles of trust and honesty and in the service of maintaining organizational order and culture" (Adserias et al., 2017, p. 327).

College and university decision-makers will find the transactional leadership approach particularly helpful in gaining broad ownership of a diversity agenda and using data to drive decision-making (Bensimon et al., 1989). Case in point, Kezar (2008) found that faculty diversification initiatives spurred the most considerable faculty resistance to the diversity agenda and necessitated transactional approaches such as utilizing data to undermine arguments against hiring diverse faculty (Williams 2013). The findings from this study will provide institutional decision-makers with said data to support faculty diversification on their campuses.

Many U.S. higher education leaders aim to diversify their undergraduate student bodies and retain that diverse cohort through to graduation, yet actualizing this aim remains elusive. The findings from this study may help institutional decision-makers in advocating for renewed faculty diversification efforts towards this goal.

Key Definitions

When studying social identities, researchers should outline the parameters of the identities under investigation. This parameter setting stems from the proposition that all social identities are socially constructed (see Jones & Abes, 2013). Indeed, "other people, as well as the individual involved, evaluate a person and make judgment based on these identities" (Patton et al., 2016, p. 66), which can engender warring definitions of various socially constructed identities. As "the involved individual," I clarify my use of various social identity terminology throughout the manuscript below. For further clarity, I also define my outcome measures below.

Social Identity Terminology

In Table 1, I provide a glossary for key terms pertaining to social identity. I derive all definitions from IPEDS and other relevant literature.

Table 1

Social Identity Terminology

Term	Definition
Race/Ethnicity	NCES leverages categories developed in 1997 by the Office of Management and Budget that are used to describe groups to which individuals belong, identify with, or belong in the eyes of the community. The categories do not denote scientific definitions of anthropological origins. The designations are used to categorize U.S. citizens, residents, and eligible non-citizens. For IPEDS, individuals indicate ethnicity as: 1) Hispanic or Latino or 2) not Hispanic or Latino. Then, individuals mark all races that apply among the following: 1) American Indian or Alaska Native, 2) Asian, 3) Black or African American, 4) Native Hawaiian or Other Pacific Islander or 5) White (see NCES, 2024).
Gender	IPEDS collects data on gender, not sex. However, both the *Condition on Education* and *Digest of Education Statistics* reports issued by NCES use sex (i.e., male, female) to report on gender (i.e., man, woman). While a socially constructed identity, IPEDS records gender as "a dichotomous variable with the possible responses of woman/man or female/male" (Lindqvist et al., 2021, p. 332).
Rank	The IPEDS Human Resources survey component includes the ranks of not on tenure track, tenure, and tenure track for academic rank of faculty (see NCES, 2024).

Level of Student	I use this qualifying variable on IPEDS to separate first-time, full-time enrolled undergraduate students from continuing (second-year and above), full-time enrolled undergraduate students.
Structural Diversity	Denson and Chang (2009) posit that there are three distinct forms of diversity in higher education: interactional diversity, curricular diversity, and structural diversity. Researchers use compositional diversity across and within various social identity categories to measure structural diversity specifically. For this reason, I use structural diversity interchangeably with compositional diversity, which I define as the proportional representation of different groups of people within the campus environment (cf., Denson & Chang, 2009; Milem et al., 2004; Mayhew et al., 2016).

Outcome Measure Terminology

In Table 2, I present a glossary for key terms relating to the measures of student success under study. I derive all definitions from IPEDS.

Table 2

Outcome Measure Terminology

Term	Definition
Retention Rate	A measure of the rate at which students persist in their educational program at an institution, expressed as a percentage. For four-year institutions, this is the percentage of first-time bachelors (or equivalent) degree-seeking undergraduates from the previous fall who are again enrolled in the current fall. For all other institutions this is the percentage of first-time degree or certificate-seeking students from the previous fall who either re-enrolled or successfully completed their program by the current fall (see NCES, 2024).
Four-Year Graduation Rate	Data for this measure are collected on the number of students entering the institution as full-time, first-time, degree/certificate-seeking undergraduate students in a particular year (cohort), by race/ethnicity and gender; the number completing their program within 100 percent of normal time (four years) to completion; the number that transfer to other institutions if transfer is part of the institution's mission (see NCES, 2024).
Six-Year Graduation Rate	Data for this measure are collected on the number of students entering the institution as full-time, first-time, degree/certificate-seeking undergraduate students in a particular year (cohort), by race/ethnicity and gender; the number completing their program within 150 percent of normal time (six years) to completion; the number that transfer to other institutions if transfer is part of the institution's mission (see NCES, 2024).

Organization of the Study

In this chapter, I introduced the purpose and significance of this study including the research question that guides this inquiry. In Chapter 2, I situate the study in relevant literature, drawing primarily upon college impact research and critical race theory and scholarship. I review this literature to identity and interrogate conceptual and theoretical models that attempt to make sense of student retention behavior and the intersecting systems of power that influence this behavior. Then, I coalesce these models to propose a novel framework for expressing and understanding the study variables and the relationships between them.

In Chapter 3, I begin by describing my paradigmatic foundations, explicating and justifying my quantitative critical race theory (QuantCrit) approach to the work. Specifically, I delineate how both critical and intersectional quantitative schools of thought inform my paradigmatic approach. From there, I discuss my role as a researcher through a positionality statement that empowered me to reflect on my relationship to the proposed research. I then use this positionality statement to show how I interwove criticality into my design methodology, which guided each of my research design decisions from my research questions to data collection to data analysis strategies. Finally, I turn to the methods, where I revisit my research questions and hypotheses, detail my data collection and analysis procedures, explain my statistical models and model selection, and disclose limitations in my research design.

In Chapters 4 and 5, I report my results and discuss the implications of the study findings. For the results section, I provide descriptive statistics for my variables, explain my model results, and test the strength of the results to model variations. For the discussion section, I interlace the findings with my conceptual framework and paradigmatic approach to offer theoretical insights and practical recommendations before closing my dissertation.

Chapter 2. Literature Review

Since the turn of the twenty-first century, U.S. higher education institutions have experienced a renewed wave in student uprisings, with collegians demanding greater gains in diversity, equity, and inclusion on campus for minoritized individuals (Barnhardt, 2014; Rhoads, 2016). To address these demands, institutional decision-makers need to first understand what impacts the campus experiences of the students demanding change, with Students of Color making up a large share of these students (Kilgo et al., 2019). Both longstanding and contemporary research on campus racial climate and the ways Students of Color must navigate those climates offers insight into what impacts the collegiate experiences of these students. Moreover, Hurtado et al. (1998) proffer a framework for understanding the external and internal forces on campus racial climate, which looks at four interrelated institutional forces: 1) Historical legacy of exclusion or inclusion, 2) structural diversity, 3) psychological dimension, and 4) behavioral dimension. Given the significant and strong effect of faculty on college student outcomes (Cuseo, 2018; Kim & Lundberg, 2016; Mayhew et al., 2016; Miller et al., 2019), ongoing research about the ways students interact with faculty remains paramount to understanding the four dimensions of the framework put forward by Hurtado et al., particularly the structural diversity dimension.

Denson and Chang (2009) define three types of diversity, specifically interactional, curricular, and structural. Interactional diversity encompasses the quantity and quality of interpersonal contact with diverse individuals. These diverse interactions occur every day either with peers (horizontally) or with subordinates and superiors (vertically). Researchers exploring roommate dynamics among individuals of different races and those of the same race focus on horizontal interactions. Conversely, investigations into interactions between advisors and

advisees, comparing same-gender and mixed-gender pairs, delve into vertical interactions. Several researchers have positively associated interactional diversity with intergroup attitudes (Lopez, 2004), student learning and personal development (Hu & Kuh, 2003), critical thinking skills (Laird et al., 2005; Pascarella et al., 2001), and a plethora of other student outcome measures (see Antonio, 2001; Gurin et al., 2002; Zúñiga et al., 2005). Curricular diversity constitutes the courses, workshops, and trainings that expose individuals to diversity-related material. For example, Vianden (2018) interviewed 92 undergraduate White heterosexual male college students about their perceptions of curricular diversity, revealing a need to weave diversity throughout the major course of study rather than a standalone course.

Lastly, structural diversity relies on compositional diversity as the measurable indicator of diversity. One study that examined structural diversity performed a cross-sectional survey of diversity program leaders at 106 U.S. medical schools to link program characteristics with minority faculty representation (Page et al., 2011). Interestingly, structural diversity has garnered less empirical attention than the other types of diversity (Denson & Chang, 2009), with less work still exploring identities beyond race and ethnicity (Holoien, 2013; Toutkoushian, 2023). For this chapter, I will attempt to review the extant literature on the impact of structural diversity on students, providing me with a scholarly foundation upon which to propel new research.

For the first section of this chapter, I will critically review student change models that assess the ability of an institution to promote equitable student outcomes related to retention and graduation rates. The second section will pertain to theoretical perspectives on intersectionality as a useful praxis for exploring and examining the relationship between institutional faculty diversity and undergraduate student retention and graduation rates. The third and final section will feature my conceptual framework, which will pull directly from the two prior sections.

Review of Student Change Models

Pascarella and Terenzini (2005) group conceptual frameworks for understanding how college students change as a consequence of their collegiate experiences into one of two broad categories, viz. "developmental" models and "college impact" models. Whereas developmental models attempt to explain the stages through which change occurs, college impact models focus primarily on the origins of change (Pascarella & Terenzini, 2005; Strayhorn, 2008). To better differentiate between the two categories, consider Chickering's (1969) Theory of Identity Development, which describes the college student identity development process through "seven vectors." Chickering defines each vector as a developmental stage or phase in the life of a college student, from developing competence at the beginning to developing integrity at the end of the process. This theory demonstrates the scaffolded approach that developmental models take to address the nature, structure, and processes through which *intra*individual change occurs.

Looking at *inter*individual change, Braxton et al. (2014) provide the Theory of Student Persistence in Commuter Colleges and Universities, which depicts student persistence as a longitudinal process. This model examines commuter student persistence through six dimensions (viz., student entry characteristics, external environment, organizational characteristics, academic and intellectual development, persistence) that pertain to their collegiate experiences. Like Hurtado et al. (1998), Braxton et al. also account for both internal and external factors that may affect college student outcomes, signifying a key component of college impact models. As both Hurtado et al. and Braxton et al. illustrate, college impact models concentrate on the origins of student change "associated with the characteristics of the institutions students attend (between-college effects)" (Pascarella & Terenzini, 2005, p. 18). As Mayhew et al. (2016) further note, between-college effects quantify and qualify the degree to which "organizational

characteristics (e.g., average level of peer cognitive development, whether the school is bureaucratic or collegial, structural diversity of the faculty) have an influence on the learning and development of the student" (p. 3). Both developmental and college impact models hold merit and play a vital role in contextualizing change among different populations of college students. That said, only college impact researchers include factors like campus structural diversity in their models, making college impact models the preferred choice for understanding how the structural diversity of the faculty affects student success outcomes over time.

From here, I select and describe the college impact model that will inform this study. Then, I review the literature on the use of said model in the study of student retention and graduation rates for all students and then minoritized students specifically. Using this review, I finish with a discussion on how scholars have used criticality in their approach to the study of student retention and graduation rates among minoritized students.

The Inputs-Environment-Outcome Model

To study assessment activities in higher education, Astin (1970, 1991, 1993) proposed the inputs-environment-outcome (I-E-O) model, which helped to pioneer the field of college impact research (Strayhorn, 2008). This relatively straightforward model provides a framework for crafting assessment activities and addressing even the most intricate matters in assessment and evaluation. To that point, Astin developed the I-E-O model early on in his academic career as part of an assessment project geared towards bolstering PhD productivity. The project aimed to encourage more undergraduate students to pursue graduate work, especially in the sciences (Astin, 1970). At the time, researchers found that certain colleges and universities were much more likely than others to produce graduates who would go on to win graduate fellowships and to earn a PhD degree (Knapp & Goodrich, 1952; Knapp & Greenbaum, 1953). The researchers

attributed these differences in PhD productivity to disparities in available resources—case in point, highly productive institutions tended to have larger libraries and smaller student-faculty ratios than did the less productive institutions. Skeptical of this conclusion, Astin noticed that National Merit Scholars also tended to prefer highly productive institutions over less productive institutions for enrollment. In response, Astin (1991) asked "Could a college's output of PhDs be explained simply in terms of its initial input of talented freshmen" (p. 17)?

Astin (1962, 1963) explored this question and found that, by and large, student input (i.e., demographic and pre-college characteristics) played the most determinative role in predicting PhD productivity. After controlling for student input factors, Astin showed that some institutions purportedly labeled as highly productive were actually underproducing PhD degree-holders and that some with low PhD productivity were exceeding expectations based on their student inputs. This observation suggested that *where* a student enrolled may not matter as much as *who* the student was before and during matriculation. Scholars and scholar-practitioners assessment in higher education gained three further and fundamental lessons from this work.

The first lesson revolves around outputs. Specifically, output alone can only offer so much about the educational effectiveness or impact of a college or university in developing talent. Researchers must assess outputs in terms of inputs. This holds especially true for the 4,000-plus higher education institutions in the U.S., which all differ greatly in the type of students that enroll. The second lesson considers the notion of multiple and intersecting social identities. Inputs do not exist in a vacuum and operate in "mutually constitutive" ways with each other (Shields, 2008, p. 301). For instance, student ability, sex, and intended major all equally help to determine PhD productivity (Astin, 1962, 1963, 1991). The third and final lesson relates to the college environment. This lesson challenges college impact researchers to consider the

limited usefulness of input and output in understanding why a given phenomenon occurs (such as whether a college overproduces or underproduces PhD graduates). As Astin (1991) queried, "What is it about the environment of a college that causes it to over- or underproduce" (p. 18)? An environment factor would constitute any variable that adds predictability to an output measure over and beyond student input characteristics, such as exposure to faculty and peer groups (Garvey & Inkelas, 2012). These three lessons taken together suggest that any complete educational assessment project must include data on student inputs, student outcomes, and the educational environment to which the student is exposed. This conclusion ultimately brought about the development of the I-E-O model.

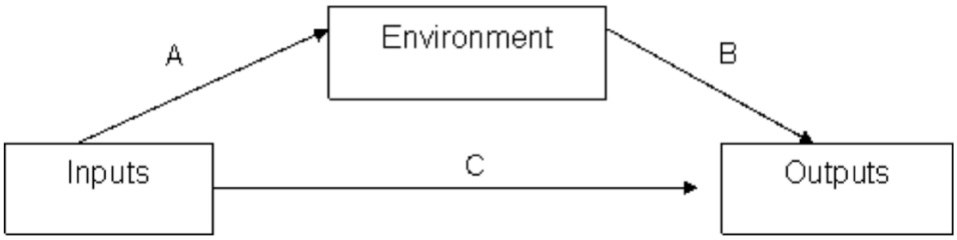
Under the I-E-O model, outcomes would refer to the aforementioned "talents" that educational programs seek to develop. Outcomes also describe the change in students that college impact models aim to capture. Output measures for this change can range from psychosocial change (e.g., sense of belonging, social self-efficacy) to educational attainment and persistence (e.g., retention and graduation rates) to the economic impact of college (e.g., debt load, post-college earnings). On the other end of the model, input represents the first component that shapes the educational experiences and outcomes of college students. Input describes student demographics, motivations, and individual experiences immediately prior to matriculation, otherwise known as student attributes. Possible input measures of these attributes include gender, race, first-generation status, family socioeconomic status, and ACT/SAT composite scores. Lastly, environment refers to the actual collegiate experience of a college student while enrolled at an institution. Examples of environmental factors include institutional characteristics (e.g., Carnegie Classification, enrollment size), student peer group (e.g., beliefs, norms), curriculum (e.g., major course of study, general education requirements), financial aid

(e.g., scholarships, federal work-study), involvement (e.g., community engagement, co-curricular activities), and faculty demographics (e.g., number of Black faculty, percent of women faculty). Of note, "environmental information is especially critical here, since the environment includes those things that the educator directly controls in order to develop the student's talents" (Astin, 1991, p. 18). Accordingly, higher education assessments should make clear how institutional decision-makers can manipulate the environment to yield desirable student outcomes.

Figure 1 illustrates the I-E-O model, with the three arrows (A, B, and C) signifying the relationship between the three classes of variables (inputs, environment, outputs). Astin (1962, 1963) showed that researchers concerned only with the relationship between environment variables and output variables (arrow B) limit both themselves and the overall interpretability of their findings. Similarly, researchers who only look at the relationship between input variables and output variables (arrow C) may miss the fact that that different types of students often choose different types of educational environments (arrow A). A researcher must evaluate all three relationships simultaneously to fully appreciate the scope of the I-E-O model. Aptly, Astin (1970, 1991, 1993) designed the I-E-O model to enable a researcher to measure the relevant input characteristics of each student and then control for the effects of these input differences to gain a less biased estimate of the comparative effects of different environments on outputs, making all three data classes essential for any comprehensive (or complete) assessment.

Figure 1

Astin's (1991) I-E-O College Impact Model



Note. Electronic image created by author based on information found in Strayhorn (2008).

Put simply, Astin (1993) crafted the I-E-O model to allow a researcher to observe change over time. The pursuit of higher education engenders this change for college students, enhancing their educational and personal development along the way. As follows, student input and student outcome together represent this development, showing changes in their abilities, competencies, knowledge, values, aspirations, and success at different time points. Given the fundamental role of change in higher education, college impact researchers should gather multiple snapshots of students over time to accurately gauge their progress. Understanding the unique environmental factors impacting each student further clarifies differences in their development.

Indeed, "input and outcome refer simply to the state of the person at two different time points, and environment refers to the intervening experiences" (Astin, 1993, p. 22). This quote suggests that panel datasets with only student input and student output data hold little merit without also including information on forces (i.e., environmental experiences) acting on them at the same time. Since environmental experiences offer the possibility of improving outcomes over time, Astin further recommends that higher education scholars, practitioners, and policymakers focus on forces within their realm of control. Investing time and resources in studying the impact of environmental experiences beyond human intervention serves little purpose. For example, consider the impact of the death of a family member (environmental event) on a college student. Such an event would naturally and negatively affect the academic

performance of a student (Servaty-Seib & Hamilton, 2006). While colleges and universities may offer services like counseling to help students cope with the loss (see Bistricean & Shea, 2021), higher education professionals can do little to change the event itself. Conversely, consider the high-impact educational practices that Kuh (2008) proposes for maximizing teaching and student learning. These practices take many different forms, depending on institutional context and priorities. As such, institutional decision-makers can change these practices (or environmental experiences) to produce more favorable student outcomes in the future.

The enduring relevance of the I-E-O model in the study and practice of college impact stems from the ease of use and transparent understanding of the framework. Astin (1970, 1991, 1993) developed and designed the I-E-O model with model parsimony in mind, meaning he strived to accomplish the desired level of prediction with as few predictor variables as possible. Other prevailing college impact models such as Tinto's (1975) Student Integration Model, Bean and Metzner's (1985) Non-traditional Student Attrition Model, and Weidman's (1989) Model of Undergraduate Socialization tend to consist of multiple levels, multiple phases, and multiple concepts at each phase (see Strayhorn, 2008; Pascarella et al., 1996), whereas Astin's I-E-O model relies on a one-dimensional, three-pronged framework. More parsimonious models "are more easily understood, if not by researchers than by readers; more easily explained in narrative and graphical descriptions, and more easily operationalized in research studies" (Strayhorn, 2008, p. 3). This ease of operationalization proves especially important in model selection based on performance criterion (e.g., Bayesian information criterion) as quantitative data analyses tend to penalize less parsimonious models (see Schwarz, 1978), making the I-E-O model the preferred framework for quantitative based research on college impact.

From this perspective, the I-E-O model serves more as a methodological guide for conducting college impact research than as a theoretical model for examining and explaining change over time (Astin, 1991; Pascarella & Terenzini, 2005). The application of this model should, in turn, empower those responsible for assessment activities to identify and interrogate connections between certain conditions (environments) and corresponding events (outcomes), with the recognition that these connections may vary among different types of people (inputs).

Applying I-E-O to the Study of Retention and Graduation

U.S. higher education institutions face numerous pressures to improve their student outcomes, either to raise their rankings in publications like *U.S. News and World Report* that rely on these metrics or to procure more money from states with performance-based funding models (Shin & Milton, 2004). The Association of Public and Land-Grant Universities (APLU), which represents nearly 300 member institutions, added to this pressure through an open letter to U.S. President Joe Biden that called for greater investment in proven college retention and completion programs. Several civil rights groups, education associations, think tanks, researchers, and other stakeholders with a strong interest in bolstering retention and graduation rates nationally also cosigned on the letter (APLU, 2022). These pressures present a need for more assessment activities around raising retention and graduation rates for all students, but especially minoritized students. However, York et al. (2015) report that college impact researchers more heavily use cumulative grade-point-averages and critical thinking acquisition than retention and degree completion (i.e., graduation) rates as their main outcome variables for student success, further validating the need for more work in the area of student retention and graduation.

Astin's (1970, 1991, 1993) I-E-O model provides a powerful tool for thinking more about student retention and graduation rates. Under this framework, institutional resources are used to

produce outcomes based on student inputs. To that end, institutional decision-makers looking to increase retention and graduation rates can either recruit students with higher likelihoods of success and retention or implement strategies to better support and graduate existing students. Put differently, college and university leaders can either change their inputs (e.g., accept students with higher ACT/SAT scores) or change their environment (e.g., implement high-impact educational practices) to yield better outputs (i.e., increased student retention and graduation rates). The I-E-O model ties retention and graduation rates to academic performance, as students must meet minimum grade requirements to remain enrolled and earn their degrees from an institution. Students who have met these minimum standards may still depart for reasons like financial constraints or dissatisfaction with the campus environment. Thus, factors that improve academic performance or encourage students to stay and subsequently succeed at the institution can positively influence retention and graduation rates.

Looking chiefly at diversity studies in higher education, Toutkoushian (2023) separates empirical studies on college student retention and degree attainment into two broad categories: Those that examine how personal characteristics like race, gender, and national origin influence whether or not a student earns a degree (e.g., Chang, 1999; DeAngelo et al., 2011; Titus, 2006) and those that study how the composition of students at a college affects institutional retention and graduation rates (e.g., Archibald & Feldman, 2008; Bailey et al., 2006; Goenner & Snaith, 2004; Ryan, 2004; Scott et al., 2006; Shin & Milton, 2004; Zhang, 2009). A few researchers have used longitudinal datasets to establish the determinants of student retention and graduation rates (e.g., Ehrenberg & Zhang, 2005; Pike & Graunke, 2015; Sav, 2012; Webber & Ehrenberg, 2010). In addition, Birdsall (2018), Hillman et al. (2014), and Pike and Robbins (2020) all leveraged longitudinal data to determine whether performance-based funding systems contributed to

increases in student retention and graduation rates. Common trends among all these studies suggest that institutional characteristics (environment) and student diversity (inputs) can contribute to changes in undergraduate student retention and graduation rates.

Almost every researcher who Toutkoushian (2023) cites prominently features Astin's work in their conceptual or theoretical framework. This pattern evinces the importance of Astin generally and the I-E-O model specifically to the study of college impact for all student populations and across varying institutional contexts. The researchers who contributed to this corpus of work appeared to favor some of his later work on evaluating and estimating retention and degree completion rates (viz., Astin, 1993, 1997). As with much of his prior work, Astin employs the I-E-O model for both studies. The titles for both studies reflect the inquiries under study. *What Matters in College?* "How 'Good' is Your Institution's Retention Rate?"

To answer the first question, Astin (1993) collected and analyzed survey data from nearly 25,000 students and another 25,000 faculty members at more than 200 higher education institutions to understand how the collegiate experience affects the social, personal, academic, and vocational development of undergraduate students. Applying the I-E-O model, Astin coded and described 192 measures of college environment to determine outcomes resulting from certain student inputs. Each environmental measure fit into one of five categories, specifically institutional characteristics, curricular characteristics, faculty environment, student environment, and individual involvement. The results from this four-year (1985–1989) study showed that the environment created by both students and faculty matters the most to student development, with differences between institutional type only accounting for indirect effects. Hence, Astin argues that institutional decision-makers should pay more attention to values than metrics in supporting and assessing the college student experience. Astin exemplifies this argument by examining and

highlighting values-based student outcomes like attitudes, values, life goals, and political identification in the study.

In addressing the second question, Astin (1997) first critiqued contemporary means of assessing institutional performance via retention rates and other raw outcome measures and then posed a more nuanced approach for institutions to assess their effectiveness in retaining and graduating students. In essence, Astin (1997) problematizes the notion that "institutions with high retention rates are presumably doing a 'better' job than are institutions with lower rates" (p. 648). Drawing upon the I-E-O model, Astin sought to demonstrate how differences in student characteristics (inputs) and institutional effects (environment) could affect institutional retention rates (outputs). The study included national longitudinal data on 52,898 students attending 365 higher education institutions, which all participated in the Cooperative Institutional Research Program's annual survey of entering first-year students in the fall of 1985 (see Astin et al., 1986). From this data, Astin generated a formula through a series of multiple regression analyses to calculate an expected institutional retention rate based on the high school grades, admission test scores, and racial and gender composition of students. The formula can be and was adapted for four-, six-, and nine-year degree completion rates after first-year entry. Astin deemed institutions with higher actual than expected rates more effective at retaining and graduating students than institutions with lower actual than expected rates. Findings suggest that student inputs account for more variance in retention rates than any environmental measure.

Informed by both works (Astin, 1993, 1997), Marsh (2014) modified the I-E-O model to test the importance of specific student (input) and institutional (environment) characteristics on the retention (output) of students at public, four-year U.S. higher education institutions. The modification comes from the pairing of the I-E-O model with Pascarella's (1984) General Causal

Model, which provided Marsh with direction for the selection and theoretical order of entry of the institutional variables. Pascarella concentrated on assessing how the institutional environment influences student success. Under the framework, factors considered included student input characteristics, institutional structural characteristics, the institutional environment, and the influence of institutional socialization agents like fellow students and faculty members. Utilizing hierarchical linear regression, Marsh distributed and sequenced the independent variables according to five "blocks": A. Student input variables (e.g., gender), B. environmental bridge variables (e.g., percentage of full-time enrolled students), C. institutional structural variables (e.g., Carnegie Classification), D. institutional financial variables (e.g., state funding allocations), and E. faculty intervention variables (e.g., student-faculty ratio). While the characteristics of student cohorts (block A) explained much of the variance in institutional retention rates, campus characteristics (blocks B, C, and D, specifically) yielded an additional and significant impact. However, Marsh (2014) found no statistically significant relationship between institutional retention rates and the percent of non-White students and female students in the entering cohort, comporting with the findings of Birdsall (2018), and Pike and Graunke (2015) (for non-White students) and DesJardins et al. (2003) and Titus (2004) (for female students).

Guided by the I-E-O model, Toutkoushian (2023) also determined that within-institution changes in student compositional diversity in regard to race, gender, major, and innate ability were not associated with gains in retention and graduation rates. In fact, Toutkoushian concluded that increases in student diversity, particularly around race/ethnicity and ability as measured by ACT scores, hampered institutional efforts to boost student outcomes. More pointedly, "retention and graduation rates tended to fall as institutions enrolled more Black and male students"

(Toutkoushian, 2023, p. 6). Strayhorn (2012) gives more insight into this trend through his examination of degree attainment among Black college men specifically.

While institutions enroll more Black college students now than ever before, degree attainment rates among this student population have yet to match these enrollment rates. The high rates of (in)voluntary departure due to a lack of academic preparation (see Adelman, 1999; Horn & Chen, 1998) and/or financial contrasts (see Tinto et al., 1994) that disproportionately affect Black college students perpetuate this phenomenon. Black college men especially face unique challenges related to stereotype threat (Bailey & Moore, 2004) and disparaging statistics (Western et al., 2003) about college prospects. The scant literature on the retention of Black men in college gives much of the attention to those enrolled at four-year institutions (Schwartz & Washington, 2002), leaving Black community college students understudied. Blending Tinto's (1994) interactionalist theory of college-student departure and Astin's (1993) IEO model of college impact, Strayhorn (2012) estimated the impact of academic and social integration on the retention of African American men enrolled at two-year community colleges. Pre-college characteristics (e.g., first-generation status, age) accounted for the greatest amount of variance explained in satisfaction and retention among Black college men, reinforcing the notion that inputs matter most in educational assessments (especially for multiply minoritized students).

This need to focus more on the lived experiences of minoritized students cuts across disciplines, especially in science fields. As evidence, Huntoon and Lane (2007), Riggs and Alexander (2007), and O'Connell and Holmes, (2011) document a persistent and pervasive underrepresentation of racially minoritized students in the geosciences. Rather than attempting to assess what geoscience scholars already know about increasing diversity, Callahan et al. (2017) probe how these scholars have gone about accumulating knowledge on increasing diversity. The

researchers espouse the I-E-O model to frame their research questions and organize their literature review. Their analysis showed that studies on programs targeted at recruiting minoritized students frequently lack the input component of the I-E-O model, leading to incomplete assessments. As a consequence, Callahan et al. warn that "claims about the success of such programs are not, in fact, built upon an understanding of the characteristics of the students who benefited from them" (p. 567). In this way, Callahan et al. call upon other geoscientists to critically reflect on the culture of their field, which the I-E-O model allows them to do.

Criticality and the I-E-O Model

Prior to the passage of Executive Order 10925 in 1961, which officially implemented race-based affirmative action policies, and Title IX of the Education Amendments Act of 1972, which prohibited sex-based discrimination in any educational settings, college enrollment rates among both Students of Color (specifically Black students) and female students remained relatively low compared to their White male peers. Of the college-going population in 1960, Black students accounted for 4.3 percent while female students constituted 37 percent (Karen 1991), making White men the largest demographic by and large. Many of these Black students attended a historically Black college or university (Cross & Slater, 1999) and women's colleges were at an all-time high of 233 institutions (Langdon, 2001), enrolling much of the female student population. Astin (1962, 1963) began to develop the I-E-O model during this time frame, with the student input data used in both studies reflecting these skewed enrollment trends.

Using a sample of 335 accredited, four-year degree-granting colleges and universities, Astin (1962) performed a factor analysis of 33 major college attributes divided across five categories, specifically institutional type characteristics, financial characteristics, student

characteristics, faculty characteristics, and miscellaneous characteristics. Astin further subdivided the sample of institutions into the following groups: Public, private, universities, liberal arts colleges, and men's institutions. In this way, Astin offers contrasts between private and public and university and liberal arts institutions but not men's and women's colleges. The sample also does not demarcate minority-serving institutions. In response, Astin offers the caveat that "this analysis has [not] taken into account all, or even most, of the major institutional differences" (p. 234). Astin (1963) discusses a similar limitation in the study to identify differential college effects on student's motivation to pursue a PhD degree. The sample for this study included 6,544 National Merit Finalists and recipients, where 4,374 (or 67 percent) identified as male and the remaining 2,170 (or 33 percent) as female. Astin followed an input-output design for controlling differential student input variables, specifically 21 characteristics. Only one characteristic used classifies as a social identity (i.e., sex). Consequently, Astin cautions that "there remains the possibility that significant results are due to uncontrolled input variables" (p. 70) like race, sexuality, national origin and other major and intersecting identity markers. These limitations ultimately led to a centering of White male student experiences and minimalizing of minoritized student experiences in model formulation.

Given that Astin (1962, 1963) relied more on empirical evidence based on a select group of students rather than on social and historical contexts to craft his model, Duran et al. (2020) claim that "by itself, Astin's I-E-O model presents a positivist view of college student experiences" (p. 135). For context, positivism embodies a philosophical approach asserting that all knowledge is based on empirical evidence and scientific inquiry, excluding metaphysical speculation (Larrain, 1979). By definition, positivists would require explicit evidence of existence of an event to acknowledge it. For example, positivists researchers can only accept and

thus analyze overt and measurable acts of racism, not implicit or indirect acts (see Anthony & Longman, 2017; Sherwood, 2015). In their study, Duran et al. reject these positivist presuppositions of race and racism interwoven into the fabric of the I-E-O model and adopt a more critical lens to understand belongingness, particularly for racially minoritized students, first-generation college students, and those who live at the intersection of both. The authors actualize this approach through the merging of critical and intersectional quantitative philosophies with the I-E-O model.

Critical theorists and researchers like Duran et al. (2020) argue that datasets can uncover the unique impacts of race, generation status, and other salient and intersecting identities on the lived experiences of individuals. Bowleg (2008), López et al. (2018), and Scott and Siltanen (2017) further emphasize the importance of considering environments and contexts in addition to identity variables, a foundational principle of intersectionality theory as defined by Crenshaw (1989; 1991). Duran et al. put this principle into practice and exuded criticality in their study design through the stating of their researcher positionalities, use of effect coding rather than dummy coding (Mayhew & Simonoff, 2015), and usage of the I-E-O model from a critical quantitative lens (Hernández, 2015; López et al., 2018; Sablan, 2019; Stage & Wells, 2014).

While not mandated, critical scholars commonly express their position in relation to a research topic through a positionality statement. These statements enable and empower scholars to discuss their social identities. Pointedly, positionality refers to how an individual views the world and their stance on a given topic (Foote & Bartell, 2011; Rowe, 2014; Savin-Baden & Major, 2013). This positionality or "where an author is coming from" should describe how the ontological and epistemological beliefs of the scholar shape their research design (Holmes, 2020; Marsh et al., 2017: Ormston et al., 2014). Motivated by this school of thought, Duran et al.

(2020) first named the social identities germane to their study and then declared how their intention for the study informed methodological decisions. For example, Duran et al. proffered that the first author "Antonio Duran identifies as a Latino first-generation college student who is particularly interested in how collegiate environments affect marginalized groups differentially in order to create equitable institutional practices" (p. 137). In this way, Duran et al. make their research agenda clear—to advance social justice and educational equity for students who must navigate the margins of both U.S. society generally and college campuses specifically.

Borrowing from critical race theory (CRT) scholarship, Mayhew and Simonoff (2015) describe how quantitative researchers in education may essentialize the racialized experiences of both White students and Students of Color alike, violating the anti-essentialism tenet of CRT (Delgado & Stefancic, 2001). This essentialization manifests particularly in the use of indicator variables as a means for comparing raced identity patterns, otherwise known as dummy coding. Under this research scheme, non-critical researchers might state that, "When compared to White students, African American students are significantly more or less likely to _____" (Mayhew and Simonoff, 2015, p. 171). This phrasing essentializes White student experiences as the norm (or reference group) through which to understand the raced experiences of Black students. To rectify this issue, Mayhew and Simonoff offer effect coding as an alternative to dummy coding. Effect coding allows researchers to examine categorical variables by comparing the value for one subgroup of students to the overall group mean for all students instead of choosing a single reference group. Adhering to this critical approach, Duran et al. (2020) entered effect codes for all nominal variables with three or more categories and disaggregated racial categories. Through this coding strategy, Duran et al. could more effectively disentangle feelings of belongingness for certain races, generation statuses, and groups at the intersection of both.

Finally, Duran et al. (2020) proclaim the vital role that student input variables (i.e., demographic and pre-college characteristics) play in college impact research. Like Astin (1993), Duran et al. also decry the tendency of education researchers to overestimate the effects of environments on student learning and development. The authors aptly incorporated the I-E-O model into their research design to resist this tendency. However, Duran et al. critique the model for having a narrow view on the world, considering the positivist assumptions rooted in the model (see Astin, 1962, 1963). They expand the scope of the model through the concurrent conceptualization and implementation of critical quantitative methodologies and epistemologies. Rather than simply establishing that everyone experiences college environments differently, Duran et al. looked at the I-E-O model from a critical quantitative (really, a critical intersectional) perspective to determine how "these environments privilege and disenfranchise groups based on their intersecting identities" (p. 135).

Notably, Mayhew and Simonoff (2015) only "borrow" from the tenets of CRT (p. 170); neither researcher identifies as a critical race theorist themselves. In fact, Mayhew who served as a co-author for both Mayhew and Simonoff (2015) and Duran et al. (2020) identifies as a quantitative criticalist who "has attempted to create an inclusive body of work that disrupts normative quantitative practice" (Duran et al., 2022, p. 156). Along these lines, scholars of quantitative criticalism unite around three methodological commitments, which emphasize greater engagement in critical epistemologies within quantitative inquiry (Baez, 2007; Carter & Hurtado, 2007; Kinzie, 2007; Perna, 2007; St. John, 2007; Tabron & Thomas, 2023; Ternashi, 2007). According to Stage (2007), two commitments ("tasks") included 1) using data to depict and identify systemic inequities in large-scale educational processes and outcomes and 2) critiquing quantitative research methods by proposing alternative models that better represent the

experiences of underrepresented individuals. Stage and Wells (2014) later described the third task as "conduct[ing] culturally relevant research by studying institutions and people in context" (p. 3). Though certainly grounded in criticality, quantitative criticalists do not necessarily focus on racialized experiences whereas critical race theorists do.

Like Duran et al. (2020), Cuellar et al. (2017) also build on the foundation of the I-E-O model through the integration of critical theoretical perspectives, specifically CRT and community cultural wealth (see Yosso, 2005). The researchers use this conceptual guide to inform future research on the Latinx student experience at Hispanic-serving institutions. While the I-E-O model accounts for race as an input characteristic, Astin (1962, 1963, 1970, 1991, 1993) did not theoretically embed the raced experiences of minoritized college students into the model. Astin would later own this limitation and embolden other researchers to incorporate theoretical perspectives into the model that align with the values and practices that the decision-makers at a given institution want to assess (Astin & Antonio, 2012; Cuellar et al., 2017). Cuellar et al. turn to and incorporate CRT to "name the ways in which race has been an integral factor in the continued marginalization of Latinx students in higher education" (p. 90). The authors also include the concept of community cultural wealth to combat deficient-based theories that place the fault of microaggressions, racism, and institutional oppression on Students of Color as individuals rather the institutions that support and sustain such marginalization. As Yosso (2005) explains, community cultural wealth draws from CRT to better capture the unique knowledges, strengths, and successes of Students of Color over and beyond social and economic capital.

Merging these concepts together, Cuellar et al. (2017) propose an adapted I-E-O model to assess and evaluate Student of Color success from a more expanded empowerment perspective,

examining the other forms of capital (i.e., aspirational, familial) that these students might bring with them to campus. Moving forward, Cuellar et al. recommend that future scholarship and institutional research should study Student of Color "experiences and empowerment through comprehensive and novel quantitative approaches" (p. 101).

The I-E-O model continues to remain "one of the most enduring and influential models that assist researchers and practitioners in examining the factors influencing student outcomes" (Ozaki, 2016, p. 26), owing principally to the adaptability of the approach. Scholars like Astin and Antonio (2012), Duran et al. (2020), and Cuellar et al. (2017) affirm this assertion through their adaption of the model to fit their research needs and examine student populations of interest. The introduction and implementation of critical epistemologies (e.g., intersectionality, quantitative criticalism) and methods (e.g., effect coding, declaring positionality) into the model that these authors propose all help to keep the model relevant in the increasingly diverse landscape of U.S. higher education.

Critical Race Theory and Intersectionality

CRT comprises an interdisciplinary academic field that emerged from the legal profession during the 1970s and 1980s to examine the crossroads between race and law in U.S. contexts. Delgado and Stefancic (2001) defined CRT as a movement that challenges the dominant social narrative that the U.S. is a color-blind society. CRT specifically emphasizes the role of race and racism in shaping society and argues that racism represents not only an individual belief but also an institutionalized practice. While Delgado and Stefancic (2001) point out that not all critical race theorists subscribe to the same tenets, six propositions tend to consistently guide the CRT literature—viz., 1) racism as ordinary, 2) interest convergence, 3) race as a social construction, 4) differential racialization, 5) intersectionality and anti-

essentialism, and 6) the unique voice of color. Aptly, CRT can help codify the effects of faculty diversity on student success.

Though most CRT contemporaries comport with the six tenets purposed by Delgado and Stefancic (2001), disagreements about the definitions, usages, and contours of these tenets persist. In particular, intersectionality continues to experience much debate among scholars about the (mis)application and (mis)use of the term as a theory, heuristic device, concept, or analytical tool (Davis, 2008; Harris & Patton, 2019), setting up the scholarly showdowns of "the intersectionality wars" (Nash, 2017, p. 117). In 1989, legal scholar Kimberlé Crenshaw coined and introduced the concept of intersectionality to academia. Rooted in CRT and Black feminist thought, Crenshaw aimed to illustrate how the U.S. legal system as well as feminist and anti-racist discourses frame identities as separate and mutually exclusive ways of being—e.g., one may either be Black or woman, but not both. This narrow way of thinking precipitates the "theoretical erasure" of Black women who embody multiple minoritized identities simultaneously (Crenshaw, 1989, p. 139; Harris & Patton, 2019).

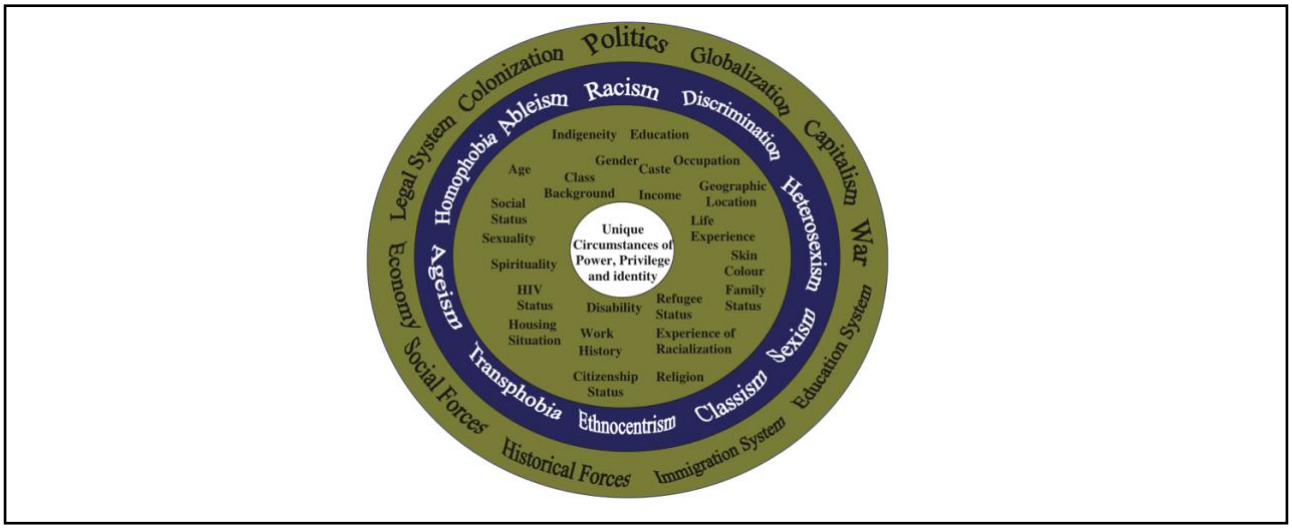
To combat this erasure, Crenshaw (1989, 1991) created intersectionality to equip scholars with "a critical analytic lens to interrogate racial, ethnic, class, ability, age, sexuality and gender disparities and to contest existing ways of looking at these structures of inequality" (Thornton-Dill & Zambrana, 2009, p. 1). This more capacious way of thinking takes a multiplicative rather than an additive approach to identity-specific experiences, which also enables the consideration of how inter-reliant sociohistorical systems shape the experiences of individuals who hold membership in multiple identity groups. Plainly speaking, intersectionality "is not about people's experiences being shaped, for example, by being female and Asian, but by the specificity of, for

instance, Asian womanhood" (Nichols & Stahl, 2019, p. 1256), suggesting that an intersectional approach considers identities *and* how those identities experience and navigate power structures.

Simpson (2009) charts this duality and interplay of identity and power through the intersectionality wheel (see Figure 2), offering a useful framework for espousing intersectionality as an approach. Under the framework, individuals experience "societal forces" (e.g., higher education) (outer circle) through different types of discrimination (e.g., racism) (third wheel from center). This discrimination affects them according to their socially constructed identities (e.g., race) (second wheel from center) in ways that intersect for their unique circumstances and social location (innermost circle). The intersectional wheel essentially shows how both overlapping forms of individual identity that co-constitute one another and intersecting forms of structural discrimination shape the experiences of individuals in a given setting.

Figure 2

Simpson's (2009) Intersectionality Wheel



Note. Electronic image created by author based on information found in Larson et al. (2016).

In all, both CRT and intersectionality share an empirical basis and activist mission, creating a linkage. As originally envisaged, CRT and intersectionality enable activists, scholars, and policymakers to first understand the nature of social inequity and then build coalitions toward combating said inequities. As Gillborn (2015) writes, "many CRT scholars are keen to explore how raced inequities are shaped by processes that also reflect, and are influenced by, other dimensions of identity and social structure: This is where the notion of intersectionality is crucial" (p. 278). From this perspective, intersectionality plays a pivotal role in understanding race inequity but retains the centrality of racism tenet of CRT. As a critical race scholar myself, I also subscribe to this perspective and approach intersectionality work accordingly.

Evolving Interpretations of Intersectionality

While Crenshaw coined the term intersectionality, other social science researchers explored the idea of intersecting identities and discrimination long before the mainstream adoption of the term (Mercer et al., 2015). For instance, Collins (2000) traced the roots of intersectionality as a concept to the work of the late W.E.B. Du Bois. Specifically, "Du Bois saw race, class, and nation not primarily as personal identity categories but as social hierarchies that shaped African-American access to status, poverty, and power" (Collins, 2000, p. 42). These theoretical musings did not extend to all social identities—case in point, Du Bois considered gender only a personal identity, not a social hierarchy. Black feminists writing and working at the same time as Du Bois refuted this notion such as Anna Julia Cooper who brought awareness to the systematic erasure of Black women by Black men in Black liberation politics (Crenshaw, 1989; Duran & Jones, 2020). Both Crenshaw (1989) and Collins (2000) ground intersectionality in the legacy of pioneering Black feminist like Cooper who called attention to the ways that society differentially impacted Black women because of their multiple marginalized identities

(Duran & Jones, 2020; Mercer et al., 2015). Generally speaking, intersectionality emerged out of a need to examine micro-level (identity markers) and macro-level (social hierarchies) systems simultaneously and interchangeably and to uplift the voices of those individuals who exist on the margins of those systems—i.e., Black women (Mercer et al., 2015; Rasky, 2011).

Crenshaw (1991) would later proffer three different forms of intersectionality to describe the compounded challenges (e.g., racism, sexism) that Black women face, namely structural, political, and representational intersectionality. Structural intersectionality delves into the systemic and institutional aspects of oppression. This form of intersectionality interrogates how seemingly neutral institutional policies, practices, and procedures have differential impacts on individuals of intersecting identities, thereby (re)producing broader inequities (Crenshaw, 1991; Collins, 1990). However, policies and procedures that fail to consider the "multilayered and routinized forms of domination that often converge" in the lives of multiply marginalized individuals (Crenshaw, 1991, p. 1245; Durfee, 2020) engender this inequity. An example illustrating a structural intersectionality approach comes from Homan et al. (2021). Their study analyzed administrative data representing macro-level structural racism, sexism, and income inequality across the U.S. in relation to population health. Findings from their multi-level analyses showed that overlapping and entrenched systems of oppression intersect with race and gender statuses to shape health, consistently leading to poorer health for Black women (Homan et al., 2021). The study ultimately emphasized the importance of addressing both gender and racial dimensions within organizational structures to promote equity.

Whereas structural intersectionality focuses on systemic and institutional aspects of oppression, political intersectionality shifts the focus to power dynamics within political contexts. This form of intersectionality explores the complex interplay of various social

categories, such as race, gender, class, and sexuality, in influencing access to resources, rights, and opportunities within political spheres. Consider a Women of Color facing discrimination not only based on their gender identity but also due to racial bias, impacting their participation in political processes (Brown, 2014). Political intersectionality underscores the interconnected nature of power structures and how they shape the experiences of marginalized groups within political spheres. Moreover, Moreau et al. (2019) examined how race, ethnicity, gender, and sexuality intersect to influence political engagement among the LGBTQ Latinx community. Their research showed that LGBTQ Latinx respondents exhibit more political participation than their non-LGBTQ Latinx counterparts do due to feelings of linked fate (i.e., an acute sense of awareness that what happens to the group will also affect the individual member) to both the Latinx and LGBTQ community (Moreau et al., 2019; Simien, 2005). Their study demonstrated how the intersection of varying social identities can create distinct experiences within the political landscape, emphasizing the importance of considering multiple axes of identity in understanding political behavior.

Shifting focus again, representational intersectionality directs attention to media, culture, and symbolic representations of individuals of intersecting identities. Intersectionality in this form considers the portrayal and perception of diverse identities across multiple mediums of communication. These portrayals and perceptions contribute to the construction of social norms and stereotypes. According to Crenshaw (1991), representational intersectionality supports two goals: 1) condemning racist and sexist representations of Women of Color and 2) advocating for greater representation of Women of Color in media. As Vardeman-Winter et al. (2013) note, "representational intersectionality explains how mediated texts represent some groups as disempowered because of their multiple identities, and how these texts, over time, contribute to

stereotypes of marginalized groups" (p. 392). To exemplify this point, Crenshaw et al. (2015) reported that media representations of police brutality disproportionately focus on Black men, distorting the true extent of the problem and overlooking incidents involving other marginalized groups—most noticeably, Black women.

As Crenshaw (1989, 1991) demonstrates, interpretations of intersectionality can and possibly should change and evolve over time. Indeed, critical Black feminist scholars continue to mull over the essence of intersectionality, advancing scholarly understandings of the CRT tenet through their sustained scrutiny of the term. To that end, Collins (2015) in her syllabus for a graduate seminar on intersectionality posited, "What exactly is intersectionality? Is it a concept, a paradigm, a heuristic device, a methodology, or a theory" (p. 2)? These questions denote the ubiquity and ambiguity of intersectionality in society. Despite existing everywhere, few can intelligibly agree on what constitutes intersectionality when observed. As Collins (2015) acquiesces, "Despite our best efforts, by the end of the [graduate seminar] course my students and I both seemed stuck in Stewart's dilemma—we thought we 'knew' intersectionality when we saw it but couldn't quite define what it was" (p. 2). Due (at least in part) to this dilemma, intersectionality faces regress problems.

Regress Problems in Intersectionality

For intersectionality studies, regress problems stem from two assumptions: 1) That an indefinite number of intersectional identity groups exists and 2) that there is no inherent justification for prioritizing one grouping over another in generalizing or forming political coalitions (Alcoff, 1991; Collins, 2003; Gasdaglis & Madva, 2020). While several intersectionality scholars refer to regress problems in passing (see Alcoff, 1991; Anthias 2009; Collins, 2003; Davis, 2008), fewer explore the full theoretical and practical ramifications of this

issue (Gasdaglis & Madva, 2020). For this reason, Gasdaglis and Madva (2020) mapped out and examined manifestations of regress problems for intersectionality in law, the social sciences, and metaphysical, normative, and epistemic interpretations of the term.

For regress problems in law, both Gasdaglis and Madva (2020) and Crenshaw (1989) discuss the U.S. District Court for the Eastern District of Missouri ruling in *DeGraffenreid v. General Motors Assembly Div., Etc.* (1976). The case revolved around a cohort of Black women (i.e., the plaintiffs) who accused General Motors (i.e., the defendant) of discriminatory practices, asserting that the company neglected to hire any Black women pre-1964 and terminated those hired post-1970 during downsizing. The district court rendered summary judgement in favor of the defendant. The court noted that General Motors employed both Black folk (specifically, Black men) and women (specifically, White women) during those time periods, decreeing that Black women (as a grouping) were not a "special class to be protected from discrimination" (*DeGraffenreid v. General Motors Assembly Div., Etc.*, 1976, as cited in Crenshaw 1989, p. 141). The plaintiffs could, in effect, argue for race-based discrimination and/or sex-based discrimination, but not a combination of both. The decision arose from concerns about creating new classes of protected minority groupings using mathematical principles, akin to opening a proverbial Pandora's box (Crenshaw, 1989; *DeGraffenreid v. General Motors Assembly Div., Etc.*, 1976; Gasdaglis & Madva, 2020).

Two approaches overwhelmingly guide how researchers, policymakers, and practitioners tend to look at multiple identities: additive and intersectional. While at times used synonymously, Hancock (2007) differentiates the two approaches. Whereas the “additive” approach considers social identities singly and assumes that effects at an intersection of identities can be understood as a sum of their parts, intersectional approaches presuppose that identities at

an intersection actively co-constitute each other and require joint consideration (Hancock, 2007; Bauer et al., 2021). The court in *DeGraffenreid v. General Motors Assembly Div., Etc.* (1976) case clearly espoused an additive approach. From this perspective, Black women could not experience discrimination *as Black women* but could face sex-based discrimination as women and/or race-based discrimination as Black individuals.

The U.S. Equal Employment Opportunity Commission (EEOC) currently protects against discrimination based on race, color, religion, sex, national origin, disability, age (≥ 40-years-old), and genetic information (EEOC, n.d.). If group-based discrimination must always be understood as co-constituting, "can a group be discriminated against specifically *as Canadian-born, black, Muslim, pregnant women over 40*" (Gasdaglis & Madva, 2020, p. 1301)? The problem here lies in where to draw the line. Based on the intersectional approach, every intersection of identities may constitute a protected group, which may (in turn) lead the U.S. legal system to conclude that no two individuals can experience the same type of discrimination. If true, then intersectionality may inevitably regress the courts to dismissing discrimination cases altogether.

This regress phenomenon pertains to the social sciences too. To corroborate this claim, consider Greenman and Xie (2008) who found no "pure" effect of race or gender in regard to earnings. Only through the simultaneous study of both identities could the authors present social-scientific generalizations. However, why stop with just race and gender? Examining factors like class, religion, geography, education status, citizenship/immigration status, ability and age would also likely reveal no isolated "pure race-and-gender" effect either (Gasdaglis & Madva, 2020).

For explanatory purposes, consider socioeconomic status (SES). Keels (2013), for example, examined the gender and racial or ethnic gaps in college grades and graduation of a cohort of first-year students attending 24 selective predominantly White institutions.

Specifically, Keels questioned whether gender, race or ethnicity, and SES interact to affect college outcomes. Results showed that the significance of gender depends on race and SES for academically motivated students, further demonstrating the entangled effects of these identities on outcomes of interest. Thus, social science researchers must provide rationales for exclusively focusing on race and gender. On top of that, intersectionality suggests that social categories mutually co-constitute each other indefinitely, which raises doubts about the very possibility of social science researchers ever truly attaining comprehensive social knowledge.

Another regress problem for social science research centers on the overstudying of inequality. The majority of research on study design or data analysis methods has focused on intercategorical approaches, which identify inequalities across intersections (McCall, 2015; Bauer et al., 2021). Some scholars worry that repeatedly documenting inequalities, even in finer detail, may reinforce perceptions of differences between groups rather than suggesting practical solutions (Bauer, 2014; Bauer & Scheim, 2019; Lofters & O'Campo, 2012).

Finally, regress problems cast doubt on the metaphysical, normative, and epistemic nature of intersectionality. The co-constitution thesis of intersectionality, in particular, postulates that phenomena such as “Black oppression” and “White privilege” operate off false pretenses. Assuming that race and gender function as “mutually constitutive” identity markers (Shields, 2008, p. 301), then any claims about Black oppression or White privilege need to include a gender element to hold any truth. Under this thesis, experiences with Blackness (and specifically, Black oppression) differ for Black men and Black women—and the same principle would apply to White men and White women in regard to White privilege. But once again, Gasdaglis and Madva (2020) would ask, “Why think that the important intersections stop with race and gender” (p. 1303)? Race, gender, and class also intersect insofar that the experiences of, for example, rich

Black women differ from those of poor Black women—and these groupings just represent binary categorizations. Race, gender, and class all lie on a continuum, making groupings even more complex. The inclusion of sexuality, ability, religion, and a host of other significant social identities furthers this complexity, possibly *ad infinitum* (Gasdaglis & Madva, 2020).

The aforementioned train of thought would then suggest that I, as a Black individual, cannot know what it is like to be Black. I could only know what it is like to be a Black able-bodied American agnostic male… et cetera member of the Black group. The regress problem of the co-constitution thesis might ultimately entail the dissolution of groupings in general and a devolution back to individualism (Young, 1994), which would make the "voice-of-color" thesis and co-constitution thesis incompatible tenets of CRT. Ehrenreich (2002) warns that interpreting intersectionality from this perspective would inevitably render the individual as "the only unit of analysis, making group-based critiques of power hierarchies impossible" (p. 271). Such a regression would amount to an abandonment of the original goal of intersectionality of examining both the individual and systems of power together.

Un/Doing Intersectionality in Higher Education Research

By design, intersectionality studies should identify, discuss, and address the ways in which U.S. power structures (e.g., racism, sexism, elitism) intersect to (re)produce complex relations of power and (dis)advantage (Cho et al., 2013; Nichols & Stahl, 2019). However, Harris and Patton (2019) contended that intersectionality studies in higher education, in particular, tend to undo, or strip, intersectionality "of its radical vision of social justice—rendering it politically neutralized and undone" in one of four ways (Bilge, 2013, p. 208). The first means of undoing intersectionality in higher education research involves the (mis)use of the term as a buzzword (Davis, 2008), with several studies only referencing intersectionality once or

twice in their limitations or implications section (Nichols & Stahl, 2019). The second way of undoing intersectionality is by linking the term with feminism solely, and not the Black feminism and anti-racist scholarship that undergirds it too.

Thirdly, undoing intersectionality also encompasses the failure of some scholars to cite Crenshaw (1989, 1991, 2011), Patricia Hill Collins (1990, 2000, 2003, 2015), the Combahee River Collective (1982), the foremothers of intersectional feminism (e.g., Anna Julia Cooper, Harriet Tubman, Ida B. Wells) and other women of color when writing about intersectionality (Nichols & Stahl, 2019). Finally, undoing intersectionality would also include not engaging in the complexities of intersectionality (Luft & Ward, 2009), with a number of academics relegating the term to an additive model that focuses on the confluence of multiple identities. This micro-level application undermines the capacity of intersectionality to critique systems of inequity and support social justice work.

The use of intersectionality in higher education research requires a comprehensive analysis of the multifaceted social identities that individuals bring into, and develop within, all systems and spaces of power and privilege. The original political project of intersectionality transforming "the institutional order for historically and multiply marginalised and faculty" must not be lost in translation (Nichols & Stahl, 2019, p. 11). Accordingly, scholarship that incorporates intersectionality should do so throughout the research process, not just in a literature review or theoretical framework section (see Alexander-Floyd, 2012; Guidroz & Berger, 2009; Harris & Patton, 2019; Luft & Ward, 2009).

As the war over intersectionality wages on (see Nash, 2017), intersectionality will continue to drift further away from the core objective of working towards transformative and radical social justice (Bartlett, 2017; Bilge, 2013), eventually fading (or "regressing") into

obscurity. To address this undoing, scholars must first investigate how intersectionality has been done to understand what it can and should achieve (Bartlett, 2017; Bilge, 2013; Crenshaw, 2011). Doing intersectionality refers to how scholars engage the theory in their work—and more specifically, how their research promotes a transformative social justice agenda that confronts systems of inequality and facilitates change within individuals, institutions, and society (Bilge, 2013; Harris & Patton, 2019; Luft & Ward, 2009; Thornton-Dill & Zambrana, 2009).

Like Harris and Patton (2019), I also hesitate to prescribe contours on what counts as intersectionality and how to use it. That said, any un/doing intersectionality as a general theory, concept, heuristic device, or analytical tool leads to regress problems in law, the social sciences (including higher education research), and metaphysical, normative, and epistemic conceptions of the term. For that reason, I support doing intersectionality more broadly as a regulative ideal.

Doing Intersectionality as a Regulative Ideal

Doing intersectionality as a regulative ideal in higher education research means accepting intersectionality as a guiding epistemological, methodological, and ontological principle. Moreover, two words compose the regulative ideal—the 1) ideal and 2) regulative. The "ideal" of intersectionality demands that activists and researchers treat current classification systems as continuously and mutually influential, specifically aiming to expose and oppose inequality and injustice. As a "regulative," intersectionality indicates a diverse and expanding array of guiding heuristics for research across various fields and the formation of multifaceted political alliances. As Gasdaglis and Madva (2020) argue, doing intersectionality as a regulative ideal under these two frameworks should resolve any regress problem. Doing intersectionality in this manner also necessitates that the value of any given social category or grouping must be empirically established rather than predetermined (see Cole, 2009; Gasdaglis & Madva, 2020; Hancock,

2007; May, 2015; McCall, 2005). To clarify, doing intersectionality this way does not blanketly regard all intersecting identities as mutually constitutive, but offers the "imperative that we must seek out the ways they might be, in gathering new knowledge about human beings and social reality" (Gasdaglis & Madva, 2020, p. 1313).

Doing intersectionality in higher education research as a regulative ideal would enable the examination of faculty race, gender, and rank as (macro-level) social hierarchies that shape their access to the American professoriate generally and tenure specifically based on (micro-level) personal identities. As Chesler and Young (2007) note, "the racial, gender, and seniority [or tenure] status of professors directly affects the degree to which they are challenged about what or how much they know about their topic" (p. 14). Faculty members receive and respond to these challenges differently depending on their specific intersection of identities. For example, White tenured male faculty may experience fewer challenges to their substantive expertise than their non-tenure female Faculty of Color peers due to underlying systems of racism, genderism, and rankism at play (Chesler & Young, 2007), which can consequently affect their ability to influence student learning outcomes. In this way, faculty experience their race, gender, and rank "through interactions with the broader social context in which dominant values dictate norms and expectations" (Torres et al., 2009, 577), providing a rationale for the examination of each identity. The two principles of the regulative ideal invites research to investigate the ways in which these socially constructed identities may mutually inform each other and, in the process, reveal and resist any apparent injustices and inequalities.

A paucity of scholarship on student success interweaves the regulative ideal of intersectionality with the quantitative research tradition (see López et al., 2017), which undergirds my methodological approach. Covarrubias (2011) provides a robust model for testing

relationships via cross-tabulations that elucidate how various intersections of race, class, citizenship, and gender (social locations or groupings) tie to different educational outcomes. Using this intersectional quantitative methodology, Covarrubias delved into the intricacies behind the factors leading to students exiting the college pipeline. Their study showed that noncitizen Chicanas (women) were twice as likely to attain a college degree compared to noncitizen Chicanos (men) in both low- and high-income quartiles (Covarrubias, 2011).

Like Covarrubias (2011), López et al. (2017) also studied the achievement gap between students across social groupings that vary according to race-ethnicity, gender, and class. To examine the simultaneity of race, gender, and class as social indicators on college outcomes, López et al. estimated saturated logistic models for six-year completion rate, developmental English course-taking, and developmental mathematics course-taking. The resulting models revealed that the reference group (i.e., White, high-income women) had a significantly higher likelihood of graduating than any other group, especially compared to low-income, American Indian men (45 percent less likely to graduate in six years). Moreover, López et al. (2017) reported linear combinations of marginal effects for each of the 20 unique groups in the sample, which allowed them to look at the association between a specific race, gender, or class variable and completion likelihood. The authors, however, take special care to note that this association for those identifying as Black, for example, "should not be interpreted as meaning that 'innate' or 'cultural' differences among Blacks is causing this relationship" (López et al., 2017, p. 193).

Ultimately, I plan to look at faculty intersectionality across three dimensions of identity (i.e., race, rank, gender) and discrimination (i.e., racism, rankism, genderism) from a quantitative lens. Plenty of studies consider these identities separately. Several studies even examine the intersections of race and gender (see Nichols & Stahl, 2019), but few integrate the element of

academic rank as well. Federal census data reveals that Women of Color make up 12.5 percent of the U.S. population, but only 2.3 percent of tenured and tenure-track faculty (National Academies of Sciences, Engineering, and Medicine, 2013). Statistics such as these show the importance of research that advances calls for a greater diversification in U.S. faculty. To answer on these calls, research must first firmly link the structural diversity of the faculty with institutional priorities such as student success, which would support the need for more institutional investment. The coupling of intersectionality as a regulative ideal and the I-E-O college impact model would help facilitate this linkage.

Synthesis of the Literature

Drawing from both college impact and intersectionality research, I developed the following conceptual model (see Table 3) to show a synthesis of the literature that will guide my study. To craft this model, I coalesced the I-E-O model (Astin 1970, 1991, 1993) with the intersectionality wheel (Simpson, 2009), creating a new, more critical college impact model for assessing the outcomes of the increasingly diverse student bodies of U.S. higher education institutions. I intend to use this visual representation to explain decisions made in the study design, which I discuss further in Chapter 3.

Table 3

Conceptual Synthesis of the Literature Guiding the Study

INPUTS (*W*)	ENVIRONMENT (*X*)	OUTPUTS (*Y*)
Intersection of (Micro-Level) Socially Constructed Identities for Students • Race/Ethnicity • Gender • Level of Student	Intersection of (Micro-Level) Socially Constructed Identities for Faculty • Race/Ethnicity • Gender • Faculty Rank Intersection of (Macro-Level) Social Hierarchies	Institutional Retention and Graduation Rates • Two-Year Retention • Four-Year Graduation • Six-Year Graduation

	• Racism/Ethnicism • Genderism • Rankism
	Institutional Characteristics • Minority-Serving Institution Status • Single-Gender Institution Status • Institutional Control

Note. Table created by author based on prior work by Cuellar et al. (2017).

In theorizing this conceptual model, I turned to CRT and intersectionality scholarship to reimagine how a basic I-E-O model might better capture the ways in which minoritized students experience college. Moreover, both CRT generally and intersectionality specifically center the lived experiences of Communities of Color and other marginalized individuals to advocate for a more socially just society (Delgado & Stefancic, 2001; Cuellar et al., 2017). To advocate for a more socially just higher education system, researchers must explicitly name the ways in which racism, genderism, and other systems of power and oppression (re)produce inequity on campus, which this model allows. I explain the three dimensions of the model in greater detail below.

Inputs

As Mayhew et al. (2016) forewarn, "With a greater number of students coming to college more cognizant of their multiple identities and/or more familiar with the lexicon used to describe intersecting identities" (p. 11), higher education scholars and scholar-practitioners should strive to understand how student input characteristics (e.g., race, gender, class year) interdependently affect their experiences and outcomes. To that point, CRT demands that any study on socially constructed identities and social hierarchies consider the central role of race and racism (Delgado & Stefancic, 2001). Prior researchers have also empirically established a relationship between race and gender (Nichols & Stahl, 2019), satisfying the simultaneous consideration of gender

from a regulative ideal standpoint (Gasdaglis & Madva, 2020). Class year (i.e., level of student) signifies a shared experience and sense of belonging within a cohort of students at a particular point in their academic journey, making class year a socially constructed identity. To relate student class-year to faculty diversity characteristics, first-year students are more likely to enroll in courses with adjunct and non-tenured faculty members than their upper-class peers (2017). Moreover, Bettinger and Long (2006) suggest that adjunct and non-tenured faculty members do a less effective job at integrating first-year students into the campus environment than their tenured and on-tenure track colleagues due, in part, to less education and engagement with the campus community. This finding implies that class year can have a meaningful effect on college student outcomes, particularly two-year retention rates. The simultaneous consideration of student race, gender, and class year characteristics may further emphasize this effect. For example, White upper-class men tend to have more agency to self-select into courses taught by faculty who share their race and gender identities than do first-year women Students of Color, particularly in science and engineering fields (see Eagan et al., 2015, Price, 2010; Riegle-Crumb et al., 2019). Though the individual relationships between these variables and student success have received much scrutiny, less empirical work interrogates their intersecting relationships.

Environment

Intersectionality enables the examination of micro-level and macro-level systems simultaneously and interchangeably. For this reason, researchers who only consider one level in their research designs will fail to encompass the full scope of the approach. The intersection of faculty race, rank, and gender characteristics constitute the micro-level predictors while the corresponding and intersecting racism, rankism, and genderism that minoritized faculty face would represent the macro-level predictors. I also include institutional-level control variables

that might significantly impact the composition of faculty bodies across race, rank, and gender, specifically minority-serving institution (MSI) status, single-gender institution status, and institutional control (i.e., public or private).

Outputs

Astin (1997) constructed multiple formulas that accounted for student input characteristics to compare the expected retention and degree completion rates of a given college or university with their actual rates. The findings from this study showed that several seemingly high performing U.S. higher education institutions may actually be underperforming based on reported data. Moreover, "Some institutions that seem to be performing well on one degree attainment measure may not appear to be as effective on another" (Astin, 1997, p. 655). I further contextualize and test this proposition using two-year retention rate and four- and six-year graduation rates as outcome measures, which will allow me to examine institutional performance at three different levels.

Chapter Summary

I aim to answer the following question: How does faculty diversity affect student success? In this chapter, I provided the foundational knowledge necessary for exploring this query, functioning as an informed backdrop against which new analyses may emerge. For the first section of the literature review, I juxtaposed college impact models with developmental models, summarized the origin and operationalization of the I-E-O model, and discussed the use of the model the study of student retention and graduation rates for all students and then minoritized students specifically. To conclude this section, I compiled the work of scholars who adhered to the advice of Astin and Antonio (2012) to incorporate theoretical perspectives into the I-E-O model that align with the values and practices that they want to assess.

The application of intersectionality as a theory, heuristic device, concept, and analytical tool aligned with the values and practices for many of the critical researchers included in the literature review. As a result, I turned to research describing the (mis)applications and (mis)uses of the term, paying particular attention to the undoing of intersectionality in higher education research. Then, I elaborated on how intersectionality researchers avoid this undoing while simultaneously paying heed to the warring implementations of the term. In this elaboration, I critiqued the use of intersectionality as a regulative ideal, which involves doing intersectionality epistemologically, methodologically, and ontologically throughout the research process. The literature review suggests that intersectionality researchers need to recommit to the original goal of advancing racial equity, an observation which further spotlights the significance of this study.

Lastly, I applied the principles of intersectionality to the I-E-O model to propose an adapted framework. Specifically, I inventoried the ways in which criticality and intersectionality could complement the I-E-O model from both an epistemological and methodological perspective to better understand the outcomes of all students and minoritized students in particular. This inventory led to the formation of a conceptual synthesis that guides the study design, which I discuss in the next chapter.

Chapter 3. Methodology

Ladson-Billings (2000) asked, "Where is 'race' in the discourse of critical qualitative researchers" (p. 272)? The same question can be and has been asked of critical quantitative researchers (see Gillborn et al., 2018; Castillo & Gillborn, 2023). As an emerging quantitative researcher, I revisit this "race question" through a multi-step approach. I begin with a review of the different ways in which critical scholars utilize quantitative methodologies. From there, I select the best suited method for examining the relationship between faculty diversity and student success—and then discuss how other quantitative researchers have used said method to center race and racism in their work. Then, I offer a reflection on my researcher positionality, focusing primarily on my connection to the topic and decisions in the research design.

After that, I outline my research design. I begin by introducing my study variables, specifically my focal predictor (X), outcome (Y), and moderator (W) variables. I also detail my additional list of predictors, which represent explanatory variables that might affect outcome variable in addition to the predictor and moderator variables. Then, I explain the dataset from which I collect and calculate my variable information. Next, I move into my data analysis procedures, going over my modeling techniques and model formulas. To conclude, I address limitations in my research design, specifically around my handling of missing data.

Critical Approaches to Quantitative Inquiry

While much of the critical research canon originates from the work of qualitative scholars (Tabron & Thomas, 2023; Covarrubias & Vélez, 2013), quantitative scholars have recently and increasingly expanded their contribution to this canon. This shift stems from a growing acceptance of quantitative data analyses that present multiple, critical truths rather than one, positivist truth (see Garcia et al., 2018; Gillborn et al., 2018; Omi & Winant, 2014; Smith,

1999; Stage, 2007; Stage & Wells, 2014; Walter & Andersen, 2016; Wells & Stage, 2015; Wilson, 2008; Zuberi, 2001; Zuberi & Bonilla-Silva, 2008). As the number of scholars engaged in critical approaches to quantitative inquiry continues to rise, so too will conflation concerns. The interchangeable use of terms like QuantCrit, critical race quantitative intersectionality (CRQI), critical quantitative intersectionality (CQI), and quantitative criticalism throughout the literature and even within the same chapter or article contribute to these conflation concerns (Tabron & Thomas, 2023). To address this concern, I, like Gillborn et al. (2018), Jang (2018), and Tabron & Thomas (2023), for example, take the time to differentiate these methods from one another, epistemologically.

To that end, I start by describing QuantCrit. Introduced by Gillborn et al. (2018), QuantCrit emerged out of a need to apply the tenets of Critical Race Theory (CRT) to quantitative data analysis. As Gillborn et al. write, QuantCrit functions "as a kind of toolkit that embodies the need to apply CRT understandings and insights *whenever* quantitative data is used in research and/or encountered in policy and practice" (p. 169). Moreover, CRT comprises an interdisciplinary academic field that emerged from the legal profession during the 1970s and 1980s to examine the crossroads between race and law in United States (U.S.) contexts. Delgado and Stefancic (2001) defined CRT as a movement that challenges the dominant social narrative that the U.S. is a color-blind society. CRT specifically emphasizes the role of race and racism in shaping U.S. society and argues that racism represents not only an individual belief but also a systemic and institutionalized practice. Grounded in this way of thinking, QuantCrit posits five guiding principles: 1) The centrality of racism, 2) numbers are not neutral, 3) categories are not natural, 4) voice and insight (i.e., data cannot "speak for itself"), and 5) a social justice orientation (Gillborn et al., 2018). Coalescing these principles, Gillborn et al. contend that

quantitative analyses based on "big data" (i.e., datasets that are supposedly *too huge* for traditional forms of human analysis) hold no inherent value outside of the interpretations people make of the data from their lived experiences. From this perspective, QuantCrit operates more like an extension of CRT than a standalone off-shoot like BlackCrit, LatCrit, or DisCrit.

Like QuantCrit, CRQI also aims to proffer "a framework guided by CRT," not an altogether new theory or field per se (Covarrubias & Vélez, 2013, p. 275). Specifically, CRQI attempts to ascertain the material impact of intersectional racism and "works toward identifying and challenging oppression at this intersection in hopes of achieving social justice for students of colors" (Covarrubias & Vélez, 2013, p. 276). To accomplish these goals, CRQI calls upon scholars to quantify the material impact of racism at its intersections, challenge the neutrality of quantitative data, center the lived experiences of People of Color, address injustice intentionally and directly, and take a transdisciplinary perspective for revealing hidden patterns. These action steps constitute the five principles of CRQI. While Covarrubias and Vélez (2013) strive to account for the material impact of intersectional racism and create change at the policy level through the five principles of CRQI, Gillborn et al. (2018) "remain fundamentally skeptical" that critical quantitative methods can ever truly realize these goals (p. 169). This skepticism (or pessimism really) demarcates QuantCrit from CRQI.

Whereas QuantCrit and CRQI both focus on race and racism primarily, CQI looks at the "mutually constitutive" nature of multiple social categorizations (Shields, 2008, p. 301). For further context, QuantCrit and CRQI both examine the centrality of racism from a CRT lens generally while CQI explores intersecting multiple oppressions from an intersectionality lens specifically. Much of the empirical work that employs critical quantitative methods tends to lean on QuantCrit and CRQI (Tabron & Thomas, 2023), leaving CQI underutilized (Jang, 2018).

Using a CQI framework, Jang (2018) investigated the impact of race, gender, and class on the math achievement scores and intention to enter higher education for Southeast Asian female students. While Southeast Asian students boasted significantly higher achievement scores than students belonging to any other racial or ethnic groups, Southeast Asian female students were significantly less likely to indicate an intention to pursue higher education that Southeast Asian male students. In fact, Southeast Asian female students reported lower higher education intentions than any other female grouping, with this pattern holding irrespective of schooling context (Jang, 2018). Jang uses these findings to suggest the need for educational strategies targeted at Southeast Asian female students, distinct from those for other female students or Southeast Asian male students. This study shows that CQI also pushes for educational equity and social justice without closely adhering to all CRT tenets like QuantCrit and CRQI.

Like CQI, quantitative criticalism also foregrounds criticality, but not necessarily CRT. Quantitative criticalism encompasses the use of "quantitative methods to represent educational processes and outcomes to reveal inequities and to identify perpetuation of those that were systematic" (Stage & Well, 2014, p. 1). From this perspective, quantitative criticalist aim to challenge established knowledge derived from positivist and post-positivist paradigms, championing for critiques and analyses that promote theoretical and practical understandings centered on equity (Stage, 2007), but necessarily racial equity like QuantCrit or CRQI. Building upon Stage and Wells (2014), Rios-Aguilar (2014) proffered that quantitative criticalists should partake in methodological self-reflection throughout the research process, from design to analysis. In sum, "quantitative criticalism challenges normative assumptions and research practices in 'quantitative research'" (Hernández, 2015, p. 95).

This extensive (but not exhaustive) review covers leading critical approaches to quantitative methodology. Other approaches not discussed include QuanCrit (see López et al., 2018) and CritQuant (see Sullivan et al., 2010). Like QuantCrit, both QuanCrit and CritQuant integrate CRT tenets into quantitative methods for the purpose of advancing a social justice agenda and achieving racial and ethnic equity. However, CritQuant only embodies two CRT tenets (viz., the permanence of racism and critique of liberalism) and QuanCrit has not received widespread adoption yet (Gillborn et al., 2018; Sullivan et al., 2010; Tabron & Thomas, 2023).

Out of QuantCrit, CRQI, CQI, and quantitative criticalism, QuantCrit will best inform my study on the effect of faculty diversity on student success, with student diversity as a moderating factor. Unlike CQI, QuantCrit places race and racism at the center of all analyses, prohibiting interpretations that do not consider the role of racist power structures in the outcomes. I also share the skepticism of Gillborn et al. (2018) about ascertaining the material impact of intersectional racism on educational outcomes, especially in a non-experimental research design. Therefore, QuantCrit provides the most suitable framework for conducting quantitative research in a way that centers race and racism with the overarching goal of promoting equity and justice.

Using QuantCrit to Center Race and Racism

Though not always required, many critical scholars often articulate their stance on a research topic through a positionality statement. Such statements allow scholars to reflect on and discuss their social identities. Essentially, positionality refers to how an individual perceives the world and their perspective on a particular issue (Foote & Bartell, 2011; Savin-Baden & Major, 2013; Rowe, 2014). This positionality, or the author's viewpoint, should outline how the scholar’s ontological and epistemological beliefs influence their research approach (Holmes,

2020; Marsh et al., 2017; Ormston et al., 2014). These beliefs form from the lived experiences of a scholar with religion, gender, sexuality, historical and geographical location, ethnicity, race, social class, and status, (dis)abilities and other social identities (Wellington, 2005; Marsh et al., 2017). These beliefs then influence how research is conducted, consequently affecting both the outcomes and conclusions drawn from it (Holmes, 2020; Rowe, 2014). To address this potential research concern, researchers may declare their positionality. As Holmes (2020) notes, researchers should declare their position in three areas: 1) The subject under investigation, 2) the research participants, and 3) the research context and process. Some scholars problematize this broad understanding of positionality. Many critical scholars understand positionality statements as a means of expressing transparency about the perspective of an author towards their research (Pillow, 2003). The problem, however, lies in how researchers share this transparency. Practices for conveying positionality range from abstract discussions on the specific identities of the researcher(s) to full accounts of how those identities may have affected the research process and outcomes (Riley et al., 2014; Secules et al., 2020).

In a collaborative inquiry informed by autoethnography, Secules et al. (2020) compiled and reviewed the positionality statements of several engineering education students, postdoctoral researchers, and faculty (including themselves) to determine the primary ways in which positionality impacts research. Findings showed that positionality impacts six fundamental aspects of research: 1) research topic, 2) epistemology, 3) ontology, 4) methodology, 5) relation to participants, and 6) communication. This doubles the number of areas of focus that Holmes (2020) identified. To end, Secules et al. interrogate the notion that positionality only matters to equity and inclusion research and researchers utilizing qualitative methodologies. The authors further assert that positionality matters for all researchers, regardless of methodological tradition

or discipline. Accordingly, Secules et al. “call on researchers who see themselves as objective and removed from the interpersonal contexts of education to consider how their personal perspective shapes their choices in research topic, methodology, and communication,” specifically (p. 38).

Clearly, Secules et al. (2020) want quantitative researchers, in particular, to think deeper about their positionality in research. That proposition will prove difficult due to the lack of positionality research geared towards the quantitative research tradition (Hampton et al., 2021). Almost all the scholarship that I have cited up until this point on the issue comes from the qualitative research tradition (e.g., Holmes, 2020; Ormston et al., 2014; Pillow, 2003; Savin-Baden & Major, 2013), leaving quantitative researchers without much support. To assess and address this assertion, Castillo and Babb (2024) conducted a systematic review of 29 empirical education studies from 2010 to 2022 that explicitly used QuantCrit. Their study specifically spotlighted scholars that embraced and extended the principles of QuantCrit through their professional and personal positionality statements, cognizance of community, robust racial and ethnic categories, intentionality on not centering Whiteness, use of atypical methods, and innovative interpretations of findings.

In the midst of highlighting these exemplars, Castillo and Babb (2024) also revealed the rarity of some of these best practices. For example, only 13 out of the 29 studies under investigation included a positionality statement, so less than half overall. The authors reviewed the available positionality statements based on the framework developed by Sybing (2022) for ethnographers. The framework suggests that positionality statements appear in their own separate space (such as a paragraph or section) and explicitly state socio-cultural and professional identities (Castillo & Babb, 2024; Castillo & Gillborn, 2023; Sybing, 2022). In a

food insecurity study, for instance, the researcher(s) might discuss their experiences with the food industry (e.g., restaurants, grocery stores, food banks) and access (or lack thereof) to food throughout their life based on their social identities. In this way, positionality statements should list the relevant identity markers of the researcher(s) *and* relate these identities back to the research at hand, reflecting on and noting any known or unknown biases along the way. As Castillo and Babb (2024) have observed, however, many studies stop at step one, forgoing the reflexivity.

While commonly considered a best practice for critical scholars, Castillo and Gillborn (2023) warn that the mere inclusion of a positionality statement does not guarantee anything about the quality and usefulness of the research. Case in point, folks from historically marginalized groups may at times seek to gain status and success by aligning with the oppressor, further normalizing Whiteness in the process (see Bell, 1992). Such an action would cast doubt on the authenticity and utility of these statements, potentially making them more harmful than helpful for marginalized communities. Along these lines, researchers who stand outside of a particular identity can produce strong and meaningful research (see Castillo & Gillborn, 2023), but only if the researcher has made efforts to move themselves outside the territory usually occupied by majoritarian identities (e.g., Whiteness).

Dusen and Nissen (2020) embody these efforts in their study on the associations between learning assistants, passing introductory physics, and equity. To that point, Dusen identifies "as a White, cisgender, heterosexual, continuing-generation (CG) man with a color vision deficiency" while Nissen refers to himself "as a White, cisgendered, heterosexual, nondisabled man" (p. 5). In their joint positionality statement, both authors offer transparency about how their identities influence their positions in relation to the power structures under study. Since neither identify as

a woman or Person of Color, both "brought a limited perspective to this work on racism, sexism, and classism" (Dusen & Nissen, 2020, p. 5), a position they acknowledged. Rather than allowing this limitation to prevent them from continuing their work, Dusen and Nissen elicited feedback from a diverse set of peers and contracted an anti-oppression coach to perform an equity audit.

The work of Dusen and Nissen (2020) speaks to a tension that occurs between conducting research that studies marginalized folks, especially in quantitative methods, and grappling with White privilege in research decision-making. That said, "it is in this tension that change and growth can happen in the products and processes of research" (Godwin, 2020, p. 79). Godwin further notes that electing not to wrestle with this tension will only serve to reinforce rather than resist the centrality of racism in research (Delgado & Stefancic, 2001). Quantitative researchers can manage this tension through a process of "coloring epistemologies" (cf., Godwin, 2020; Scheurich & Young, 1997), which entails scholars with majoritarian identities engaging with the work of Scholars of Color and recognizing how racism perpetuates dominant discourses.

One of the co-authors in Reeping et al. (2023), specifically David, exemplifies this practice of coloring epistemologies through their positionality statement. David, a White man, and his two Black co-authors examined the data analysis procedures used in quantitative engineering education research related to broadening participation for Black undergraduate students. One of the Black co-authors lent David a copy of *White Logic, White Methods* (Zuberi & Bonilla-Silva, 2008) after he expressed discomfort about the use of a race variable in regression modeling. This and subsequent readings of Godwin (2020), Holly (2020), and Pawley (2017) caused David to introspect on his applications and fundamental understandings of quantitative methods, leaving him in a liminal state for a while. He eventually found synergy

with the other two authors to help grow the QuantCrit body of literature. To wrap up their positionality statement, David acknowledged his position as an outsider to the population of interest but affirmed his commitment to diversity and inclusion, assuaging the fear of Castillo and Gillborn (2023) about an outsider looking inside (and evaluating) another community.

Despite now proudly identifying as a Scholar of Color, I reference these White scholars because for a long time I, too, felt like an outsider looking inside Communities of Color, making their experiences more relatable to me. I would describe my entire higher education career as an ongoing exercise in coloring epistemologies, which ultimately led me to this current study and more immediately segues into my positionality statement.

Positionality Statement

I note my role as a researcher through a process of reflexivity. This process requires that I self-reflect about who I am as researcher, how my subjectivities and biases (in)form the research design, and how my worldview is shaped by the research I do and vice versa (Wilkinson, 1988). If positionality only asks that researchers clearly state their assumptions relating to the research (Wilson et al., 2022), then reflexivity challenges researchers to further consider what to do with these assumptions (Jamieson et al., 2023). As a QuantCrit scholar, I must declare both.

Indeed, "scholars who use QuantCrit should critically think about how their life experiences and identities may lead to unconscious or conscious bias" (Castillo & Babb, 2024, p. 7). While naming my culturally ascribed identities (e.g., race, gender) will prove easy enough, "others, such as political views, personal life-history, and experiences, are more fluid, subjective, and contextual" (Holmes, 2020, p. 2), making them more difficult to identify and interrogate. In spite of this limitation, I attempt to show how my life experiences led me to this current study.

I grew up in a single-parent, low-income household. The parent who raised me, my mother, comes from mixed origin—that is, she is the product of a White German mom and Black American father. Born in Berlin, Germany, my mother immigrated to the U.S. (specifically, Georgia) in the 1970s as a child of mixed complexion. Her identity colored her experience. My mother faced overt racism from not only schools, businesses, and churches, but also from her own mother. All these racist experiences weighed heavily on my mother, and she wanted me to be prepared for this reality. From early on, my mother attempted to teach me about the reality of being Black in White America. To her, White folks represented the enemy and I, as a Black boy, should be wary of them. Unfortunately for her, my experiences did not mirror her own. Throughout my PreK-12 educational experience, I experienced no overt or even covert forms of racism—I did, however, experience discrimination from people who looked like me. Up until the fourth grade, I had attended a predominantly White school where I was one of maybe five Black children. I got along well with my peers and the teachers. Going into fifth grade though, local government officials redistricted my neighborhood, sending me to a predominantly Black school. I vividly remember that year as the worst one in my life to date. The Black kids their seemingly went out of their way to give me a hard time, bullying me, calling me names for "acting White," and making me feel overall unwelcomed. From this experience, I learned that racial differences held meaning—and for a long time, I believed that Black folks (not White folks) perpetuated these differences. I could not reconcile my mother's warnings with my lived experiences, so I grew apathetic to them and the idea of race and racism as a whole. I carried this apathy all the way to college where I gained a new perspective on the role of race in my life.

I entered my undergraduate alma mater wanting to pursue a major in science, technology, engineering, and mathematics (STEM), specifically environmental sciences. My first semester I

took two major courses and two general education courses. The course instructors for my two major courses were both White men while a White woman and Black man taught my remaining two courses. For the two courses taught by the White men, I withdrew from one mid-semester and earned a "C+" in the other. In my class with the White woman and Black man, I earned a "B+" and "A-" respectively. Fast forward three and a half years, I ended up graduating *magna cum laude* with a Bachelor of Arts in Africana Studies. I attest this success to my choice of major—not because of what I studied necessarily, but for who taught me in the major. Despite White women faculty, men Faculty of Color, and women Faculty of Color only accounting for a minority of my undergraduate professoriate, almost every faculty member I had identified as one of those listed identities. On top of that, all of these faculty were either tenured or on the tenure-track. The only contingent faculty I had were White individuals.

My experience of switching majors comports with the findings of Eagan et al. (2015) Price (2010), and Riegle-Crumb et al. (2019). These scholars all showed that Black students (like me) generally declare STEM majors at the same rate as our White peers (see Xie et al., 2015), but that we persist through to graduation with those majors at significantly lower rates. As Riegle-Crumb et al. (2019) note, "micro-aggressions and a relative lack of support and inclusion on the part of faculty and fellow classmates (both of whom are predominantly White)" likely drive Black students away from the field (p. 142), a reality I experienced firsthand. I eventually found a home in Africana Studies where Black faculty (specifically Black women faculty) overwhelmingly preponderated (see Rojas, 2009). These faculty helped contribute to my success in the same ways that the Africana Studies faculty at San Francisco State university did for their students (see Sueyoshi & Sujitparapitaya, 2020). However, Africana Studies departments

generally and faculty diversification efforts specifically takes steep institutional investments, investments that research would have suggested that my college would not make.

To that point, Stout et al. (2018) found that many colleges, particularly those in rural areas, reported having two or fewer racially minoritized faculty. Three colleges in their sample, with student enrollments ranging from 260 to 2990, reported no racial or ethnic diversity within their faculty. The enrollment for my undergraduate alma mater sat within that range during my matriculating years. And while not located in a rural community, we were in a small suburban town. As Stout et al. evince, creating a diverse faculty body does not occur overnight and requires a serious campus commitment. Kaplan et al. (2018) pointed out and problematized three roadblocks to diversifying U.S. higher education faculty, namely 1) a lack of a critical mass of minority faculty, 2) a need for coordinated programmatic efforts and resources to address retention and promotion, and 3) a senior leader champion. A popular means of removing these roadblocks includes cluster hiring, where an institution recruits and onboards new faculty as a group rather than as individuals (Sá, 2008). This approach heavily favors well-funded research universities, with some work even showing faculty pushback about the rushed hiring processes and a greater benefit for White faculty than minoritized faculty (Curran et al., 2020).

My undergraduate institution opted for a more integrated approach to diversifying not only the curriculum but the faculty body as a whole. Leaders at the institution specifically started to erect and endow several cultural and ethnic studies departments such as Africana Studies (my major), Gender and Sexuality Studies, and Hispanic Studies. The departments developed and evolved over several years through generous support from external funding, endowments, private donations, and internal institutional funding, which represented the type of institutionalization that such academic areas need to survive (see Saunders & Paquet, 2008).

These departments naturally attracted diverse faculty across race, rank, and gender, which enhanced my learning and thus success in the process. For these reasons, I label this research as both personal and purposeful; I intend to promote more nuanced ways of thinking about the role, approaches to, and need for faculty diversity throughout U.S. higher education.

I even crafted my candidacy and subsequent dissertation committee for this project with this goal in mind. I selected my committee members based not only on their methodological and epistemological foci, but also for their unique ontologies that informed their lived experiences. My chair identifies as a Ghanian/American man who has painful and traumatic experiences with race and racism both in the classroom and broader U.S. society (Quaye, 2012, 2014). Another committee member identifies as "an African American cisgender woman who [also] attended a PWI" and "experienced numerous racial microaggressions (e.g., insults, assumptions of inferiority, and social locations)" (Mills, 2020, p. 48). The most senior member of my committee identities as both as a quantitative criticalist and White heterosexual man who aims "to create an inclusive body of work that disrupts normative quantitative practice" (Duran et al., 2022, p. 156). No published scholarship discusses the positionality of my methodological specialist, but their lived experiences will nonetheless help advance my learning and work. The members of my committee also occupy a spectrum of faculty ranks, from (tenure-track) assistant professor to (tenured) full professor. The culmination of their expertise and experiences will no doubt propel my work and help me refine my own positionality as well.

Applying a QuantCrit Research Design

I follow the suggestions detailed by Castillo and Gillborn (2023) for interweaving criticality (specifically, QuantCrit) into my research design. The suggestions subscribe to the five principles of QuantCrit (see Gillborn et al., 2018), using them as an organizing framework. I

start with the centrality of racism principle, which encourages quantitative researchers to explicitly express how racism may affect every aspect of data collection and analysis (Castillo & Gillborn, 2023; Gillborn et al., 2018). While at times racism may occur in crude and obvious ways, CRT brings attention to the more insidious and invisible nature of racism that frequently permeates the entire fabric of institutions (Feagin, 2006; Pérez Huber & Solórzano, 2015). QuantCrit enables the critical quantitative researcher to render racism quantifiable and thus visible. To do so, Castillo and Gillborn (2023) offer two suggestions: 1) drafting a positionality statement and 2) framing research questions from an asset-based perspective.

The absence of a positionality statement would signal that I consider my life histories, concerns and biographies of the researcher as completely detached from the data, analysis, and presentation of my research. Such an action would only further hegemonic operations of Whiteness in U.S. society, whereby race and racism exist tangentially to more mainstream concerns (Castillo & Gillborn, 2023; Leonardo, 2009). I fight against this trend and center the role of race and racism in the research process by drafting my own positionality statement. I also use the word draft rather than write to indicate the dynamic and evolving quality of positionality.

As for framing research questions from an asset-based perspective, Castillo and Gillborn (2023) want quantitative researchers to resist our pervasive inclination towards deficit thinking in social policy research. For context, consider two questions: Why are White women faculty, men Faculty of Color, and women Faculty of Color not more prevalent in U.S. higher education institutions? Why do U.S. higher education institutions hire disproportionate numbers of White men faculty? Both questions seek to understand the race- and gender-based discrepancy in faculty diversity. However, the first question assumes that the explanation will lie with White women faculty, men Faculty of Color, and women Faculty of Color (or the minoritized faculty).

The second question removes the presumed responsibility from the minoritized faculty members and places the onus on systemic barriers instead. The second question puts the intentionality of U.S. higher education institutions at the heart of the inquiry. Likewise, I model my two research questions under the asset-based framework to show how colleges and universities have (or have not) diversified their faculty over time—and to illuminate the impact of such (in)action.

Another principle of QuantCrit proposes that numbers are not neutral. As Crawford et. al. (2019) caution, quantitative research "tools, models and techniques that fail to take account of racism as a central factor in daily life" only help to further normalize Whiteness, specifically White Supremacist ideas (p. 126). Accordingly, Castillo and Gillborn (2023) ask QuantCrit methodologist to choose both their denominators and models carefully. For choosing a denominator, quantitative researchers must present their analysis in a meaningful way. To put this point into perspective, Fryer (2019) found that U.S. police shoot Black, Latinx, and White individuals at equal rates *when stopped*. However, Fryer made everyone stopped by the police the denominator, which curtails the fact that police are more likely to stop Black folks than individuals from any other race or ethnic group (Pierson et al., 2020). My study will attempt to calculate diversity scores for institutions using the Toutkoushian (2023) formula, which will place the total number of race, gender, and rank in the denominator. While a seemingly standardized measure, institutional context matters. Different colleges and universities may have different diversity goals, making variable selection for the model of paramount concern.

Additionally, statistical models attempt to show how much variation in an outcome (e.g., faculty diversity) is explained by the variables included, thus "controlling" for them. That said, institutional contexts do not exist outside of racist systems, so when controlling for certain factors a researcher may unintentionally be controlling for racism (Castillo & Gillborn, 2023).

Therefore, Castillo and Gillborn advise quantitative scholars to choose variables based on prior critical research. I plan to include three control variables: 1) institutional control (public/private), 2) single-gender institution status (yes/no), and 3) MSI status (yes/no). I settled on the institutional control variable given the recent surge in state-supported sanctions against diversity, equity, and inclusion on college campuses (e.g., Russell-Brown, 2023). I included the single-gender institution variable given the contention in higher education literature about the impact of attending a women-only college on student (particularly, women student) outcomes (cf., Kim & Alvarez, 1995; Rice & Hemmings, 1988). Finally, Bowman and Denson (2022) informed my decision to include an MSI indicator variable based on their mixed findings on the effect of attending an MSI on the six-year graduation rates of racially minoritized students.

Along with the prior two principles, QuantCrit scholars also believe that categories are neither natural nor given. This principle builds off the CRT tenet that conceptions of race are socially constructed, meaning there are no manifest differences between races besides the differences members of society inscribe. To subvert this thinking, Castillo and Gillborn (2023) and Gillborn et al. (2018) suggest that quantitative researchers read "racism" for "race" whenever encountered. For instance, women Faculty of Color remain disproportionately under-represented in academia at all (but especially senior) ranks (Fox Tree & Vaid, 2022). Their conspicuous absence has nothing to do with their race but everything to do with racist power structures that systemically exclude them from the American professoriate. Hence, data collection and analysis based on social categorizations should resonate with the communities of interest. I created my categories based on intersectionality theory (Crenshaw, 1989, 1991) with the goal of advancing equity and justice for women Faculty of Color generally and Black women

faculty especially. Likewise, I rely on race, gender, and rank categories to push forward this agenda.

Like race, Castillo and Gillborn (2023) also problematize the social construction of data through another principle of QuantCrit. Researchers, often guided by funders, shape all aspects of social science research, determining what to study, how to study it, and whom or what to include in data collection. Put differently, data exists everywhere but holds no meaning outside of that ascribed by the researcher. The idea that data cannot "speak for itself" presupposes that the researcher uses the experiences and insights of the communities under study to ascribe this meaning. As Lawrence III et al. (1993) state, CRT "insists on recognition of the experiential knowledge of people of color and our communities of origin in analyzing law and society" (p. 6). As follows, Castillo and Gillborn insist that QuantCrit scholars take steps on ensure that their research does not simply encode majority beliefs. I took these steps by referencing a diverse and eclectic set of scholars from a plethora of epistemological, methodological, and ontological backgrounds to inform my research design, specifically highlighting Scholars of Color in the process. I also presented my research findings in an accessible fashion as recommended by Castillo and Gillborn. Specifically, I calculated diversity index scores using the formula developed by Lieberson (1969), standardized by Allen and Wolniak (2019), and furthered by Toutkoushian (2023), which gave an interpretable percentage out of 100.

Since CRT "works toward the end of eliminating racial oppression as part of the broader goal of ending all forms of oppression" (Lawrence III, et al 1993, p. 6), QuantCrit as a tool of CRT should do the same. This sentiment epitomizes the principle of QuantCrit that advocates for a social justice orientation in research. While quantitative data has historically served as a tool for those in positions of power, QuantCrit aims to invert this paradigm. In fact, QuantCrit equips

researchers with the toolkit necessary to leverage quantitative data in the pursuit of fostering a more equitable society (Castillo & Gillborn, 2023). QuantCrit asks the quantitative researcher to consider interpretation versus results. Results cannot "speak for themselves," but interpretations allow the researcher to speak for them. My interpretations will acknowledge the ways in which racism may operate beneath the surface to influence the results. Specifically, I will discuss how the culture of academia prevents many colleges and universities from achieving maximum faculty diversity (Fox Tree & Vaid, 2022). As Carter-Sowell et al. (2019) point out, the notion of racist systems like meritocracy "masks ways in which certain groups have benefited and others have been excluded from access to resources and networks that lead to professional advancement" (p. 306). I will attempt to unmask the impact of racist systems like meritocracy on faculty diversity and student success in my advancement of a critical race agenda in higher education research.

Methods

Through this study, I plan to further quantify the relationship between the structural diversity of faculty and student retention and graduation rates, thereby extending the prior work of Stout et al. (2018). To do so, I explored the following research question:

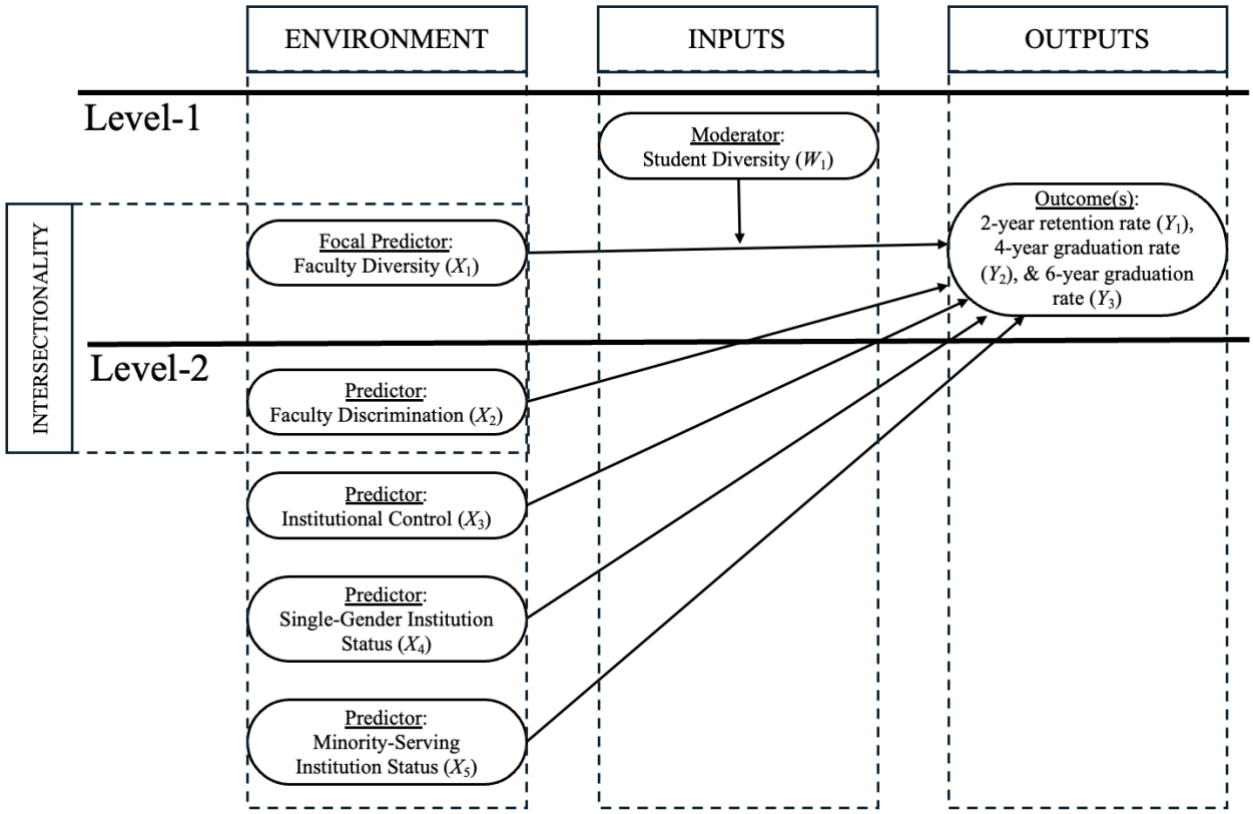
- What is the relationship between faculty diversity characteristics and undergraduate student retention and graduation rates at U.S. higher education institutions?

Drawing upon longitudinal data from a national database, I conducted a QuantCrit research study to answer these questions. Specifically, I relied on multilevel regression modeling techniques to analyze and interpret the data. For modeling purposes, I reconfigured my conceptual synthesis of the literature guiding the study (Table 3) to better explain the level structure inherent in the data, delineate the relationship between study variables, and ground my

analytical strategy in the literature. This reconfiguration of my conceptual framework allowed me to express my adapted I-E-O model through a more graphical means as shown in Figure 3.

Figure 3

Graphical Representation of Conceptual Synthesis of the Literature Guiding the Study



Note. Electronic image created by author.

I refer to Figure 3 in describing my data, measurements, and data analysis methods. In particular, I reference the graphic in validating and explaining variable placement in my models. This conceptual guide also informs the limitations and delimitations of the study design.

Data

I queried IPEDS to obtain data for this study. All colleges, universities, and technical schools that participate in federal financial aid programs must provide IPEDS with data on institutional characteristics, institutional prices, admissions, enrollment, student financial aid,

degrees and certificates conferred, student persistence and success (e.g., retention rates, graduation rates), institutional human resources, fiscal resources, and academic libraries. NCES began collecting these data for IPEDS in 1993. I chose this particular database for data collection for three reasons: 1) ease of access as public data, 2) standardization of inputs, environment, and outputs across institutional type, and 3) longitudinal data tracking. Using these data, I constructed a panel dataset for entering cohorts of students and full-time instructional faculty from 2012 through 2022. This 11-year timespan represented all years for which data were available. I also restricted the dataset to U.S.-only, degree-granting, Title IV-participating, primarily baccalaureate or above public and private not-for-profit institutions with full-time, first-time undergraduates. Unlike Toutkoushian (2023), I decided to not drop institutions with a zero percent graduation rate from the dataset. An institution can report a zero percent graduation for many and meaningful reasons. For example, Northeastern University reports a zero percent four-year graduation rate due primarily to their undergraduate cooperative education program, which puts most students on a five-to-six-year graduation track. Peirce College also reports zero percent four- and six-year graduation rates at some time points due to the high number of adult learners enrolled at the institution; graduation rates only capture first-time, full-time undergraduate students, not adult learners who often enroll part-time (Kamer & Ishitani, 2020). The resulting data set consisted of approximately 1,700 institutions per year. The population dataset ultimately included a diverse and eclectic set of institutions, ranging from highly prestigious schools (e.g., Vanderbilt) to research universities (e.g., The Ohio State) to liberal arts colleges (e.g., Davidson).

Measurements

The dependent (or outcome) variables were two-year retention rate and the four- and six-year graduation rates for cohorts of full-time, degree-seeking, first-time undergraduate students. Faculty diversity represented the primary (or focal) predictor variable while student diversity constituted the moderator variable for this study. I measured both faculty diversity and student diversity at each time point in the study, allowing me to examine differences across repeated measures for each institution (i.e., within-institution variance). This data collection approach would result in both measurements varying across repeated measures and institutions, making them level-1 (or time-varying) variables.

Since doing intersectionality entails looking at both intersecting identities and systems of power concurrently, I also included a faculty discrimination measure as another predictor variable. Other independent variables that could influence these outcomes, which I have accounted for in the study design, included institutional control, single-gender institution status, and MSI status. Much of the previous empirical work on the relationship between faculty diversity and student success almost exclusively covers public institutions (Bowman & Denson, 2022; Cross & Carman, 2022; Fairlie et al., 2014; Llamas et al., 2021; Stout et al., 2018; Taylor et al., 2022), insinuating a need to look at private institutions as well through the institutional control variable. Given the unique history and purpose of single-gender institutions and MSIs to serve specific student populations (Cole, 2011), these institutions by design attract more race and gender homogenous faculty and student bodies, which would impact their diversity indexes and student outcomes. Owing to their static nature, I measured level of faculty discrimination and private, single-gender, and MSI status only once per institution for all repeated measures (i.e., between-institution variance), treating them all as level-2 (or time-invariant) variables.

Calculating Diversity

Whereas researchers can capture attributes on a continuity (e.g., age) through statistics like standard deviation and range, categorical factors such as race and gender require a different approach. Several methods exist for measuring the diversity of items for categorical factors. For example, Keylock (2005) used the Shannon index to map the distribution of species in a region. The Shannon index (SI_k) can be computed using the following formula:

$$SI_k = -\sum_{j=1}^{J} p_{jk} ln(p_{jk}).$$

In this formula, p_{jk} represents the proportion of items for the k-th attribute that are in the j-th category and J = number of categories. Toutkoushian (2023) questioned the interpretability of scale and value of this index, especially when a category has no items as *ln* (0) = undefined. Addressing this limitation and more applicably to this study, Chang (1999) and Titus (2006) measured student racial diversity both within and between institutions with this formula:

$$D_{race} = \frac{1}{\sqrt{\frac{\sum(p_j - 0.25)^2}{4}}}.$$

For this equation, let p1, ..., p4 represent the proportions of students in the four racial categories (i.e., African American, Hispanic, Asian, and White) considered by the authors. Since students were assigned into one of four racial categories, institutions achieved maximum diversity when students were divided evenly across the four categories. Stout et al. (2018) leveraged a similar formula to record the distribution of faculty across five ethnic and racial groups (i.e., African American, Hispanic, Asian, White, and American Indian). One can write the Diversity Score formula, as defined by Stout et al., as follows:

$$D_{\text{race/ethnicity}} = (1 - \sqrt{\frac{\left(p_j - .20\right)^2}{5}})*100.$$

The formula proposed by Stout et al. (2018) permits a possible range of Diversity Scores from 55 to 100, limiting the scale of interpretability. Moreover, neither formula has been extended to other attributes such as gender and academic rank. To deal with these concerns, I relied on the diversity index used by Toutkoushian (2023) and Allen and Wolniak (2019) where the structural diversity of students and faculty can be expressed on a scale from 0 to 100, as in:

$$\mathrm{D_k} = \left(\frac{1 - \sum p_{\mathrm{jk}}^2}{1 - (\frac{1}{J})} \right) *100.$$

The expression within the numerator represents a calculation based on one minus the total of squared proportions related to the *k*-th attribute. As students are more evenly distributed among the *J* categories, this numerator value increases. In contrast, the denominator indicates a value derived from one minus the hypothetical quantity assuming an equal distribution of students across the *J* categories. The combined result within the parentheses ranges from zero (when all students belong to one category) to one (when students are equally distributed among the *J* categories). By multiplying the resulting value by 100, the index is rescaled to a range of 0 to 100, which can be interpreted as the percentage of maximum diversity that exists among students and faculty.

Originally introduced by Lieberson (1969) and Herring (2009), Toutkoushian (2023) and Allen and Wolniak (2019) used a standardized version of a metric previously utilized in the *U.S. News and World Report* rankings to calculate the diversity index score. This approach allows for the concurrent consideration of multiple categorical attributes, such as race, rank, gender, and year, without worry about the number of possible values. The formula also provides an intuitive

interpretation and places all attributes on the same scale. Of note, however, diversity index levels will naturally vary across attribute depending on data availability. Nevertheless, I applied this formula in calculating the structural diversity of faculty and students.

Calculating Faculty and Student Diversity. This research looks at the race, gender, and class year of a student co-constitutively and considers how this amalgam of identities interacts with the intersecting race, gender, and rank identities of faculty. For the race variable, I restricted the sample to five categories—i.e., 1) Asian, 2) Black, 3) Latinx, 4) White, and 5) all other. The all-other category included American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, and multiracial (two or more race) students, following the categorization schema of Toutkoushian (2023). I created a composite group for students of these racial identities due to their low frequencies in the dataset, denoting a concern commonly cited by other scholars in the field (see Bowman & Denson, 2022; Cross & Carman, 2022; Stout et al., 2018). I also excluded faculty and students in the non-resident alien and race or ethnicity unknown categories since race could not be defined. For the gender variable, IPEDS relegates available data to the men-women binary, which excluded gender non-conforming individuals from the dataset as well.

For the faculty diversity measure of academic rank, I looked at three categories: 1) Tenured, 2) on-tenure track, and 3) not on tenure track/no tenure system—for instructional faculty only. For the student variable of class year, I created two measures: 1) First-time degree-seeking students and 2) continuing degree-seeking students, which did not include transfer students. Altogether, I ended up with 30 unique categories to calculate the diversity index score for faculty (see Table 4), spanning from non-tenured White men faculty to tenured Black women faculty. To calculate the student diversity index, I had 20 unique categories that intersected

across race, gender, and level of student (see Table 5), ranging from first-year Asian men students to continuing Latinx women students.

Table 4

Faculty Diversity Distributions

		Asian	Black	Latinx*	White	All Other
Tenured	Men	p_{j1}	p_{j2}	p_{j3}	p_{j4}	p_{j5}
	Women	p_{j6}	p_{j7}	p_{j8}	p_{j9}	p_{j10}
On-tenure track	Men	p_{j11}	p_{j12}	p_{j13}	p_{j14}	p_{j15}
	Women	p_{j16}	p_{j17}	p_{j18}	p_{j19}	p_{j20}
Not on tenure track/no tenure system	Men	p_{j21}	p_{j22}	p_{j23}	p_{j24}	p_{j25}
	Women	p_{j26}	p_{j27}	p_{j28}	p_{j29}	p_{j30}

**Note*. IPEDS uses the classification Hispanic or Latino for this category.

Table 5

Student Diversity Distributions

		Asian	Black	Latinx*	White	All Other
First-year	Men	p_{j1}	p_{j2}	p_{j3}	p_{j4}	p_{j5}
	Women	p_{j6}	p_{j7}	p_{j8}	p_{j9}	p_{j10}
Continuing	Men	p_{j11}	p_{j12}	p_{j13}	p_{j14}	p_{j15}
	Women	p_{j16}	p_{j17}	p_{j18}	p_{j19}	p_{j20}

**Note*. IPEDS uses the classification Hispanic or Latino for this category.

Calculating Faculty Discrimination. As the Combahee River Collective (1977) write, "If Black women were free, it would mean that everyone else would have to be free since our freedom would necessitate the destruction of all systems of oppression" (p. 7) In support of this statement, I centered Black women professors in my calculation of faculty discrimination.

Despite making up 12 percent of the U.S. population, Black faculty represent only six percent of the U.S. professoriate, with Black men and Black women accounting for three percent each (Heilig et al. 2019). Black women also constitute about two-thirds of all Black doctorate degree holders, but still maintain gender parity with Black men in faculty roles (Gray & Brooks, 2021), suggesting a disproportional representation of Black women faculty in U.S. higher education. This disproportionately shows that scholars of other races and genders are more likely to be offered faculty positions, particularly tenure-track positions (Gray & Brooks, 2021; Njoku & Evans, 2022). Even in tenure-track roles, Black women faculty are less likely to eventually earn tenure than their peers of other races and genders due to reduced support (for important grants to perform research and publications) and time off to conduct professional duties (see Blackshear & Hollis, 2021; Woody et al., 2000). On top of that, Black women are less likely to have their claims of race- and gender-based discrimination believed since many judges and attorneys fail to recognize the very presence of intersectional discrimination (De Leon & Rosette, 2022). These trends give need for a closer look at the discrimination that Black women face in U.S. higher education, which may provide insight into the discrimination that all minoritized faculty face.

To calculate my faculty discrimination variable ($FacultyDiscrimination_j$) as measured through institutional discrimination against Black women faculty, I used an effect coding scheme (Mayhew & Simonoff, 2015). To do so, I first computed the percentage of faculty of who hold tenure for each race and gender grouping (e.g., of all White men faculty, X percentage held tenure). Then, I calculated the mean and standard deviation (SD) of all these percentages for each institution at the 10 time points (i.e., academic years 2012-2013 through 2021-2022). Next, I determined where the percentage of Black women faculty with tenure at a given institution at a

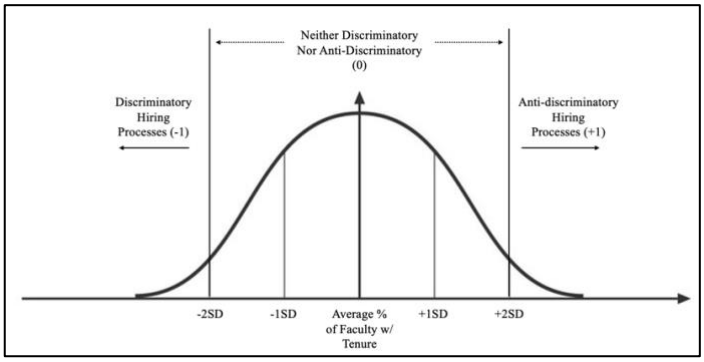
specific time fell within the normal distribution of faculty with tenure across each race and gender grouping in my study (see Table 4).

If the percentage of Black women faculty with tenure lied below or at (≤) minus two SD of the average of all tenured faculty of a given institution at a specific time, then that would indicate that an institution perpetuated systems of racism, rankism, and genderism in their faculty hiring practices, particularly toward Black women faculty. On the other end, if the percentage of Black women faculty with tenure rested at or above (≥) plus two SD of the average of all tenured faculty, then that would denote an institution with faculty hiring practices rooted in anti-racism, anti-rankism, and anti-genderism. These extrapolations algin with U.S. legal precedent that any disparities within two SD are usually substantially equal in nature, meaning not statistically significant (Browne, 1993; King & Wang, 2023). Moreover, CRT presupposes the embeddedness of racism in U.S. institutions, particularly higher education institutions. When coupled with intersectionality, critical race researchers may also presume the presence of other systems of oppression like genderism and rankism. Assuming that racism, genderism, and rankism are constantly operating in the background, then a college or university having a percentage of Black women faculty with tenure at or greater than two SD the average of all tenured faculty should not occur unless institutional leaders are actively working against those systems. An institution where the percentage of Black women with tenure sat between plus two and minus two SD of the average of all tenured faculty would suggest that neither discriminatory nor anti-discriminatory faculty hiring practices were occurring. If the percentage of Black women with tenure lied below or at two minus SD, I coded that as -1; between minus two and plus two SD as 2; and at or above two plus SD as 1. For clarity, Figure 4 illustrates my coding

scheme for $FacultyDiscrimination_j$, specifically showing how I looked for the placement of the percentage of Black women with tenure along a bell curve.

Figure 4

Illustrative Overview of Faculty Discrimination Calculation



Note. Electronic image created by author.

Institutional Characteristics

To account for additional variance, I introduced three time-invariant predictor variables, specifically institutional control (private/public), single-gender institution status (yes/no), and MSI status (yes/no). I coded all three on a binary indicator scale. For institutional control, institutions classified either as public or private. The single-gender institution status variable included men's colleges and women's colleges. Hampton-Sydney, Morehouse, and Wabash represented the only four-year men's colleges whereas the women's colleges included all member institutions of the Women's College Coalition (currently, n = 31).

The last institutional characteristic variable controlled for whether an institution classifies as an MSI or not as defined under Title III of the Higher Education Act of 1965. However, I delimited this category to Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCU) only because of their strict exclusion criteria. Other MSIs like Predominantly Black, Hispanic-Serving, Native American Non-Tribal, Alaskan Native or Native

Hawaiian-Serving, and Asian American and Native American Pacific Islander-Serving institutions all garner their statuses based primarily on undergraduate enrollment patterns, which may fluctuate from year to year. HBCUs and TCUs bear no such enrollment requirement, making their status as MSIs more static and time-invariant rather than time-varying.

Dependent Variables

The dependent (or outcome) variables were two-year retention rate and four- and six-year graduation rates for cohorts of full-time, degree-seeking, first-time undergraduate students. The retention rate shows the percentage of entering students who reenrolled at the same institution at the start of their second year. Graduation rates capture the percentage of entering students who earned a baccalaureate degree from the same institution where they initially enrolled. All three variables are continuous and measured on a percentage scale of one to 100 percent. I collected data for entering cohorts of students and full-time instructional faculty from 2012 through 2022. This 11-year timespan denotes all years for which data were currently available. In addition, data reporting by race/ethnicity and gender was optional for academic years 2012 and 2014 (see Ginder & Kelly-Reid, 2013), making missing data a possible concern.

Data Analysis

Statisticians use multilevel modeling (MLM) as an umbrella term for any statistical models with parameters that vary at more than one level. Moreover, MLM may also refer to hierarchical linear models, linear mixed-effect model, nested data models, random coefficient, random-effects models, random parameter models, or split-plot designs. While often regarded as generalizations of linear models (viz., linear regression), MLM can also apply to non-linear models such as quadratic and piecewise functions (Raudenbush & Bryk, 2002).

Researchers find MLM especially suitable for study designs that involve data organized across multiple levels, otherwise known as nested data (Tabachnick & Fidell, 2007; Luke, 2004). In these designs, individuals (at a lower level) are typically nested within contextual or aggregate units (at a higher level). These models not only focus on individual-level data but also allow the examination of repeated measurements for individuals (Luke, 2004; Tabachnick & Fidell, 2007). This flexibility makes MLM an appropriate alternative analytical approach for both univariate and multivariate analysis of repeated measures (e.g., ANCOVA), facilitating the exploration of individual variations in growth curves (Cohen et al., 2002; Raudenbush & Bryk, 2002).

As follows, MLM stands out as a popular choice for examining individual changes over time in educational and social science studies especially (Laird & Ware, 1982; Raudenbush & Bryk, 2002; Kim et al., 2022). Within the MLM framework, longitudinal datasets adopt a long format (or univariate format), signifying that each subject (e.g., each college or university) is associated with multiple rows of observations measured across various time points (Kim et al., 2022). The long-format datasets necessitate a variable indicating the time of each observation such as age, year, or time of measurement. Since the data incorporates time information for each measurement occasion, MLM does not require the repeated measures to follow a uniform time spacing or to encompass an equal number of repetitions for all subjects (Raudenbush & Bryk, 2002; Kim et al., 2022).

The calculation and interpretation of the intraclass correlation (ICC) generally provides justification for whether to take an MLM approach to quantitative data analysis (Nezlek, 2008). The ICC equation draws on the standard formula for computing a correlation, namely dividing the covariance by the product of the standard deviation. The difference between the two calculations lies in the fact that correlation standardizes the covariance between two variables

whereas ICC does so between two observations, effectively measuring the proportion of variance due to between-group mean differences (Raudenbush & Bryk, 2002; Nezlek, 2008). Put differently, ICC assesses the strength of the nested data structure. ICC values range from zero to one. An ICC of zero indicates no between-group differences to produce dependence, rendering the nesting of the data irrelevant. An ICC of zero would instead satisfy an assumption of ordinary least squares (OLS) regression, making that the more appropriate statistical model under these circumstances (Nimon, 2012). On the other end of the range, if ICC = 1, then all differences are between group differences and individuals within a group have identical scores. Though some scholars do not prescribe a minimum ICC per se for employing MLM (see Luke, 2004; Raudenbush & Bryk, 2002), Heck and Thomas (2008) recommend using an ICC of 0.05 or five percent as the minimum threshold for deciding whether to use multi-level (e.g., linear mixed-effects) over single-level (e.g., OLS) regression modeling techniques.

To justify MLM for my study, I first ran an intercept-only (or null) model on SPSS software for each dependent variable mentioned in my research question to ensure that the ICC for all of them meet the Heck and Thomas (2008) recommended minimum threshold (i.e., ICC ≥ 0.05). I also group-mean centered the level-1 predictor (i.e., faculty diversity) and moderator (i.e., student diversity) variables and grand-mean centered the level-2 predictor variables (i.e., faculty discrimination, institutional control, single-gender institution status, MSI status) to avoid possible multicollinearity and increase the interpretability of the results (Enders & Tofighi, 2007; Shieh, 2011). From there, I began my analysis.

Analytical Approach

Altogether, I ran eight models. Model 1 assessed the appropriateness of a MLM rather than single-level analytical approach, constituting the random-intercept-only (i.e., null) model.

Models 2 through 8 directly addressed my research question through which I incrementally added fixed and random effects per relevant theory. I sequenced variable entry into the regression analysis for my predictors based on the work of Astin (1991), Marsh (2014), and Pascarella (1985). By assigning the order of entry for variables into a series of regression analyses, I could better assess the contribution of each predictor variable based on what was added to the explanation of the variance at that step in the analysis. This approach allowed me to determine the effects of independent variables after accounting for the effects of predictors previously entered into the statistical models, enabling me to parse out the effect of each predictor on the outcome variables (Tabachnick & Fidell, 2007).

After running all models, I compared the Bayesian information criterion (BIC) value for each, a well-known general approach to model selection that favors more parsimonious models over more complex models—i.e., BIC assigns a penalty based on the number of parameters being estimated in the model (Schwarz, 1978). I selected the model with the lowest BIC as the best fitting model from which to draw conclusions about the data. All models relied on repeated measures data without time in the model, considering that college completion rates do not vary widely over time (see Causey et al., 2022).

Model 1. For this model, I asked: How much do U.S. higher education institutions vary in their means of two-year retention rate, four-year graduation rate, and six-year graduation rate? To answer this question, I ran a random-intercept-only model to calculate ICC and quantify the extent of clustering by institution. I expressed this model using the following question:

Level-1:

$$Y_{rij} = \beta_{0rj} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + U_{0rj}$$

For this multilevel model, Y_{rij} represented the predicted value of outcome r (i.e., two-year retention rate, four-year graduation rate, or six-year graduation rate) of repeated measure i at institution j. β_{0rj} denoted the overall intercept, representing the average outcomes across all groups if no group-level differences are considered. Like β_{0rj}, γ_{00r} served as another fixed effect that shows the overall slope of the model. U_{0rj} was the random effect, representing individual variations from the average intercept and slope. Finally, ε_{rij} constituted the residual error term.

Model 2. For Model 2, I added faculty diversity ($FacultyDiversity_{ij}$) as a level-1 fixed and random effect. In this way, $FacultyDiversity_{ij}$ functioned as my focal predictor since I introduced this variable first in the sequence. I constructed the following equation for this random coefficient regression model:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj} FacultyDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + U_{1rj}$$

Model 3. Next, I introduced the student diversity variable (i.e., $StudentDiversity_{ij}$) into modeling series as another level-1 fixed and random effect. I expressed this model as follows:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj} FacultyDiversity_{ij} + \beta_{2rj} StudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + U_{2rj}$$

Model 4. For Model 4, I attempted to assess the moderating role of student diversity on the effect of faculty diversity on institutional retention and graduation rates. Pointedly, I implemented a 1 X (1 → 1) model design, where the first "1" denotes the level at which I measure the moderator, the second "1" refers to the level at which I measure the focal predictor, and the last "1" indicates the level at which I measured the outcome variables. Put differently, I ran a random coefficient regression model with an interaction term ($FacultyXStudentDiversity_{ij}$) between faculty diversity and student diversity. Relying on the work of Bauer and Curran (2015) and Loeys et al. (2018), I fitted the following multilevel model:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj} FacultyDiversity_{ij} + \beta_{2rj} StudentDiversity_{ij} + \beta_{3rj} FacultyXStudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + U_{2rj}$$

$$\beta_{3rj} = \gamma_{30r} + U_{3rj}$$

Model 5. Building on the prior models, I next added faculty discrimination ($FacultyDiscrimination_{ij}$) as a level-2 fixed effect. This model aligns with intersectionality

theory, which regards race, rank, and gender as both personal identities (i.e., $FacultyDiversity_{ij}$) and social hierarchies (i.e., $FacultyDiscrimination_{j}$). I wrote the equation for this scaffolded model as follows:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj}FacultyDiversity_{ij} + \beta_{2rj}StudentDiversity_{ij} + \beta_{3rj}FacultyXStudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + \gamma_{01r}FacultyDiscrimination_{j} + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + \gamma_{11r}FacultyDiscrimination_{j} + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + \gamma_{21r}FacultyDiscrimination_{j} + U_{2rj}$$

$$\beta_{3rj} = \gamma_{30r} + \gamma_{31r}FacultyDiscrimination_{j} + U_{3rj}$$

Model 6. Continuing upon Model 5, I then introduced institutional control ($Private_{j}$) as another level-2 fixed effect and time-invariant variable. Researchers have found meaningful differences in retention and graduation rates between undergraduate students at public and private institutions (Causey et al., 2022; Toutkoushian, 2023). I coded this variable as Yes = 1 (for private) and No = 0 (for public). For this intercepts- and slopes-as-outcomes model, I used the following function:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj}FacultyDiversity_{ij} + \beta_{2rj}StudentDiversity_{ij} + \beta_{3rj}FacultyXStudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + \gamma_{01r} FacultyDiscrimination_j + \gamma_{02r} Private_j + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + \gamma_{11r} FacultyDiscrimination_j + \gamma_{12r} Private_j + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + \gamma_{21r} FacultyDiscrimination_j + \gamma_{22r} Private_j + U_{2rj}$$

$$\beta_{3rj} = \gamma_{30r} + \gamma_{31r} FacultyDiscrimination_j + \gamma_{32r} Private_j + U_{3rj}$$

Model 7. For Model 7, I added single-gender institution status ($SingleGender_j$) as another level-2 fixed effect and time-invariant variable. I coded this variable as Yes = 1 (for single-gender institutions) and No = 0 (for co-educational institutions). I used the following equation to run this model:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj} FacultyDiversity_{ij} + \beta_{2rj} StudentDiversity_{ij} + \beta_{3rj} FacultyXStudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + \gamma_{01r} FacultyDiscrimination_j + \gamma_{02r} Private_j + \gamma_{03r} SingleGender_j + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + \gamma_{11r} FacultyDiscrimination_j + \gamma_{12r} Private_j + \gamma_{13r} SingleGender_j + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + \gamma_{21r} FacultyDiscrimination_j + \gamma_{22r} Private_j + \gamma_{23r} SingleGender_j + U_{2rj}$$

$$\beta_{3rj} = \gamma_{30r} + \gamma_{31r} FacultyDiscrimination_j + \gamma_{32r} Private_j + \gamma_{33r} SingleGender_j + U_{3rj}$$

Model 8. Model 8 introduced MSI status (MSI_j) as the last level-2 fixed effect and time-invariant variable. Like with $SingleGender_{ij}$, I again coded MSI_j as Yes =1 (for MSIs) and No = 0 (for non-MSIs). I articulated this model as follows:

Level-1:

$$Y_{rij} = \beta_{0rj} + \beta_{1rj} FacultyDiversity_{ij} + \beta_{2rj} StudentDiversity_{ij} +$$

$$\beta_{3rj} FacultyXStudentDiversity_{ij} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + \gamma_{01r} FacultyDiscrimination_j + \gamma_{02r} Private_j + \gamma_{03r} SingleGender_j + \gamma_{04r} MSI_j + U_{0rj}$$

$$\beta_{1rj} = \gamma_{10r} + \gamma_{11r} FacultyDiscrimination_j + \gamma_{12r} Private_j + \gamma_{13r} SingleGender_j + \gamma_{14r} MSI_j + U_{1rj}$$

$$\beta_{2rj} = \gamma_{20r} + \gamma_{21r} FacultyDiscrimination_j + \gamma_{22r} Private_j + \gamma_{23r} SingleGender_j + \gamma_{24r} MSI_j + U_{2rj}$$

$$\beta_{3rj} = \gamma_{30r} + \gamma_{31r} FacultyDiscrimination_j + \gamma_{32r} Private_j + \gamma_{33r} SingleGender_j + \gamma_{34r} MSI_j + U_{3rj}$$

Limitations

For this section, I discuss three methodological concerns around defining diversity, measuring student success, and handling missing data.

Defining Diversity

One possible methodological concern revolves around how the instrument I used to collect and compute the focal predictor and moderator variables measures diversity. The diversity index that Allen and Wolniak (2019) and Toutkoushian (2023) posited calculates compositional diversity on a linear and finite scale where institutions with the greatest variance in diversity garner the lowest scores (down to zero percent) while those with the lowest variance receive the highest scores (up to 100 percent). Assessing and assigning diversity scores in this manner would suggest that achieving maximum diversity simply means ensuring an equal distribution of individuals across all observable categories of difference. Under this school of thought, diversity refers to "the position of a population along a continuum ranging from homogeneity to heterogeneity with respect to one or more qualitative variables" (Lieberson, 1969, p. 851). Harrison and Klein (2007) would later define this understanding or measuring of

diversity as *variety diversity*, which captures differences in group composition in a population on some categorical variable (e.g., race, sex).

As Budescu and Budescu (2012) further explain, assume that the target categorical variable can take J distinct values (i.e., categories). The authors then let P_i equal the proportion of cases in category i, where $i = 1 \ldots J$, all $P_i \geq 0$, and $\sum_{i=1}^{J} P_i = 1$. The J proportions follow a multinomial distribution (see e.g., Wickens, 1989). From there, Budescu and Budescu measure *variety diversity* using a single-value function of this distribution, where $D = f(P_1, P_2 \ldots P_J)$. This model holds four assumptions: That all values must 1) be bounded from above and below; 2) reach minimal value when all the observations are concentrated in one category (e.g., $P_1 = 1$ and $P_2 = \ldots = P_J = 0$), indicating no diversity; 3) obtain maximal value when all J categories are equally represented ($P_1 = P_2 = \ldots = P_J = 1/J$), suggesting maximum diversity; and 4) remain invariant across all transformations that maintain the integrity of the J categories (Budescu and Budescu, 2012). The diversity index that Allen and Wolniak (2019) and Toutkoushian (2023) use satisfies all these desiderata, making their model suitable for measuring the variety diversity of college students ($J = 20$) and faculty ($J = 30$) alike.

Some researchers have asked, how much diversity is enough? Pointedly, Bowman (2013) explored and problematized this question. During the timeframe of data collection (2012–2022), United States (U.S.) Supreme Court rulings in *Grutter* and *Gratz* set the tone that institutions should strive for a ‘‘critical mass’’ of underrepresented racial minority (URM) students to allow all students to engage in cross-racial interactions, setting up the notion of a minimum threshold. Accordingly, “if diversity interactions yield diminishing returns for promoting student growth (i.e., students who have moderately frequent and very frequent interactions across race tend to have similar outcomes)” (Bowman, 2013, p. 876), then U.S. higher education institutions would

logically stop diversifying at some point. Moreover, Bowman reported a positive curvilinear relationship between college diversity interactions and first-year student outcomes, meaning the two variables increase together up to a certain point. This finding means a diversity index that places a premium on maximal heterogeneity may run into problems with external validity or the generalizability of results across varying institutional contexts.

To account for some of this external validity concern, I included a number of predictor variables to assess differences across institutional type, specifically institutional control, single-gender institution status, and MSI status. Previous research on the link between faculty diversity characteristics and college student outcomes primarily examines public institutions (see Bowman & Denson, 2022; Cross & Carman, 2022; Fairlie et al., 2014; Llamas et al., 2021; Stout et al., 2018; Taylor et al., 2022), highlighting the need to investigate private institutions as well. Single-gender institutions, especially women's colleges, along with MSIs, inherently draw more faculty and students from underrepresented race and gender backgrounds. This demographic focus likely influences both diversity outcomes and student success in these settings.

Measuring Student Success

Concerns over the validity of measure apply to my outcome variables of student success as well. Part of this concern stems from the operational definitions of two-year retention rate and four- and six-year graduation rates provided by IPEDS (see NCES, 2024). Their definitions exclude all first-time, full-time freshmen who begin in the spring semester, part-time students, and students who transfer into the institution (Wade, 2019), or roughly 61 percent of students at four-year U.S. higher education institutions according to some estimates (Cook & Hartle, 2011; Glenn, 2010). Critics also note how the reporting requirements for retention and graduation rates prevent colleges and universities from counting students who transfer between institutions and

complete their undergraduate education elsewhere (Carey, 2004; Wade, 2019). The American Association of State Colleges and Universities (AASCU), which serves about 400 public comprehensive universities, acknowledges these claims but still maintains that these two measures serve as legitimate accountability indicators (AASCU, 2016).

Although groups like the AASCU have advocated for more work that centers retention and graduation rates, York et al. (2015) found that student success studies tend to use cumulative grade-point-average (GPA) as the main outcome variable, with degree completion rates making up the least used measurement of student success. This finding comports with Toutkoushian (2023) who claimed that diversity studies in higher education often examine openness to diversity, intellectual engagement, self-concept, and satisfaction rather than outcomes such as college retention and degree completion. To address this research gap, two-year retention, four-year and six-year graduation rates comprised the units of measurements for my study, but I excluded community colleges considering that current definitions of retention and graduation rates disadvantage those institutions especially (see Bailey et al., 2006).

Handling Missing Data

Due to my research design of my study, I experienced some degree of missingness in my data collecting, cleaning, and computing, which required addressing. Missing and omitted data poses an issue to all longitudinal analyses using IPEDS and other large-scale institutional data (Hearn & Rosinger, 2014). Scholars have developed and implemented many methods for dealing with this issue, including (but not limited to): listwise deletion, pairwise deletion, mean substitution, regression-based single imputation, multiple imputation (MI), and maximum likelihood (ML) estimation techniques.

The prevailing method for addressing missing data involves simply omitting cases with the missing data and analyzing the remaining dataset. Commonly referred to as complete case analysis or listwise deletion, researchers draw upon this method more than any other. To corroborate this claim, listwise deletion even serves as the default option in most statistical software packages (Kang, 2013), including SPSS. While listwise deletion removes all cases with missing data, pairwise deletion eliminates information only when the particular data-point needed to test a particular assumption is missing. This opting for pairwise deletion retains more information compared to listwise deletion because it utilizes all observed information, including cases with missing data. However, this approach introduces two issues: 1) the model parameters rely on distinct sets of data with varying statistics, such as sample size and standard errors; and 2) it may generate an intercorrelation matrix that lacks positive definiteness, potentially hindering subsequent analysis (Kang, 2013; Kim & Curry, 1977; Shi et al., 2020).

Mean substitution replaces missing data values for a variable with the mean value of that variable. However, it contributes no new information, merely inflating the sample size and leading to an underestimation of errors. Consequently, mean substitution lacks general acceptance in the field of statistics (Kang, 2013; Little et al., 2014; Enders, 2022). Building on mean substitution, regression-based single imputation supplants missing and omitted data with estimated values. Rather than discarding cases with missing values (like listwise or pairwise deletion), this method retains all cases by substituting the missing data with probable values estimated from other available information. Though this approach retains more data than other methods, regression-based single imputation offers no new information—much like mean substitution (Kang, 2013; Lipps & Kun, 2023).

Unlike traditional methods (e.g., listwise or pairwise deletion, mean substitution), modern approaches like MI and ML easily support valid inferences when the study design carefully addresses reasons for missing data (Little et al., 2014; Peugh & Enders, 2004; Yu, 2015). MI fills in estimates for missing data multiple times to capture the uncertainty in those estimates whereas ML uses each cases available data to compute maximum likelihood estimates, which is the value of the parameter that is most likely to have resulted in the observed data. Both methods assume data missing at random (MAR) or data missing completely at random (MCAR), meaning missing values do not correlate with an underlying variable (Little et al., 2014; Yu, 2015). The use of either technique under data missing not at random (MNAR), meaning data missingness is related to missing data itself, would be inappropriate. While Stout et al. (2018) and Cross and Carman (2022) simply removed missing cases through listwise deletion, I will more closely follow the methodology of Fairlie et al. (2014), Llamas et al. (2021), and Bowman and Denson (2022) who all executed some MI or ML technique to handle their missing data. This presumes, of course, that my data is MCAR or MAR, which I test in the next chapter. Analyzing highly similar data with an unbalanced sample due to missing data, Toutkoushian (2023) found no substantial change when only institutions with complete data for the period under study were considered, a finding that could possibly extend to this study and support the MCAR or MAR assumption.

Chapter Summary

For this chapter, I sought to spell out the methodological approach of the study. At the outset, I specified the QuantCrit paradigm that guided the study and described my positionality and connection to the research topic. Then, I discussed how I put the principles of QuantCrit

methodology into practice in my study through the phrasing of the research questions, collecting and analyzing of data, and centering of race and racism.

Moving on to the methods, I provided information on my dataset and my process for collecting, cleaning, and computing and the data. The dataset consists of institution-level panel data on public and private four-year institutions across the U.S. from academic year 2012-2013 to 2021-2022. Using formulas derived from the literature, I created variables for measuring faculty diversity, student diversity, and faculty discrimination. I pulled data for all study variables from secondary data sources.

To analyze the data, I took an iterative approach. Specifically, each subsequent model built upon the last, with additional variables added to the base model each time. For each model, I used MLM regression techniques to understand the impact of various predictors both between and within institutions. I ended the chapter by commenting on the limitations of the study, particularly in regard to defining diversity, measuring student success, and handling missing data. I gave context for each limitation, conjectured on possible validity issues the limitation presented for the study, and discussed my strategy of mitigating said limitation.

Chapter 4. Results

For this study, I aimed to qualify and quantify the relationship between faculty diversity and undergraduate student retention and graduation rates across various U.S. higher education contexts. I also sought to understand how student diversity moderates this relationship. In the previous chapter, I detailed the process of data collection and analysis consistent with paradigmatic foundations grounded in criticality. In this chapter, I present the results of my data analyses in response to the following research question:

- What is the relationship between faculty diversity characteristics and undergraduate student retention and graduation rates at U.S. higher education institutions?

For my first research hypothesis to this question, I predicted that faculty diversity would significantly relate to my outcome variables even after accounting for differences in student demographics and institutional characteristics. I also predicted that faculty diversity would interact with student diversity to significantly affect student outcomes for my second research hypothesis. The null hypotheses propositioned that I would find no significant main or interaction effects between any of the study variables. To test these hypotheses, I ran several linear mixed-effects models in SPSS. I offer the results of these models in this chapter

I start this chapter by overviewing descriptive statistics for all variables included in the study, detailing patterns and trends in the data. Next, I submit my model results, which I structured to iteratively add more explanatory variables to determine the effect of each on undergraduate student retention and graduation rates. Finally, I report on the robustness checks that I conducted to determine whether the main results were sensitive to issues such as student race and gender differences and changes over time. These checks helped to inform my missingness assumptions.

Descriptive Statistics

Data for this study came from IPEDS datasets located on the NCES website available for free public download without any licensing requirements. I pulled raw data in ASCII format and converted into SPSS data files using the SPSS syntax files, which are also available at the NCES website. I list and define the IPEDS variables used in this study in Tables 1 and 2. To lay out the descriptive statistics for these data, I first outline overall trends for all variables and then describe changes in undergraduate student retention and graduation rates and the two diversity index measures over time. I also include a correlation matrix to check for collinearity between the study variables.

Overall Trends

Table 6 contains descriptive statistics for the observed variables without any data transformation or mean centering. The average two-year retention rate was 75 percent and the overall average graduation rates were 39 percent (four-year) and 54 percent (six) for academic years 2012-2013 through 2021-2022. The range for each dependent variable was zero to 100 percent. I also measured the faculty and student diversity indexes on a possible zero to 100 percent scale. The average faculty diversity index across all time points and institutions was 86.17 percent with an observed range of 49.86 percent to 97.36 percent. The average student diversity index was 82.69 percent with an observed range of 0.00 percent to 97.89 percent. These statistics show that U.S. higher education institutions generally reported higher levels of faculty diversity than student diversity. As a further note, the standard deviation for the faculty diversity index was 4.87 percent while the standard deviation for the student diversity index was 11.69 percent. The larger standard deviation for the student diversity index means that observations for this variable were less tightly clustered around the mean than the faculty diversity indexes. This

finding suggests that faculty diversity indexes varied less over time and between institutions than student diversity indexes.

I measured the remaining four variables in Table 6 on categorical scales. Overwhelmingly, U.S. higher education institutions reported a faculty discrimination score of 0, making neither discriminatory nor anti-discriminatory hiring practices against Black women faculty with tenure a common practice. That said, discriminatory practices (-1) occurred more frequently than anti-discriminatory (1) hiring practices as evidenced by the mean value of -.02. Unlike faculty discrimination scores, private institution, single-gender institution, and MSI statuses varied only between institutions, not between repeated measures. Private not-for-profit, four-year or above institutions (1) represented approximately two-thirds of the population (μ = 0.67) while public, four-year or above institutions made up the remaining one-third (0). Single-gender institutions (1) constituted a minority of institutions (μ = 0.02) as compared to co-educational institutions (0). As with single-gender institutions, MSIs (1) also only accounted for a small percentage of all institutions in the study (μ = 0.02), with all non-MSIs coded as 0.

Table 6

Descriptive Statistics for Variables in the Study—2012-2022

Variable	μ	σ	Min.	Max.	*N*
Dependent variables					
Retention rate—2 years	75.22	13.54	0.00	100.00	16,140
Graduation rate—4 years	38.54	22.68	0.00	100.00	15,806
Graduation rate—6 years	53.84	20.21	0.00	100.00	15,806
Independent variables					
Faculty diversity index	86.17	4.87	49.86	97.36	11,117
Student diversity index	82.69	11.69	0.00	97.89	15,375
Faculty discrimination score	-0.02	0.17	-1	1	4,413
Private institution	0.67	0.47	0	1	16,770
Single-gender institution	0.02	0.14	0	1	16,770
Minority-serving institution	0.05	0.22	0	1	16,770

Note. Data are from the Integrated Postsecondary Education Data System for academic years 2012-2013 through 2021-2022. Sample includes four-year public and private not-for-profit institutions.

Table 7 presents data on retention and graduation rates by institutional characteristics for all institutions included in the dataset for each time point from academic year 2012-2013 to 2021-2022. The table demarcates by category for each of the level-2 predictors, specifically level of faculty discrimination and private, single-gender, and MSI status. The two-year retention rate, four-year graduation rate, and six-year graduation rate are provided for each category, along with their respective means ($\bar{x}$), standard deviations (s), and sample sizes (n). Notably, institutions classified as anti-discriminatory have a higher four-year graduation rate (48.92 percent) than those labeled discriminatory (39.59 percent), while private institutions exhibit a higher six-year graduation rate (55.84 percent) compared to public institutions (49.8 percent). Single-gender institutions report the highest four-year (54.5%) and six-year (63.9%) graduation rates overall. In contrast, MSIs show significantly lower graduation rates, with a six-year rate of 32.13% compared to 55.05% for non-MSIs. These findings highlight disparities in student retention and completion based on institutional characteristics.

Table 7

Retention and Graduation Rates by Institutional Characteristic—2012-2022

	Two-year retention rate			Four-year graduation rate			Six-year graduation rate		
Variable	$\bar{x}$	s	*n*	$\bar{x}$	s	*n*	$\bar{x}$	s	*n*
Discriminatory									
Anti (1)	75.83	10.77	12	48.92	19.54	12	61.58	16.84	12
No (0)	81.79	9.85	4,278	43.97	23.97	4,263	63.02	18.56	4,263
Yes (-1)	80.26	9.92	116	39.59	22.15	116	61.46	17.95	116
Private									
Yes (1)	75.27	14.79	10,763	43.57	23.48	10,507	55.84	21.2	10,507
No (0)	75.13	10.62	5,377	28.58	17.1	5,299	49.87	17.43	5,299

Single-Gender									
Yes (1)	78.48	11.39	330	54.5	20.75	324	63.9	16.38	324
No (1)	75.16	13.58	15,810	38.21	22.61	15,482	53.63	20.23	15,482
MSI									
Yes (1)	63.72	12.94	844	16.15	11.76	836	32.13	13.96	836
No (0)	75.86	13.29	15,296	39.79	22.5	14,970	55.05	19.82	14,970

Note. Data are from the Integrated Postsecondary Education Data System for academic years 2012-2013 through 2021-2022. Sample includes four-year public and private not-for-profit institutions.

Changes in Retention, Graduation, and Diversity

Table 8 shows the trend in average undergraduate student retention and graduation rates over the time period in this study. The average two-year retention rate varied between 74 percent and 76 percent and did not trend up or down over the time period. In contrast, the average four-year graduation rate increased from 36 percent to 41 percent and the average six-year graduation rates rose from 53 percent to 55 percent over the period from 2012 to 2022. These findings suggest that graduation rates may experience more sensitivity to time than retention rates, which I tested for through a robustness check and share later on in this chapter.

Table 8

Average Retention and Graduation Rates by Year

Year	Two-year retention rate (%)	Four-year graduation rate (%)	Six-year graduation rate (%)
2012-13	74.9	36.25	52.53
2013-14	75.83	36.7	52.65
2014-15	75.7	37.49	53.34
2015-16	75.6	37.61	53.53
2016-17	75.3	37.63	53.47
2017-18	75.02	38.24	53.57
2018-19	75.44	39.03	53.94
2019-20	75.5	39.83	54.57
2020-21	74.35	41.08	55.46
2021-22	74.62	41.34	55.19

Note. Data are from the Integrated Postsecondary Education Data System for academic years 2012-2013 through 2021-2022. Sample includes four-year public and private not-for-profit institutions.

In Table 9, I provide a similar look at the two diversity index measures and how they changed over time. As the table shows, faculty diversity averaged about three percentage points higher than student diversity for every year in the study. The two indexes also underwent nearly parallel growth from 2012 to 2022. The average faculty diversity index increased from 85 percent during the 2012-2013 academic year to 87 percent during the 2021-2022 academic year. Similarly, student diversity grew from 82 percent to 84 percent during the same timeframe.

Table 9

Average Diversity Indexes by Year

Year	Faculty diversity index	Student diversity index
2012-13	85.29	81.99
2013-14	85.17	81.47
2014-15	85.83	82.06
2015-16	85.62	82.26
2016-17	86.01	82.56
2017-18	86.34	82.96
2018-19	86.58	83.26
2019-20	86.83	83.2
2020-21	86.75	83.1
2021-22	86.88	83.61

Note. Data are from the Integrated Postsecondary Education Data System for academic years 2012-2013 through 2021-2022. Sample includes four-year public and private not-for-profit institutions. Diversity indexes show the percentage of possible diversity across race (Asian, Black, Latinx, White, All Other), gender (man, women), class level (first-year, continuing) for students, and tenure status (tenured, on-tenure track, not on tenure) for faculty. Index values

range from 0 (all students/faculty in one category) to 100 (students/faculty are evenly distributed among all categories).

As Tables 8 and 9 display, average four- and six-year graduation rates and the two diversity index measures shared analogous growth trajectories from 2012 to 2022, hinting at a possible relationship between the variables. Dissimilarly to graduation rates, retention rates exhibited no trends over time, which could suggest a weaker association between retention and the two diversity index measures. The models I explore next will provide greater insight into these observations.

Checking for Collinearity

Pearson's correlation coefficient (r) helps to check the collinearity of independent variables. Using two-tailed significance testing with pairwise deletion procedures, Table 10 shows the correlation analysis between all the independent variables used in this study.

Table 10

Pearson's Correlation Coefficients

Variable	Faculty Diversity	Student Diversity	Faculty Discrimination	Private	Single-Gender	Minority-Serving
Faculty	1	0.214***	0.068***	-0.316***	-0.034***	0.302***
Diversity	(11,117)	(10,722)	(4,413)	(11,117)	(11,117)	(11,117)
Student	0.214***	1	0.026+	-0.163***	-0.133***	-0.161***
Diversity	(10.722)	(15,375)	(4,271)	(15,375)	(15,375)	(15,375)
Faculty	0.068***	0.026+	1	0.047**	0.008	0.023
Discrimination	(4,413)	(4,271)	(4,413)	(4,413)	(4,413)	(4,413)
Private	-0.316***	-0.163***	0.047**	1	0.090***	-0.075***
	(11,117)	(15,375)	(4,413)	(16,770)	(16,770)	(16,770)
Single-Gender	-0.034***	-0.133***	0.008	0.090***	1	0.026***
	(11,117)	(15,375)	(4,413)	(16,770)	(16,770)	(16,770)
Minority-Serving	0.302***	-0.161***	0.023	-0.075***	0.026***	1
	(11,117)	(15,375)	(4,413)	(16,770)	16,770	(16,770)

Note. Data are from IPEDS for 4-year public and private not-for-profit, primarily baccalaureate or above institutions for academic years 2012-2013 to 2021-2022. IPEDS = Integrated Postsecondary

Education Data System. Diversity and discrimination variables were calculated for all full-time instructional staff and full-time undergraduate students. Values in the table represent the Pearson's correlation coefficients (r) and sample size (n).

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Faculty diversity showed low correlation with private institution status ($r = -0.316$, $p < 0.001$), followed by minority-serving institution status ($r = 0.302$, $p < 0.001$), student diversity ($r = 0.214$, $p < 0.001$), faculty discrimination ($r = 0.068$, $p < 0.001$), and single-gender institution status ($r = -0.034$, $p < 0.001$). Here the absolute value of Pearson correlation coefficient is less than 0.8 (Shrestha, 2020), suggesting little likelihood of collinearity between the variables. This low correlation reflected the relationship between all the independent variables in this study.

Model Summaries

For this study, I ran eight linear mixed-effects models. Model 1 affirmed my MLM approach to data structuring and analysis. Models 2 through 8 answered my research question about the relationship between faculty diversity and undergraduate student retention and graduation rates after accounting for student demographics and institutional characteristics, such as level of faculty discrimination, institutional control (i.e., private), single-institution status, and MSI status. I also explored any interactions between faculty diversity and student diversity in regard to institutional retention and graduation rates in Models 4, 5, 6, 7, and 8. I group-mean centered both the level-1 variables (i.e., faculty diversity, student diversity) and grand-mean centered all the level-2 predictor variables (i.e., faculty discrimination, private, single-gender institution, MSI). I also used ML estimation for handling missing data, which utilizes all available data under the MAR assumption. Since I performed multiple statistical tests simultaneously on a single data set, I reduced the likelihood of finding false positives by multiplying each *p* value by the number of tests conducted (i.e., three). In essence, I

implemented a Bonferroni correction on the *p*-values while keeping the significance thresholds stable at $p < 0.10$, $p < 0.05$, $p < 0.01$, and $p < 0.001$ (Armstrong, 2014). I concluded this section by putting the model summaries in conversation with my research and null hypotheses.

For all models, I report the information criteria (i.e., BIC value), estimates of fixed effects (i.e., parameter coefficient estimates), and coefficients of determination (i.e., $R^2_{Marginal}$ and $R^2_{Conditional}$). In line with Nakagawa and Schielzeth (2013), I calculate both $R^2_{Marginal}$ and $R^2_{Conditional}$ as follows:

$$R^2_{Marginal} = \frac{\sigma^2_{Fixed}}{\sigma^2_{Fixed} + \sigma^2_{Random} + \sigma^2_{Residual}}$$

$$R^2_{Conditional} = \frac{\sigma^2_{Fixed} + \sigma^2_{Random}}{\sigma^2_{Fixed} + \sigma^2_{Random} + \sigma^2_{Residual}}$$

Under this formulae, σ^2_{Fixed} represents the variance explained by fixed effects (i.e., model parameters), σ^2_{Random} accounts for variance due to random effects (i.e., grouping structure), and σ^2_{Fixed} makes up the residual (unexplained) variance. Since both formulas capture the residual variance and $R^2_{Conditional}$ specifically encapsulates the ICC, I do not explicitly denote either outside of model 1.

Model Summaries for Two-Year Retention Rates

As referenced in Table 6, two-year retention rates averaged around 75 percent across all time points, with a possible range of 0 to 100 percent. Table 11 shows a summary the eight models I ran for this outcome variable. To begin my analysis, I first ran a random-intercept model (i.e., Model 1), which contained no other predictor other than the intercept. I took the

estimates of covariance parameters for this model to calculate the ICC. To obtain these estimates, I used the following model expression:

Level-1:

$$Y_{rij} = \beta_{0rj} + \varepsilon_{rij}$$

Level-2:

$$\beta_{0rj} = \gamma_{00r} + U_{0rj}$$

ICC equals the estimate of intercept or U_{0rj} variance divided by the sum of U_{0rj} variance residual or ε_{rij} variance, so 127.69 / (127.69 + 60.26) = 0.679. This ICC value suggests that about 67.9 percent of the variance in retention rates is between institutions, which rests well above the 0.05 threshold. To check this number, I compared the calculated ICC value with the $R^2_{Conditional}$, which should match since $R^2_{Conditional}$ measures variation due to both fixed and random effects. Altogether, Model 1 proved that I could move forward with my MLM approach.

For Models 2 through 8, I increasingly added parameters, starting with my focal predictor (i.e., faculty diversity) and finishing with my institutional characteristic variables. In assessing the goodness of fit for these models, I relied on BIC value comparisons. Goodness of fit refers to how well a statistical model describes a given set of observations. Measures of goodness of fit tend to evaluate the difference between the observed data and the values predicted by the model. In the case of BIC, lower values would suggest that the model better fits the data. This approach also penalizes models for overfitting where a model too closely fits the observed data, making predicts of future observations unreliable. Model 8 boasted the best goodness of fit (BIC = 23321). Model 8 also accounted for a substantial portion of the variance in two-year retention rates, with the fixed effects explaining 12.9 percent of the variance ($R^2_{Marginal}$ = 0.129) and the combination of fixed and random effects explaining 94 percent of the variance in the outcome

variable ($R^2_{Conditional}$ = 0.940). Of note, private institution status appears to account for much of the variance in two-year retention rates as evidenced by the jump in $R^2_{Marginal}$ values from Model 5 ($R^2_{Marginal}$ = 0.001) to Model 6 ($R^2_{Marginal}$ = 0.099), equating to a 9.8 percentage point difference.

Under this model, only the intercept (F(1,668.383) = 43515.835, p < 0.001), student diversity (F(1,352.764) = 25.554, p < 0.001), institutional control (F(1,653.356) = 81.227, p < 0.001), and MSI status (F(1,693.225) = 33.116, p < 0.001) significantly contributed to the ability of the model to explain variations in two-year retention rates. Both MSI status (β = -10.518) and student diversity (β = -0.270) negatively related to the outcome, whereas institutional control (β = 6.439) positively associated with two-year retention rates. In other words, Model 8 suggests that a one percentage point increase in student diversity would predict a 0.270 decrease in two-year retention rates, after accounting for the other parameters in the model. The model could similarly predict 6.439 percent higher two-year rates for private institutions than public institutions when controlling for all other study variables. The faculty diversity (F(1,202.924) = 0.071, p = 1), faculty discrimination (F(1,3428.216) = 4.336, p = 0.111), and single-gender institution (F(1,634.229) = 1.688, p = .582) variables did not reach any of the significance thresholds for p, making estimates from these predictors possibly biased. I also observed no meaningful interaction effect between level of faculty diversity and student diversity (F(1,59.379) = 0.073, p = 1).

Table 11

Model Comparisons for Two-Year Retention Rates

Parameter	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	75.033***	76.818***	76.873***	76.868***	80.666***	82.255***	82.239***	82.089***
	(0.284)	(0.301)	(0.302)	(0.303)	(0.387)	(0.401)	(0.402)	(0.391)
Fa. Div.		-0.071+	-0.007	0.001	0.015	-0.015	-0.016	-0.014
		(0.033)	(0.033)	(0.033)	(0.052)	(0.053)	(0.053)	(0.053)
St. Div.			-0.272***	-0.275***	-0.250***	-0.271***	-0.271***	-0.270***

			(0.032)	(0.032)	(0.053)	(0.054)	(0.054)	(0.053)
Fa.-St. Div.				0.006	0.008	0.014	0.014	0.009
				(0.017)	(0.033)	(0.034)	(0.034)	(0.034)
Fa. Dis.					-0.628	-0.650	-0.651	-0.646
					(0.311)	(0.310)	(0.310)	(0.310)
Private						6.694***	6.599***	6.439***
						(0.723)	(0.729)	(0.714)
Sin.-Gen.							2.894	3.428
							(2.694)	(2.639)
MSI								-10.518***
								(1.828)
$R^2_{Marginal}$	0.000	0.000	0.002	0.002	0.001	0.099	0.100	0.129
$R^2_{Conditional}$	0.679	0.883	0.893	0.896	0.941	0.941	0.941	0.940
BIC	117,060	66,881	64,394	64,338	23,441	23,361	23,356	23,321
Sample size	16,140	11,062	10,697	10,697	4,268	4,268	4,268	4,268

Note. Data are from IPEDS for 4-year public and private not-for-profit, primarily baccalaureate or above institutions for academic years 2012-2013 to 2021-2022. IPEDS = Integrated Postsecondary Education Data System. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Diversity and discrimination variables were calculated for all full-time instructional staff and full-time undergraduate students. Values in the table represent the estimated coefficients (unstandardized β) and standard errors based on linear mixed-effects models.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Model Summaries for Four-Year Graduation Rates

Like with two-year retention rates, Table 6 shows that four-year graduation rates averaged around 38.54 percent across all time points, with a possible range of 0 to 100 percent. Unlike two-year retention rates, Table 8 shows that four-year graduation rates rose gradually over the course of the years under study. Table 12 layouts the outputs for the eight models I performed on this dependent variable. For Model 1, I extracted the estimates covariance parameters, which would constitute the random effects for the intercept only. Following the ICC formula again, I calculated 460.43 / (460.43 + 60.76) = 0.883. An ICC of 0.883 indicates that 88.3 percent of variability in four-year graduation rates is between institutions. This number

matched the computed $R^2_{Conditional}$ value, qualifying me to move forward with a MLM rather than a single-level regression for this outcome variable.

Repeating my procedures for analyzing two-year retention rates, I iteratively included additional parameters in each model, from just one independent variable in Model 2 to seven independent variables (i.e., six main effects, one interaction effect) in Model 8. To select the best fitting model, I leveraged the BIC values, choosing the model with the lowest value. Of note, I observed a slight increase in BIC values from Model 3 to Model 4, suggesting that the interaction term between faculty diversity and student diversity reduced the fitness of the model. That said, Model 8 still reported a much lower BIC value than any other model (BIC = 25575). . The fixed effects explained 40.5 percent of the variance in four-year graduation ($R^2_{Marginal}$ = 0.405). This means that factors identified as fixed, such as demographic variables, institutional characteristics, or other known predictors, explain nearly half of the differences in graduation outcomes across the population. The consideration of random effects provided a substantial increase in the explanatory power of the model ($R^2_{Conditional}$ = 0.987). The high $R^2_{Conditional}$ value indicates that very little variability in graduation rates remains unexplained once both fixed and random effects are incorporated into the model. This indicates a highly comprehensive model that encapsulates nearly all the key factors influencing four-year graduation rate outcomes. Following the same pattern as two-year retention rates, private institution status once again explained much of the variance in four-year graduation rates as evidenced by the surge in $R^2_{Marginal}$ values from Model 5 ($R^2_{Marginal}$ = 0.005) to Model 6 ($R^2_{Marginal}$ = 0.381), representing a 38.05 percentage point change.

For Model 8, all parameters held significance at one of the established thresholds, with the exception of the fixed effects for the interaction between faculty diversity and student

diversity ($F(1,181.336) = 0.701$, $p = 1$) and the single-gender institution status ($F(1,647.716) = 4.062$, $p = 0.132$). The faculty diversity ($F(1,317.085) = 63.621$, $p < 0.001$), student diversity ($F(1,420.735) = 61.490$, $p < 0.001$), faculty discrimination ($F(1,3086.820) = 8.652$, $p = 0.009$), private ($F(1,659.411) = 441.665$, $p < 0.001$), and MSI ($F(1,696.821) = 38.261$, $p < 0.001$) variables each meaningfully raised the predictive power of the model. Whereas faculty diversity ($\beta = 0.706$), student diversity ($\beta = 0.757$), and private institution status ($\beta = 29.670$) positively affected the outcome variable, level of faculty discrimination ($\beta = -1.063$) and MSI status ($\beta = -22.181$) negatively related to four-year graduation rates. These statistics demonstrate the effect of faculty diversity characteristics on four-year graduation rates as a one percentage point increase in faculty diversity would correspond to a 0.706 increase in the outcome variable, after controlling for all other fixed effects in the model.

I observed no interaction effect between faculty diversity and student diversity ($F(1,181.336) = 0.701$, $p = 1$), leaving any estimates from this variable potentially biased. In Model 4, faculty diversity and student diversity positively ($\beta = 0.048$) and significantly ($F(1,184.668) = 6.075$, $p = 0.045$) interacted when the model only included the intercept, faculty diversity, and student diversity as parameters, but the additional level-2 fixed effects in later models removed the explanatory of the interaction term.

Table 12

Model Comparisons for Four-Year Graduation Rates

Parameter	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	38.094***	41.397***	41.450***	41.403***	43.992***	51.134***	51.079***	50.719***
	(0.533)	(0.619)	(0.619)	(0.619)	(0.925)	(0.792)	(0.791)	(0.772)
Fa. Div.		0.653***	0.461***	0.462***	0.760***	0.700***	0.698***	0.706***
		(0.049)	(0.045)	(0.045)	(0.088)	(0.089)	(0.089)	(0.088)
St. Div.			0.539***	0.543***	0.774***	0.754***	0.755***	0.757***
			(0.048)	(0.048)	(0.097)	(0.097)	(0.097)	(0.097)
Fa.-St. Div.				0.048*	-0.044	-0.035	-0.034	-0.039
				(0.019)	(0.047)	(0.047)	(0.047)	(0.046)

Fa. Dis.					-1.041*	-1.068**	-1.068**	-1.063**
					(0.362)	(0.361)	(0.361)	(0.361)
Private						30.490***	30.178***	29.670***
						(1.437)	(1.447)	(1.412)
Sin.-Gen.							9.617	10.522
							(5.351)	(5.221)
MSI								-22.181***
								(3.586)
$R^2_{Marginal}$	0.000	0.003	0.004	0.004	0.005	0.381	0.384	0.405
$R^2_{Conditional}$	0.883	0.955	0.962	0.963	0.987	0.987	0.987	0.987
BIC	116,815	72,627	69,387	69,390	25,961	25,625	25,616	25,575
Sample size	15,806	10,995	10,634	10,634	4,254	4,254	4,254	4,254

Note. Data are from IPEDS for 4-year public and private not-for-profit, primarily baccalaureate or above institutions for academic years 2012-2013 to 2021-2022. IPEDS = Integrated Postsecondary Education Data System. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Diversity and discrimination variables were calculated for all full-time instructional staff and full-time undergraduate students. Values in the table represent the estimated coefficients (unstandardized β) and standard errors based on linear mixed-effects models.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Model Summaries for Six-Year Graduation Rates

According to Table 6, six-year graduation rates averaged around 53.84 percent during the years under study, with a possible range of 0 to 100 percent. As with four-year graduation rates, Table 8 demonstrates that six-year graduation also grew gradually over time. Table 13 exhibits the model results for the eight different regression analyses I ran on this dependent variable. As before, I started by collecting the estimates of covariance parameters from a random intercept-only model (i.e., Model 1). I calculated ICC as 354.65 / (354.65 + 65.8) = 0.844, meaning that 84.4 percent of variability in six-year graduation rates occur at level two of the data structure. Since the $R^2_{Conditional}$ value mirrored this number, I could then proceed with my MLM approach for examining six-year graduation from a hierarchical perspective.

In Models 2 through 8, I actively built the models step-by-step, adding parameters progressively based on insights from relevant literature. I started with the faculty diversity variable in Model 2 and continued to add new variables until Model 8, which contained a total of eight parameters. Among all the models, Model 8 best fit the six-year graduation rate data as evidenced by the lowest criterion for model selection (BIC = 24566). This low BIC value suggests that Model 8 most effectively balanced model complexity with explanatory power. Interestingly, BIC values increased rather than decreased (as expected) from Model 3 to Model 4, reflecting the same phenomenon I found with four-year graduation rates. This suggests that the interaction term between faculty diversity and student diversity lowered the overall fit of the model.

The independent variables collectively explained 27.0 percent of the variance in six-year graduation rates ($R^2_{Marginal} = 0.270$), showing that a substantial portion of the variation in graduation outcomes originated from the fixed effects in the model. The explanatory power of Model 8 increased dramatically with the addition of random effects. The random effects measure variability that arises from unobserved institutional differences not directly measured by the fixed effects. After accounting for these random effects, Model 8 could explain about 97.6 percent of the variation in six-year graduation ($R^2_{Conditional} = 0.976$), which captured nearly all remaining variance in six-year graduation rates for the institutions included in the study. As with two-year retention rates and four-year graduation rates, private institution status accounted for the most variability in six-year graduation rates, raising the $R^2_{Marginal}$ values from Model 5 ($R^2_{Marginal} = 0.003$) and Model 6 ($R^2_{Marginal} = 0.226$) by 22.3 percent.

For Model 8, only faculty discrimination ($F(1,3148.257) = 2.744$, $p = 0.294$) and single-gender institution status ($F(1,644.384) = 1.788$, $p = 0.546$) failed to achieve a minimum

significance of $p < 0.1$, meaning these cannot meaningfully add to the ability of the model to explain variability in six-year graduation rates. The faculty diversity ($F(1,282.997) = 59.936$, $p < 0.001$), student diversity ($F(1,353.430) = 22.860$, $p < 0.001$), the interaction between faculty diversity and student diversity ($F(1,187.177) = 4.741$, $p = 0.093$), private institution status ($F(1,661.924) = 213.775$, $p < 0.001$), and single-gender institution status ($F(1,696.068) = 59.837$, $p < 0.001$) variables all significantly improved the explanatory power of the model.

Although faculty diversity ($\beta = 0.568$), student diversity ($\beta = 0.394$), and private institution status ($\beta = 17.942$) positively correlated with the outcome variable, MSI status ($\beta = -24.039$) and the interaction term ($\beta = -0.089$) negatively related to six-year graduation rates. From these findings, I can conclude that faculty diversity characteristics had a real and beneficial effect on undergraduate student six-year graduation rates. Moreover, I observed a marginal effect of the interaction between student diversity and faculty diversity on the outcome variable. This finding implies that as faculty diversity and student diversity at a given institution increase, six-year graduation rates inversely decrease.

Table 13

Model Comparisons for Six-Year Graduation Rates

Parameter	M1	M2	M3	M4	M5	M6	M7	M8
Intercept	53.298***	56.989***	57.031***	57.007***	61.736***	66.068***	66.036***	65.686***
	(0.470)	(0.428)	(0.515)	(0.515)	(0.728)	(0.697)	(0.697)	(0.672)
Fa. Div.		0.428***	0.290***	0.298***	0.589***	0.563***	0.562***	0.568***
		(0.040)	(0.038)	(0.038)	(0.073)	(0.074)	(0.074)	(0.074)
St. Div.			0.285***	0.287***	0.399***	0.386***	0.386***	0.394***
			(0.041)	(0.014)	(0.083)	(0.083)	(0.083)	(0.082)
Fa.-St. Div.				0.014	-0.078	-0.085	-0.085	-0.089+
				(0.017)	(0.041)	(0.041)	(0.041)	(0.041)
Fa. Dis.					-0.509	-0.545	-0.544	-0.543
					(0.328)	(0.328)	(0.328)	(0.338)
Private						18.523***	18.345***	17.942***
						(1.266)	(1.277)	(1.412)
Sin.-Gen.							4.999	6.058
							(4.721)	(4.531)
MSI								-24.039***
								(3.108)

$R^2_{Marginal}$	0.000	0.002	0.002	0.002	0.003	0.226	0.228	0.270
$R^2_{Conditional}$	0.844	0.951	0.957	0.958	0.982	0.982	0.982	0.982
BIC	117524	69355	66599	66603	24817	24633	24627	24566
Sample size	15,806	10,995	10,634	10,634	4,254	4,254	4,254	4,254

Note. Fac. Div. = Faculty Diversity. Fac. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Values in the table represent the estimated coefficients (unstandardized β) and standard errors based on linear mixed-effects models.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Revisiting Hypotheses

Considering the results from Model 8 in Tables 11, 12, and 13, I partially reject the null hypothesis (H_{o1}) that faculty diversity characteristics do not significantly relate to undergraduate student retention and graduation rates at U.S. higher education institutions, after accounting for level of faculty discrimination and other institutional characteristics. Moreover, student diversity characteristics, institutional control, and MSI status each helped to explain variability in observed cases for all three outcome variables. Faculty diversity meaningfully related to both four- and six-year graduation rates, but not two-year retention rates. Level of faculty discrimination only held significance for four-year graduation rates, whereas single-gender institution status added no explanatory power to any of the models. From these results, I found much support for my first alternative hypothesis (H_{a1}) that the faculty diversity characteristics significantly related to institutional retention and graduation rates during the time period under study. This finding highlights the importance of student diversity, institutional control, and MSI status in shaping student success, while also spotlighting the selective influence of faculty diversity and faculty discrimination on graduation outcomes specifically.

As for my second set of hypotheses on the interaction effect between faculty diversity and student diversity, I fail to reject the null hypothesis (H_{o2}) that student diversity characteristics do not significantly moderate the effect of faculty diversity characteristics on undergraduate

student retention and graduation rates at U.S. higher education institutions. However, I reject this hypothesis for six-year graduation rates. As Table 13 shows, both faculty diversity and student diversity characteristics interacted to significantly ($F(1,187.177) = 4.741$, $p = 0.093$) and negatively ($\beta = 0.048$) affect six-year graduation rates. These observation partially affirm my second alternative hypothesis (H_{a2}) that student diversity levels do moderate the effect of faculty diversity on institutional retention and graduation rates. However, the fact that student diversity did not broadly moderate the relationship between faculty diversity and all outcome variables underscores the nuanced role of diversity interactions in shaping student success.

Robustness Checks

Due to missing data in IPEDS, not all institutions had complete data for every year in the sample. Missing data can skew study outcomes by introducing bias, since the information may not occur randomly and could systematically influence the variable of interest. This could reduce the statistical power of the analysis, leading to less accurate or reliable results. For this reason, I ran Little's (1988) MCAR test to determine if missing data in my dataset occurred randomly, meaning the missingness does not depend on either observed or unobserved variables. The test evaluates whether the pattern of missing data ignores the actual values of the variables. When the data are truly random, no systematic bias influences the results. The null hypothesis assumes the data follow the MCAR pattern, and a significant p-value reveals that the missingness does not occur completely at random. I rejected the null hypothesis ($\chi^2 = 3056.244$, df = 28, $p = 0.000$), making my data either MAR or MNAR.

Unlike with data MCAR, whether data are MAR or MNAR depends on understanding the underlying mechanism of the missingness. The key difference between MAR and MNAR lies in the relationship between the missingness and the data themselves. Data are considered

MAR if the probability of missing data is related to the observed data but not to the unobserved data. Data MNAR assumes that the probability of missing data depends on unobserved data not included in the dataset. I tested for the MAR assumption by assessing whether the main and interaction effects remained robust against various model variations and comparing missing data patterns to observed variables.

Robustness Check for Student Race and Gender

This robustness check examines the students included in the six-year graduation rate calculations. In addition to the overall institutional graduation rate, IPEDS breaks down graduation rates by both gender and race as well. Accordingly, I re-estimated Model 8 from Table 13 for six-year graduation rates by race and gender as shown in Table 14. The first column reports the results for all students as a point of comparison. I restricted the race-specific models in the second and third columns to Black and White students, respectively. Small cohort sizes in other racial groups at many institutions introduced substantial year-to-year variability in graduation rates, a methodological concern comparably cited by Toutkoushian (2023). For the last two columns, I provide the results for students categorized as either men (column 4) or women (column 5).

Overall, I observed similar patterns in the main and interaction effects among the students analyzed here. Six-year graduation rates significantly and positively related to faculty diversity, student diversity, and institutional control by race and gender. The negative connection between MSI status and aggregate six-year graduation rates appeared much weaker for Black students compared to White students and students from either gender category. All other study variables, including the interaction effect between faculty diversity and student diversity characteristics, faculty discrimination, and single-gender institution status, remained statistically

insignificant across race and gender groupings. Thus, I can conclude that my results did not vary based on differences in student demographics.

Table 14

Robustness Check for Student Race and Gender – Six-Year Graduation Rates

Parameter	(1) All	(2) Black	(3) White	(4) Men	(5) Women
Intercept	65.686***	57.337***	68.045***	62.720***	69.403***
	(0.672)	(0.800)	(0.659)	(0.717)	(0.647)
Fa. Div.	0.568***	0.564***	0.568***	0.480***	0.511***
	(0.074)	(0.133)	(0.096)	(0.087)	(0.076)
St. Div.	0.394***	0.580***	0.496***	0.387***	0.375***
	(0.082)	(0.134)	(0.091)	(0.098)	(0.084)
Fa.-St. Div.	-0.089+	0.149	-0.015	0.095	0.030
	(0.041)	(0.101)	(0.041)	(0.049)	(0.035)
Fa. Dis.	-0.543	-1.717	-0.522	-0.493	0.151
	(0.338)	(0.852)	(0.436)	(0.386)	(0.352)
Private	17.942***	18.492***	17.024***	18.553***	16.403***
	(1.412)	(1.458)	(1.205)	(1.283)	(1.183)
Sin.-Gen.	6.058	10.510	6.217	-11.185	3.147
	(4.531)	(5.377)	(4.483)	(8.217)	(4.387)
MSI	-24.039***	-12.247***	-24.963***	-24.373***	-21.595***
	(3.108)	(3.755)	(3.059)	(3.342)	(3.007)
Sample size	15,806	14,799	15,749	15,658	15,354
$R^2_{Marginal}$	0.270	0.192	0.263	0.259	0.248
$R^2_{Conditional}$	0.982	0.901	0.965	0.977	0.976

Note. Linear mixed-effects models are based on the same years and institutions as Table 13. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Values in the table represent the estimated coefficients and standard errors. Six-year graduation rates were disaggregated by race and gender, creating five measures for the dependent variable of six-year graduation rates. Column 1 = six-year graduation rate for all students. Column 2 = six-year graduation rate for

Black students. Column 3 = six-year graduation rate for White students. Column 4 = six-year graduation rate for men. Column 5 = six-year graduation rate for women.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Robustness to Time

Consistent results across years in panel data analyses can provide some evidence in favor of the data MAR rather than MNAR assumption. To test this assertion, I split the dataset into five subsets separated by year. The first column contains model results for all years, representing the point of reference for all other models. From there, I divided the dataset into two years blocks in chronological order, going from the 2012-2013 to 2013-2014 academic years in the second column to the 2020-2021 to 2021-2022 academic years in the sixth column. Adhering to this setup, Tables 15, 16, and 17 reveal the impact of time variations on the main and interaction effects for all three outcome variables. For all models, I employed the same parameters and conditions as those used in Model 8 of Tables 11, 12, and 13.

As Table 15, 16, and 17 show, time variations did little to affect model results for any of the outcome variables. Interestingly, faculty diversity characteristics negatively associated with two-year retention rates from the 2012-2013 to 2013-2014 academic year, but positively associated with this dependent variable from the 2020-2021 to 2021-2022 academic years. I observed a similar trend with four- and six-year graduation rates, where faculty diversity characteristics only showed a significant positive relationship with graduation outcomes in the later years of the study. Moreover, sample sizes and effect sizes as measured through the R^2 values remained constant for all outcome variables in every model, affirming my choice not to include time in the model parameters to maintain model parsimony. I can also likely conclude from these data trends that no major external shocks, policy changes, or other significant

(unobserved) occurrences dramatically altered the variable relationships under study, meaning that the observed variables likely capture the reasons for the missingness in the dataset.

Table 15

Robustness Check for Time – Two-Year Retention Rates

Parameter	(1) All	(2) Years 1-2	(3) Years 3-4	(4) Years 5-6	(5) Years 7-8	(6) Years 9-10
Intercept	82.089***	83.672***	84.298***	83.978***	82.853***	81.813***
	(0.391)	(0.597)	(0.527)	(0.484)	(0.471)	(0.511)
Fa. Div.	-0.014	-0.801***	-0.107	-0.052	-0.036	0.619***
	(0.053)	(0.230)	(0.163)	(0.146)	(0.217)	(0.167)
St. Div.	-0.270***	-0.171	0.456*	-0.659***	-0.447	-0.139
	(0.053)	(0.190)	(0.173)	(0.122)	(.243)	(0.142)
Fa.-St. Div.	0.009	-0.166	0.325*	-0.078	0.225	-0.108
	(0.034)	(0.084)	(0.112)	(0.125)	(0.124)	(0.072)
Fa. Dis.	-0.646	0.822	1.540	0.212	0.037	-1.598*
	(0.310)	(1.140)	(0.830)	(0.765)	(1.067)	(0.591)
Private	6.439***	8.428***	7.370***	8.108***	4.653***	7.388***
	(0.714)	(0.901)	(0.898)	(0.852)	(0.761)	(0.858)
Sin.-Gen.	3.428	1.556	3.242	1.178	1.915	3.298
	(2.639)	(3.004)	(3.239)	(3.049)	(2.889)	(2.996)
MSI	-10.518***	-10.050***	-11.833***	-10.000***	-10.956***	-7.501***
	(1.828)	(2.324)	(2.436)	(2.288)	(2.126)	(2.342)
Sample size	16,140	3,185	3,217	3,244	3,228	3,266
$R^2_{Marginal}$	0.129	0.197	0.162	0.191	0.104	0.149
$R^2_{Conditional}$	0.940	0.966	0.961	0.969	0.883	0.961

Note. Linear mixed-effects models are based on the same institutions as Table 11. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Values in the table represent the estimated coefficients and standard errors. Dependent variable disaggregated by academic years under study. Column 1 = all years. Column 2 = years 2012-13 and 2013-14 only. Column 3 = years 2014-15 and 2015-16 only. Column 4 = years 2016-17 and 2017-2018 only. Column 5 = years 2018-19 and 2019-20 only. Column 6 = years 2020-21 and 2021-2022 only.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 16

Robustness Check for Time – Four-Year Graduation Rates

Parameter	(1) All	(2) Years 1-2	(3) Years 3-4	(4) Years 5-6	(5) Years 7-8	(6) Years 9-10
Intercept	50.719***	50.907***	52.059***	52.370***	52.376***	53.392***
	(0.772)	(1.157)	(1.074)	(0.997)	(0.916)	(0.880)
Fa. Div.	0.706***	0.106	0.327	0.558*	0.534*	0.571**
	(0.088)	(0.317)	(0.182)	(0.193)	(0.207)	(0.192)
St. Div.	0.757***	-0.158	0.324	0.003	0.281	0.650***
	(0.097)	(0.263)	(0.196)	(0.162)	(0.228)	(0.159)
Fa.-St. Div.	-0.039	-0.112	0.037	-0.113	-0.283	-0.074
	(0.046)	(0.112)	(0.123)	(0.164)	(0.135)	(0.079)
Fa. Dis.	-1.063**	-1.276	-0.067	-0.508	-0.214	-1.105
	(0.361)	(1.452)	(0.905)	(1.008)	(0.853)	(0.633)
Private	29.670***	32.743***	32.341***	32.441***	28.836***	26.481***
	(1.412)	(1.895)	(1.857)	(1.754)	(1.608)	(1.541)
Sin.-Gen.	10.522	9.830	8.145	8.679	7.391	7.475
	(5.221)	(6.301)	(6.660)	(6.263)	(6.111)	(5.387)
MSI	-22.181***	-24.453***	-21.437***	-23.402	-21.334	-18.250***
	(3.586)	(4.862)	(5.011)	(4.688)	(4.452)	(4.207)
Sample size	15,806	3,104	3,136	3,175	3,172	3,219
$R^2_{Marginal}$	0.405	0.422	0.410	0.432	0.397	0.384
$R^2_{Conditional}$	0.987	0.992	0.993	0.991	0.990	0.990

Note. Linear mixed-effects models are based on the same institutions as Table 12. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Values in the table represent the estimated coefficients and standard errors. Dependent variable disaggregated by academic years under study. Column 1 = all years. Column 2 = years 2012-13 and 2013-14 only. Column 3 = years 2014-15 and 2015-16 only. Column 4 = years 2016-17 and 2017-2018 only. Column 5 = years 2018-19 and 2019-20 only. Column 6 = years 2020-21 and 2021-2022 only.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 17

Robustness Check for Time – Six-Year Graduation Rates

Parameter	(1) All	(2) Years 1-2	(3) Years 3-4	(4) Years 5-6	(5) Years 7-8	(6) Years 9-10
Intercept	65.686***	66.829***	67.501***	67.654***	67.440***	68.187***
	(0.672)	(1.005)	(0.932)	(0.878)	(0.785)	(0.750)
Fa. Div.	0.568***	0.087	0.262	0.396+	0.239	0.518*
	(0.074)	(0.259)	(0.177)	(0.172)	(0.193)	(0.200)
St. Div.	0.394***	-0.284	-0.184	0.028	0.359	0.409*
	(0.082)	(0.215)	(0.190)	(0.145)	(0.212)	(0.167)
Fa.-St. Div.	-0.089+	-0.024	-0.065	-0.044	-0.159	-0.144
	(0.041)	(0.091)	(0.119)	(0.147)	(0.125)	(0.083)
Fa. Dis.	-0.543	-1.045	-0.526	0.510	-1.264	0.031
	(0.338)	(1.178)	(0.880)	(0.901)	(0.801)	(0.675)
Private	17.942***	20.539***	19.755***	20.215***	17.452***	16.295***
	(1.412)	(1.660)	(1.610)	(1.545)	(1.373)	91.292)
Sin.-Gen.	6.058	5.569	4.164	4.501	3.651	5.078
	(4.531)	(5.518)	(5.777)	(5.517)	(5.215)	(4.515)
MSI	-24.039***	-24.186***	-23.281***	-25.669***	-21.585***	-19.031***
	(3.108)	(4.257)	(4.346)	(4.129)	(3.800)	(3.527)
Sample size	15,806	3,104	3,136	3,175	3,172	3,219
$R^2_{Marginal}$	0.270	0.290	0.275	0.299	0.266	0.271
$R^2_{Conditional}$	0.982	0.992	0.989	0.989	0.986	0.981

Note. Linear mixed-effects models are based on the same institutions as Table 13. Fa. Div. = Faculty Diversity. St. Div. = Student Diversity. Fa.-St. Div. = Interaction between Faculty Diversity and Student Diversity. Fa. Dis. = Faculty Discrimination. Sin.-Gen. = Single-Gender Institution. MSI = Minority-Serving Institution. Values in the table represent the estimated coefficients and standard errors. Dependent variable disaggregated by academic years under study. Column 1 = all years. Column 2 = years 2012-13 and 2013-14 only. Column 3 = years 2014-15 and 2015-16 only. Column 4 = years 2016-17 and 2017-2018 only. Column 5 = years 2018-19 and 2019-20 only. Column 6 = years 2020-21 and 2021-2022 only.

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Testing MAR Assumption

The probability of a data point missing under the MAR assumption depends on the observed data, but not on the missing data themselves. In other words, the likelihood of missing

data can arise from the observed data, while the missing data does not influence their own probability of absence. To confirm this assumption for my dataset, I used the cross tabulations command in SPSS. First, I created a binary indicator variable for each dependent variable to note whether the data are missing (1 for missing, 0 for not missing). Next, I performed a chi-square test using the three independent variables for which all cases have values, specifically institutional control, single-gender institution status, and MSI status. Table 18 lists the results of these tests. The data suggest a significant association between institutional control and the likelihood of missing data for two-year retention rates ($\chi^2 = 30.948$, df = 1, $p < 0.001$), four- and six-year graduation rates ($\chi^2 = 46.232$, df = 1, $p < 0.001$), with private institutions accounting for about 77 percent of all missingness. I observed similar trends for single-gender institution and MSI statuses, with coeducational institutions and non-MSIs accounting for nearly 100 percent of missingness across all three dependent variables. From these patterns, I can draw conclusions about missing behavior based on observed data, which corroborates my MAR assumption. This corroboration makes my use of default ML estimation in SPSS appropriate for handling missing cases.

Table 18

Chi-Square Test Results for Missingness

Dependent variable	Institutional control	Single-gender institution status	Minority-serving institution status
Two-year retention rate	30.948***	13.140***	23.050***
Four-year graduation rate	46.232***	9.597**	27.798***
Six-year graduation rate	46.232***	9.597**	27.798***

Note. Values in the table represent the Pearson chi-square value based on the cross tabulations function in SPSS. + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Chapter Summary

In this chapter, I presented the findings of my quantitative inquiry into the relationship between the structural diversity of full-time instructional faculty and undergraduate student retention and graduation rates across various U.S. higher education contexts. I started this chapter by tabling the descriptive statistics for all variables in the study, detailing patterns in the data over time, describing the types of institutions that populate the dataset, and determining the frequency distribution of the data within the dataset. The next section of the chapter delved into my statistical models where I presented interpretations of the output tables in relation to the study context. Then, I put these interpretations in conversation with the study hypotheses to either reject or fail to reject them. Finally, I conducted a number of robustness checks to determine the strength of the main results to variations in student demographics and time. I also account for the mechanism of missingness in the dataset using observed cases. The results of these checks corroborated my data MAR assumption, enabling the use of ML estimation techniques in my handling of missing data.

Generally speaking, student diversity characteristics, institutional control, and MSI status significantly contributed to explaining variability in all outcome measures. Single-gender institution status failed to meaningfully explain variability for any dependent variable. Despite a lack of significance, I still considered this institutional characteristic in my models since where a student attends college can and does affect their outcomes (Astin, 1993; Lennon & Day, 2012), but single-gender institution status may not in this case due to a small sample size. This finding can hold relevance for future research by prompting scholars to further investigate whether single-gender institution status influences student outcomes in larger or more diverse samples.

Level of faculty discrimination only exuded explanatory power for variability in four-year graduation rates, whereas faculty diversity related with both four- and six-year graduation rates. While I observed a negative interaction effect between level of faculty diversity and student diversity for six-year graduation rates, neither two-year retention nor four-year graduation rates recorded a significant interaction effect between the two diversity measures. I discuss the implications of these findings further in the next chapter where I situate them within the relevant literature.

Chapter 5. Discussion

In this study, I looked at the relationship between the structural diversity of faculty and undergraduate student two-year retention and four- and six-year graduation rates. To do this, I relied on a relatively unique way of measuring faculty diversity for the categorical factors of race, rank, and gender simultaneously. More specifically, I examined how this relationship varied across U.S. higher education contexts by including several institution-level predictor variables (e.g., institutional control, single-gender institution status). I also explored how student diversity interacts with faculty diversity at different levels to affect student success outcomes. Altogether, I aimed to determine whether increasing structural diversity at a given institution would impact their institutional retention and graduation rates, a quandary of the utmost importance to twenty-first century college and university decision-makers and higher education policymakers (Toutkoushian, 2023).

In the first chapter, I overviewed the topic, providing a glossary of key terms and accentuating the need for this research. In the second chapter, I interwove college impact research with intersectionality literature to craft a conceptual synthesis of the literature guiding the study. In the third chapter, I detailed my multilevel regression model design and paradigmatic approach rooted in criticality. In the fourth chapter, I presented the study findings, including descriptive statistics for each study variable, model summaries and comparisons, and checks for the robustness of the results.

In this chapter, I start by sharing a summary of the key findings from the study. Next, I discuss these findings in relation to relevant college impact research, intersectionality literature, and (finally) quantitative critical race theory (QuantCrit), highlighting emergent insights in

process. From there, I proffer recommendation for areas of future research. Lastly, I offer implications for policy and practice.

Summary of the Findings

In this section, I summarize the study findings in relation to my research question, which asks: What is the relationship between faculty diversity characteristics and undergraduate student retention and graduation rates at U.S. higher education institutions? Through this line of inquiry, I sought to understand (1) the main effect of faculty diversity on undergraduate student retention and graduation rates, (2) how student diversity moderates this effect, and (3) how these effects vary based on different student input and environmental contexts. I unpack these understandings in conversation with my data and relevant literature.

Faculty Diversity and Student Success

In response to Barbera et al. (2020) and Llamas et al. (2021), I developed this study to empirically explicate and establish the relationship between faculty diversity characteristics and undergraduate student retention and graduation rates, filling the lacuna that both sets of authors cite. After accounting for possible confounding factors such as student diversity and institutional characteristics, I found that greater levels of faculty diversity predicted higher four- and six-year graduation rates for all students, which echoes the findings of Stout et al. (2018), Llamas et al. (2021), Bowman and Denson (2022), and Cross and Carman (2022). That said, I observed no relationship between faculty diversity characteristics and two-year retention rates, straying from the conclusions of Fairlie et al. (2014). For further context, both faculty diversity levels and four- and six-year graduation rates gradually increased over time while two-years retention rates have more or less stagnated (see Matias et al., 2022; Toutkoushian, 2023), which can possibly help elucidate these data trends.

Faculty Diversity, Student Diversity, and Student Success

Like Toutkoushian (2023) and Webber and Ehrenberg (2010), I found a negative association between student diversity characteristics and two-year retention rates. However, level of student diversity positively related to four- and six-year graduation rates, supporting the claims of Fine and Handelsman (2010) about the benefit of diversity interactions across race, gender, and experience differences on college student outcomes. Surprisingly, I observed a significant interaction effect between student diversity and faculty diversity characteristics for six-year graduation rates only—and a negative one at that. A negative interaction between level of student diversity and faculty diversity means that when both variables reach high levels simultaneously, they reduce the expected increase in six-year graduation rates, or even relate to a decrease in the outcome. While greater student and faculty diversity may initially boost six-year graduation rates, their interaction shifts adversely at higher levels of both, leading to diminishing returns for the institution. Bowman (2013) reported a similar positive curvilinear relationship between college diversity interactions and first-year student outcomes, meaning the two variables increase together up to a certain point.

Faculty Diversity, Student Diversity, and Student Success by Context

My robustness checks show that the main results remained fairly strong and steady across various contexts. As for student demographic differences, I saw no race-based or gender-based difference in the effect of faculty diversity or student diversity for six-year graduation rates specifically, which deviates from the negative correlation that Cross and Carman (2022) found between White student graduation rates and campus diversity scores. The significance of the interaction effect did not carry across any race or gender grouping. Lastly, time variations marginally affected model results, with faculty diversity and student diversity characteristics

having a slightly stronger effect on the outcomes (more so, four- and six-year graduation rates than two-year retention rates) in the early 2020s than the early 2010s.

Discussion of the Findings in Relation to College Impact Research

To discuss the findings in relation to college impact research, I return to Astin's (1970, 1991, 1993) inputs-environment-outputs (I-E-O) model. Using the I-E-O model, college impact researchers can explain how a student's starting characteristics (inputs) interact with the college environment to influence their educational outcomes (outputs) like overall satisfaction and academic success. I organize my discussion of the findings around the three components of the model, specifically inputs, environment, and outputs.

Inputs

For student input characteristics, I looked at the distribution of students across race, gender, and class level categories to calculate a standardized diversity index variable for every institution at each time point in the study. Though my student diversity indexes significantly related with each outcome variable, I found that these indexes did not account for much of the variances in two-year retention, four- or six-year graduation rates among institutions. Marsh (2014) ran into a similar problem in a study that examined the relative importance of specific student and institutional characteristics on retention rates at U.S. higher education institutions. Specifically, Marsh reported that neither the percentage of Students of Color nor the percentage of women students in entering cohorts of students contributed much to predicting retention rates. Moreover, student diversity indexes negatively associated with two-year retention rates, but positively related to four- and six-year graduation rates. The small decreases in two-retention rates associated with student diversity reflect the findings of Toutkoushian (2023) who found a similar association between diversity indexes by race only and two-year retention rates.

However, Toutkoushian also established a negative connection between diversity indexes by race and four- and six-year graduation rates and no connection for diversity indexes by gender, which I did not.

In line with Llamas et al. (2021), I observed that a more diverse campus predicted higher graduation rates overall. Llamas et al. also documented a positive correlation between campus racial/ethnic composition and student-faculty racial/ethnic match, supplying evidence for a need to increase both student and faculty diversity to improve student outcomes. I discovered no such correlation (or interaction) between my faculty diversity and student diversity variables, but my models did not include campus racial climate survey data as a mediating variable. Altogether, student diversity characteristics added some value to the predictive power of the study models and lessened some of the effect of faculty diversity for all outcomes.

Environment

My study included five institutional characteristic variables for environment, namely faculty diversity, faculty discrimination, institutional control, single-gender institution status, and MSI status. Faculty diversity served as the focal predictor and accounted for a substantial portion of total variance (from both fixed and random effects) for all outcomes. In light of the experiences with gendered racism that Black women faculty face in academia (see Blackshear & Hollis, 2021; Gray & Brooks, 2021; Heilig et al., 2019; Njoku & Evans, 2022; Woody et al., 2000), I wanted to account for this reality while examining the relationship between faculty diversity characteristics and student success outcomes. Results showed that faculty discrimination only meaningfully added to my models for four-year graduation rates, revealing a negative relationship between degree of faculty discrimination and the outcome variable. In effect, that means colleges and universities generally reported lower four-year graduation rates

when Black women tenured faculty accounted for a larger share of all tenured faculty at a given institution, which somewhat substantiates the claims of Eagly (2016) about the limited effect of diversity alone on educational performance.

By far, institutional control as measured by private institution status explained the greatest amount variance due to fixed effects only for each outcome variable among all predictor variables. In a comparative study of 365 baccalaureate institutions, Astin et al. (1996) found that private institutions had the highest graduation rates, owing largely to the fact that private institutions tended to enroll better prepared students. Likewise, I included both the student diversity and institutional control variables to parse out this confluence, underscoring the true effect of faculty diversity on undergraduate student retention and graduation rates.

Given that single-gender institutions report higher graduation rates than their co-educational peer institutions (Lennon & Day, 2012), I expected the single-institution status variable to profoundly contribute to the explanatory power of my models. Instead, single-gender institution barely increased the amount explained variance for any model and left other model results virtually unchanged, with this trend partially stemming from the decline in the relevance of these institutions over time (cf., Kim & Alvarez, 1995; Rice & Hemmings, 1988). On the other end, MSI status as measured through historically Black college and university (HBCU) or tribal college and university (TCU) status markedly increased the amount of explained variance for all outcome variables without ostensibly altering other model results, an effect that Bowman and Denson (2022) also observed. That said, MSI status made the interaction effect between student diversity and faculty diversity significant for six-year graduation rates only, implying that MSIs may play a crucial role in understanding the effect of faculty-student diversity interactions on student educational outcomes.

Outputs

In accordance with the recommendation of Astin (1993) and Astin et al. (1997), I consider multiple measures of student success, specifically two-year retention, four- and six-year graduation rates. I could explain the greater amount of variance in graduation rates than retention rates through my models, mirroring the results of Toutkoushian (2023). Like Ehrenberg and Zhang (2005), Pike and Robbins (2020), and Shin and Milton (2004), I posit that both time-varying (i.e., faculty diversity, student diversity) and stable (i.e., faculty discrimination, institutional control, and MSI status) institutional characteristics affect undergraduate retention and graduation rates. Single-gender institution status as a stable institutional characteristic held no significance for any outcome measure after accounting for other time-varying and stable institutional characteristics.

Overall, results remained relatively robust to any model variations. Out of all the outcome measures, models for four-year graduation rates provided the strongest and most comprehensive results. Beyond that, study results corroborate the concerns of Astin (1997) and Marsh (2014) about comparing institutions that differ demonstrably without considering how student and institutional characteristics affect institutional outcomes. My findings also underscore the call from Nagaoka et al. (2023) to place more emphasis on both four- and six-year graduation rates rather than just on six-year graduation rates, especially since my study variables differentially affected both outcomes. By looking at both outcomes simultaneously, researchers can gain a more comprehensive understanding of how faculty diversity characteristics affect graduation rates. Nagaoka et al. also push for disaggregating graduation rates by race and gender, which I did through my robustness checks. By disaggregating, studies like my dissertation can help policymakers evaluate how well colleges serve students from

different backgrounds and determine which institutional characteristics matter most to which students.

Discussion of the Findings in Relation to Intersectionality Literature

In this section, I explore and extrapolate how my study findings connect with relevant intersectionality literature. First, I examine how the multiplicity of faculty identities shape student success outcomes. From there, I present a case for reconceptualizing faculty discrimination claims, particularly from Black women professors. Finally, I close with a look at how differing institutional contexts influence the effect of faculty diversity and faculty discrimination on undergraduate student retention and graduation rates.

Two Makes a Crossroad, Three Make a Scholar

Researchers have already shown that faculty race (e.g., Stout et al. 2018; Llamas et al., 2021), rank (e.g., Ehrenberg & Zhang, 2005; Sav, 2012), and gender (e.g., Robst et al., 1998; Ko, 2022) characteristics affect student success outcomes, separately. Some empirical evidence also exists that dually links faculty race and gender characteristics to the educational outcomes of college students (e.g., Price, 2010). The novelty of my study comes from the examination of faculty race, rank, and gender characteristics simultaneously in relation to institutional retention and graduation rates specifically.

As my results indicate, faculty diversity as measured by the distribution of faculty across race, rank, and gender groupings both positively and significantly relates to four- and six-year graduation rates, but not necessarily to two-year retention rates. This finding affirms the value of grouping faculty by race, rank, and gender beyond pre-determined ideations, which adheres to the guidelines of doing intersectionality as a regulative ideal (Gasdaglis & Madva, 2020). In this way, I can declare that faculty race, rank, and gender characteristics act in “mutually

constitutive" ways to influence student success outcomes (Shields, 2008, p. 301). Like Chesler and Young (2007), I found that the multiplicity of the socially-constructed identities of faculty manifest in unique ways to impact the college student experience. For this reason, scholars should continue to look at the effects of faculty race, rank, and gender characteristics on educational outcomes, but through multiplicative rather than additive models.

Believing Black Women Faculty

According to Cotter et al. (2003), Black women experience more intense workplace racism than other Women of Color, with this trend applying to higher education occupations as well. Indeed, both higher education and legal institutions disproportionally deny Black women faculty professorial positions (Gray & Brooks, 2021; Njoku & Evans, 2022), limit their chances of gaining tenure (Blackshear & Hollis, 2021; Woody et al., 2000), and dismiss their claims of discrimination more often than those of their peers from other race and gender groupings (De Leon & Rosette, 2022). To determine the effect of this discrimination of student outcomes, I constructed a categorical variable to test for (1) discriminatory, (2) anti-discriminatory, and (3) neither discriminatory nor anti-discriminatory hiring practices at the institutions included in this study. Based on my measure of discrimination against Black women faculty with tenure, which follows the conservative two standard deviations away precedence of U.S. courts (Browne, 1993; King & Wang, 2023), I found that the overwhelming majority of institutions engage in neither discriminatory nor anti-discriminatory hiring practices—at least, not in an overt fashion that would easily pass judicial review. That said, I also observed a significant relationship between faculty discrimination and four-year graduation rates specifically, which means that how U.S. higher education institutions treat their tenured, on-tenure track, and non-tenured Black women faculty matters to student success outcomes.

Though the Equal Employment Opportunity Commission (EEOC) acknowledged the presence of intersectional discrimination almost two decades ago, De Leon and Rosette (2022) note that "the EEOC has not offered guidance for how its own body or the courts should approach such cases, nor how plaintiffs might go about building these cases" (p. 805). This lack of guidance has created a significant gap in addressing the nuanced realities of intersectional discrimination, leaving plaintiffs with limited tools to navigate the complexities of these cases. As a result, Black women tenured faculty experiencing compounded forms of oppression—such as racism, rankism, and genderism—often face an uphill battle in proving their claims within a legal framework that prioritizes single-axis analyses. In response, college and university leaders can implement more equity audits whereby both internal and external auditors conduct regular assessments of faculty hiring and promotion processes to identify and address biases or inequities that disproportionately impact Black women and other marginalized faculty.

Context Matters

Discrimination does not occur in a vacuum. To that end, intersectionality provides a tool for examining how socially-constructed identities (e.g., race, rank, gender) interact with social hierarchies (e.g., racism, rankism, genderism) across varying structural, political and representational contexts (Crenshaw, 1991; Torres et al., 2009). I studied structural intersectionality specifically, seeking to understand how overlapping systems of racism, rankism, and genderism for Black women faculty intersect to affect institutional retention and graduation rates.

As for time contexts, faculty diversity seemed to have a more significant and larger effect on all outcomes in the more recent rather than later years under study, particularly around election years. The advent of the novel coronavirus and campus reactions to the murder of

George Floyd in 2020 could also have engendered this effect. In light of these events, the Association of American Colleges and Universities (AAC&U) conducted and released a national survey of campus stakeholders, which identified increasing faculty diversity as a strategic priority for U.S. higher education institutions during this time of unprecedented change (Finley, 2021). This survey showed a renewed emphasis by the more than 1,000 member institutions of the AAC&U to tackle racism on college campuses through efforts like investment in faculty diversification, evincing the need to think about context when doing intersectionality work.

Discussion of the Findings in Relation to QuantCrit

In this section, I frame my discussion of the findings around the five guiding principles of QuantCrit: (1) The centrality of racism; (2) numbers are not neutral; (3) categories are neither "natural" nor given; (4) data cannot "speak for itself": and (5) a social justice orientation (Gillborn et al., 2018). Using QuantCrit entails directly addressing enduring and current racist structures and critically evaluating one's role in these systems (Garcia et al., 2018), with the goal of transforming research practices to foster more racially aware, informed, and equitable methods (Castillo & Gillborn, 2022). I attempt to accomplish this goal in this section.

The Centrality of Racism

QuantCrit researchers work under the assumption that structural systems of oppression (e.g., racism, sexism) permeate throughout all facets of U.S. culture and society. These same systems work in both open and subtle ways to (re)produce performance gaps among students, particularly penalizing those who do not identify as White men. To avoid perpetuating and legitimatizing racial inequities among student populations, QuantCrit researchers must view and interpret their work from a critical race-conscious perspective.

To put this principle into practice, I employed a number of strategies to critically understand the meaning and place of race and racism in my work. First, I drafted a positionality statement to chronicle how my socially-constructed identities, lived experiences, and personal values coalesced to shape, inform, and bias my views on the relationship between faculty diversity and student success. Additionally, I tried to examine identities in a structural and intersectional way. As Castillo and Babb (2024) warn, "It is difficult to apply the QuantCrit principle of 'the centrality of racism', or said differently 'the centrality of Whiteness', without decentering Whiteness" (p. 10). I decentered Whiteness in my study by using effect coding for all race, rank, and gender groupings rather than reference coding scheme (see Mayhew & Simonoff, 2015). This approach also allowed me to examine faculty race, rank, and gender characteristics co-constitutively rather than individually.

Numbers are not Neutral

Unlike general quantitative researchers, QuantCrit researchers must strive to gather and analyze data in ways that do not privilege the interests, perspective, and assumptions of White elites. Accordingly, numbers in QuantCrit studies should hold no more or less objectivity than data collected through other means, which dispels the myth of neutrality that numbers hold. Policymakers place a heavy premium on numbers, especially numbers that regard Eurocentric and White supremacist ideals as the norm (Gillborn et al., 2018; Castillo & Babb, 2024). For this reason, QuantCrit researchers should present their findings in ways that adequately address the biases introduced throughout their data collection and analysis procedures.

For my study, bias could have manifested in a few ways. First, I made a conscious choice to calculate faculty diversity in a way that gives every race, rank, and gender grouping equal standing. Put differently, I argued that an institution achieved maximum diversity by simply

ensuring an equal distribution of individuals across all observable categories of difference, which does not account for institutions where decision-makers deliberately want more skewed distributions for differing equity and inclusion goals. I also ran into a multiple comparisons problem. Specifically, I performed several statistical inferences on the same dataset, which increases the likelihood of returning erroneous inferences (i.e., false *p*-values). To compensate for this concern, I imposed a stricter significance threshold through a Bonferroni correction whereby I multiplied the calculated *p*-values by the number of comparisons I made (i.e., three). This approach, however, raise the risk of Type II errors (false negatives), meaning that the true effects of some of my parameters could go unnoticed due to the high bar for significance (Armstrong, 2014).

Categories are Neither "Natural" Nor Given

In QuantCrit, categories are arbitrary. The researcher creates them. Against the recommendation of Castillo and Babb (2024), I created an "Other" category to encompass faculty and students who identified racially as either American Indian or Alaskan Native, Native Hawaiian or Pacific Islander, or multiracial. Faculty and students from these racial categories constituted small and seemingly insignificant percentages of the whole campus. Rather than contribute to their continued erasure in research, I created a composite variable for all these students and faculty. Due to lack of a better word, I referred to all individuals in these categories as all-other races, which demonstrates the capricious nature of categorizing based on socially constructed identities. To offer another example, I chose to only focus on Black women faculty with tenure for my discrimination variable, stemming primarily from my grounding in critical Black feminist thought. A QuantCrit scholar rooted in the LatCrit tradition could just have easily focused on Latina professors with tenure. The point rests on my choices as the researcher, based

on my positionality, to categorize people in a particular manner. This qualifies as neither good nor bad but warrants acknowledgement.

Although categories do not form naturally, I considered intersecting identities to create more accurately defined categories that tell fuller stories of the data. As Castillo and Babb (2024) observed, "more granular categories can help study authors begin to understand, albeit with the limitations of quantification, the nuances and inequities between and within racial/ethnic categories" (p. 17). Moreover, I aimed to determine the effects of faculty race, rank, and gender characteristics on student outcomes as a whole, supporting my decision not to disaggregate results by the same intersecting categories. I only separated by race and gender to check the robustness of my results, not disparities in outcomes.

Data Cannot "Speak for Itself"

When researchers share data or findings without clearly indicating a viewpoint, readers tend to interpret this information through the prevailing perspective. This often results in interpretations that reflect racist or sexist biases, which in turn reinforce negative stereotypes about marginalized groups (Gillborn et al., 2018; Castillo & Gillborn, 2023; Castillo & Babb, 2024). In many cases, data without a voice speak for White racial interests. QuantCrit researchers can give data a voice, grounding their analyses in the experiences and insights of the communities directly impacted by their work (Lawrence, 1993). I did this by having the perspectives and understandings of prominent intersectionality and QuantCrit scholars inform my research process (e.g., Crenshaw, 1989, 1991; Garcia et al., 2018; Harris & Patton, 2019), drawing upon literature from a diverse set of scholars to develop my framework.

Pursuant to the recommendation of these scholars (specifically, Garcia et al., 2018), I want to emphasize that the race, rank, and gender variables used in this study represent social

constructs, not biological determinants. I also want to note the quantitative relationships shown in this study are associative, not causal. Much like the QuantCrit researchers before me, I do not intend to mask inequities by controlling away racism, rankism, or genderism (Castillo & Gillborn, 2023; Castillo & Babb, 2024). Instead, I attribute the results to these systems of oppression rather than to race, rank, and gender as socially-constructed identities.

A Social Justice Orientation

QuantCrit researchers promote social justice by engaging in academic work that actively disrupts inequitable narratives embedded in traditional statistical analysis. To actualize this social justice imperative, QuantCrit researchers (1) collect and analyze data from a critical perspective, (2) collaborate with marginalized communities whether through readings or conversations, and (3) position their research findings as a catalyst for equitable policies and social change (Garcia et al., 2018; Gillborn et al., 2018). The social justice orientation principle of QuantCrit ties together the other four principles into the overarching objective of both critical race theory (CRT) generally and intersectionality specifically, which is to end all forms of oppression (Lawrence, 1993; Crenshaw, 2011: Castillo & Babb, 2024).

As Bell (1992), Delgado and Stefancic (2001), and Gillborn et al. (2018) all promulgate, progress toward social justice for minoritized groups only occurs when their interests align with those of the majority through a process known as interest convergence. Through this study, I attempt to achieve interest convergence by empirically linking increases in faculty diversity with improved educational outcomes for all students. Along these lines, policy change at the institutional or governmental level requires a compelling reason, not just persuasiveness (cf., Caruth & Caruth, 2013). My findings give this compelling reason, showing that faculty diversity positively relates to both four- and six-year graduation rates. U.S. higher education leaders and

policymakers lean on graduation rates as a measure of institutional effectiveness in supporting student success and program quality. Strong graduation rates also boost the reputation of the institution, helping to attract new students and secure essential funding (Shin & Milton, 2004). These benefits demonstrate the convergence between the graduation goals of colleges and universities and the social justice goals of intersectionality, CRT, and QuantCrit, which ultimately amplifies the achievability of both sets of goals.

Areas for Future Research

While this study advances several implications for U.S. higher education policy and practice, I offer three recommendations for further research. First, future researchers might consider the use of interaction terms to measure the effects of intersecting identity markers on the educational outcomes of college students. Interaction terms, or "interaction variables," result from multiplying two or more independent variables rather than looking at these variables separately. For example, I might multiple a Black race variable by a male sex variable to identify Black men in a study. For my diversity indexes, I computed composite variables, not interaction variables. To test the replicability of my results, I suggest that future researchers follow the Toutkoushian (2023) approach of creating a unique diversity index variable for each identity under investigation, which means creating a different diversity index for race, rank, and gender for this study. From there, I propose developing a three-way interaction term between these indexes, which could generate results that differ from my composite variable. Both Castillo and Gillborn (2023) and Castillo and Babb (2024) also recommend the use of interaction terms as an innovative method to capturing the effects of multiple identities.

Second, I advocate for more research that draws from both the qualitative and quantitative research traditions to better study the exact nature of the relationship between the

structural diversity of faculty and the retention and graduation rates of students. As Bowman and Denson (2022) caution, "the use of institution-level data on racial representation inherently provides a rough proxy for the visual cues that any individual student actually receives" (p. 412). Consequently, I can only claim so much about the effects of faculty race, rank, and gender characteristics on the college student experience through quantitative methods alone. I can answer *what* and to some degree *how* questions, but not necessarily *why*. Qualitative methods, such as case studies, interviews, and focus groups may help future researchers gain a greater understanding of how diversity interactions with faculty shape student experiences.

Lastly, additional studies are needed to clarify how international faculty with U.S. employment visas impact the relationship between faculty diversity and student success. Out of all the researchers I cited on this topic (see Fairlie et al., 2014; Stout et al., 2018; Llamas et al., 2021; Bowman & Denson, 2022; Cross & Carman, 2022; Taylor et al., 2022), only Bowman and Denson explicitly included international faculty in their calculation of faculty diversity. In IPEDS data, international faculty constitute a distinct response option within race/ethnicity, making the racial identity of these faculty an unknown quantity. Like many of the aforementioned researchers, I excluded these faculty due to this uncertainty about their racial identity, including them could have significantly altered the results of my study. Future researchers should think critically about how to incorporate international faculty into their research as to not contribute to their continued erasure in the research.

Implications

This study has implications for U.S. higher education faculty, administrators, and policymakers. Though some colleges and universities continue to face criticism for maintaining predominantly homogeneous faculty rosters (Bitar et al., 2022), U.S. higher education as a sector

has generally made strides toward diversifying the U.S. professoriate and fostering inclusive campus environments (see Matias et al., 2022; Smith et al. 2012; Trejo, 2017). The study findings affirm this progress but challenge institutional decision-makers to do more to answer the calls of scholars like Antonio (2000), Cardell et al. (2020), Fox Tree and Vaid (2022), and Griffin (2020) to achieve greater faculty diversity both in the hiring and retention of White women faculty, men Faculty of Color, and women Faculty of Color.

To achieve greater diversity in faculty hiring, higher education leaders can ensure current hiring and recruitment practices align with the diversity, equity, inclusion, and justice goals of the institution. In practice, faculty hiring committees could put all committee members through implicit bias training, ensure all committees contain faculty members from minoritized backgrounds who have an equal vote in the process, and ask applicants to submit a diversity statement. Additionally, institutional decision-makers might consider establishing accountability measures to track progress and set strategic goals—e.g., Brown University boldly announced a 10-year plan to double the proportion of underrepresented minority faculty to 18 percent by 2025 (see Llamas et al., 2021). Such efforts not only diversify faculty representation but also enrich campus culture and enhance educational outcomes for all students.

As for attaining greater faculty diversity in retention, higher education executives can do more to recognize the added workload demands of minoritized faculty members, particularly Faculty of Color. Both Crisp and Cruz (2009) and Kuh and Hu (2001) demonstrate that increased faculty interaction typically benefits most students most of time. Moreover, Tierney and Bensimon (1996) report that Faculty of Color allocate more time and resources to these interactions than their White colleagues, with this pattern holding especially true for Women Faculty of Color (Fox Tree & Vaid, 2022). However, tenure and advancement processes do not

tend to reward these faculty for this additional (often emotional) labor. To rectify this injustice, I show that faculty diversity matters and can make a difference in whether and when a student graduates. Though faculty diversity by race, rank, and gender individually matters findings from this study suggest that these three identities intersect and positively impact student success outcomes. For this reason, institutional stakeholders should make efforts to ensure greater faculty diversity by race and gender at all faculty ranks, which means properly recognizing Faculty of Color (particularly, Women Faculty of Color) for their work in promotion and tenure decisions.

Finally, results reinforce the concerns raised by Chang (1999, 2005), Llamas et al., (2021) Smith (1997), and Toutkoushian (2023) who argued that simply having a diverse student and faculty body does not necessarily ensure that students will benefit as a result. Evidently, four-year graduation rates decrease as both student diversity and faculty diversity levels increase. This result suggests a need to work on raising diversity in student admissions and faculty hiring while also supporting and retaining students and faculty once they come to campus. In essence, access and diversity should not come at the expense of equity and inclusion. By focusing on both sets of goals concurrently, institutional decision-makers can create more representative and supportive environments where students see themselves reflected in their instructors, thereby increasing four- and six-graduation rates along the way.

Conclusion

Through this study, I show that faculty diversity matters, particularly in regard to college student outcomes. Specifically, I found that the even distribution of faculty across race, rank, and gender groupings positively associates with undergraduate student four- and six-year graduation rates, even after accounting for between-group differences in degree of discrimination against Black women faculty, institutional control, and single-gender institution and MSI statuses. That

said, I found no significant relationship between level of faculty diversity and the likelihood that first-year college students return for their second year (i.e., two-year retention rate). Findings confirm that diverse faculty bodies enhance inclusivity and promote degree completion but fail to affect two-year retention rates, suggesting that other factors beyond faculty demographics more meaningfully affect early retention. These conclusions call upon college and university leaders to expand faculty diversity initiatives while also addressing additional retention drivers to support students throughout their educational journeys.

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