Academic Profiles of Students in a College of Agriculture

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Abstract

This paper establishes a clearer picture of the demographics of a single cohort of undergraduate students that entered North Carolina State University's College of Agriculture and Life Sciences (CALS) in the fall semester of 2013. We compared the demographics of the cohort with the overall population of North Carolina to determine how well the student population at CALS represents the state it serves. We found that female students, White students, and students from economically developed counties were over-represented in the cohort as compared to the general population of the state. Using descriptive statistics, we created academic profiles for student groups of interest. The comparisons we made between groups show evidence that male, Latinx, out-of-state, and nontraditional students have mean graduation rates which are troublingly low. This research can help to guide efforts at these institutions to more effectively develop resources to continue to facilitate success for student groups who are thriving and to better support those who are experiencing hardship.

Keywords: academic profile, ethnicity, nontraditional, out-of-state, success

Colleges of Agriculture (COAs) have an outsized role to play in the future of the United States and the world at large. Cascading challenges face our society as we seek to "feed the world" without bringing the life sustaining systems of the Earth to a breaking point. A major determining factor in our ability to meet these fundamental challenges will be our degree of success in producing a new generation of well-trained graduates in the fields of agriculture, food, and natural resources (AFNR). The fate of the planet, our society, and economy rests in no small part on the shoulders of the current and future enrollees in our nation's COAs.

The success of these students is therefore a matter of the utmost importance. Recruitment, admissions, advisory and teaching faculty and staff at these institutions are charged with a heavy responsibility. As the challenges we face as a society evolve, COAs will have to adapt to address them. The student demographics that these institutions

serve are likely to continue changing as well. Gaining an intimate understanding of who is being trained in COAs and what they need to be successful should be a top priority to all involved in AFNR education at the post-secondary level.

Student Demographics

Over the past few decades COAs have undergone major changes in the student population that they serve (Archibeque-Engle and Gloeckner, 2016; Buchanan, 2008; Martin and Wesolowski, 2018; Nokes and Gustafson, 1994; Peffer, 2011; Setterbo et al., 2017). Faculty and staff at COAs need to understand student demographics better in order to create an environment that is conducive to the growth and achievement of students from many different backgrounds. COAs at 1862 Land Grant universities have historically catered to a student body that was White, male, and from a farm setting (George, 1978). However, many reports document a more recent influx of female students from urban or sub-urban backgrounds with a strong interest in animal and veterinary science (Buchanan, 2008; Dyer et al. 1999; Geocker, 1982; Peffer, 2010). Scholars have noted that in many cases these female students from suburban or urban backgrounds are high achievers academically (Lancaster and Robinson, 2011; McMillan et al., 2009; Soberon et al., 2012), yet they also face challenges with being accepted by their peers from a more traditional agricultural background and may be more inclined to transfer out of the COA in favor of a major housed in another college (Martin and Wesolowski, 2018; Nokes and Gustafson, 1994; Setterbo et al., 2017).

In addition to recruiting and retaining female students from urban and sub-urban backgrounds, many authors note that the future viability of COA programs will depend on attracting a much larger number of students from minoritized racial and ethnic groups (Archibeque-Engle and Gloeckner, 2016; Foreman et al., 2018; Powell, 2017). This assumption is largely premised on the changing demographics of the undergraduate population overall, which is projected to become significantly less White in the years to come (Foreman et al., 2018; Hoover, 2013; Nuñez, and Murakami-Ramalho, 2012). However, according to Archibeque-Engle and Gloeckner (2016), the College of Agriculture Science at Colorado State University actually became less representative of the racial and ethnic diversity of Colorado between 1990 and 2010. The authors also found that White non-Hispanic students were 1.78 times more likely to graduate in four years as compared to minoritized students (Archibeque-Engle and Gloeckner, 2016).

Opportunity gaps have been identified by authors across many student demographic groups in addition to those associated with gender, race, and ethnicity (Archibeque-Engle and Gloeckner, 2016; Burk et al., 2013; Byun et al., 2012; Terenzini and Pascarella, 2005). Scholars have identified rural students (Byun et al., 2012; Corley et al., 1991), Pell Grant recipient students (Archibeque-Engle and Gloeckner, 2016, Schudde and Scott-Clayton, 2016), transfer students (Archibeque-Engle and Gloeckner, 2016; Terenzini and Pascarella, 2005), out-of-state students (Murtaugh et al., 1999), first-generation students (Archibeque-Engle and Gloeckner, 2016; Stephens et al. 2012; Terenzini and Pascarella, 2005) and nontraditional students (e.g., undergraduates who are 25 years old or above) (Burk et al., 2013; Murtaugh et al., 1999; Lancaster and Robinson, 2011; Goings, 2016) as being at elevated risk for experiencing hardship. In their comprehensive study, Archibeque-Engle and Gloeckner (2016) argue that many of these opportunity gaps have remained consistent for decades, and, in order to close them, COA faculty and staff need to carefully track performance among higher risk groups and set growth goals for improvement.

To predict the level of success students are likely to attain in college, many indicators have been tested by scholars. High school GPA (HSGPA) has been touted as one of the most useful factors in assessing the likelihood that students will be successful in college (Burk et al., 2013; Zwick and Himelfarb, 2011; Geiser and Santelices, 2007; Garton et al., 2002). While some perceive HSGPA as an inconsistent metric granted the variations in curricula and quality of instruction between the nation's high schools, empirical evidence suggests that it is a highly dependable indicator of performance in college (Allensworth and Clark, 2020; Geiser and Santelices, 2007; Zwick and Himelfarb, 2011). In a study of 17,753 students who graduated from Chicago public schools between 2006 and 2009, Allensworth and Clark (2020) found that HSGPA had a larger effect on graduation than the high school the student attended or standardized tests score (ACT).

The value of SAT and ACT standardized tests as admissions criteria is considered controversial by many (Geiser and Santelices 2007; Zwick and Himelfarb, 2011; Maruyama, 2012). Scholars note that performance on standardized tests is strongly correlated with student socioeconomic status (SES) (Geiser and Santelices 2007; Zwick and Himelfarb, 2011). When used in admissions decision making, standardized tests exacerbate inequities (Geiser and Santelices 2007; Zwick and Himelfarb, 2011). According to Geiser and Santelices (2007) "Rank-ordering students by test scores produces much sharper racial/ethnic stratification than when the same students are ranked by HSGPA" (p.2). However, there is evidence that standardized test scores may include information that adds to the explanatory power of statistical modeling. Garton et al. (2002) found that a combination of HSGPA and ACT explained a greater proportion of the variance in first year GPA for freshmen in the College of Agriculture, Food, and Natural Resources at the University of Missouri, than other combinations of available predictors such as learning style and high school class rank. Similarly, Zahner et al. (2012) found the inclusion of SAT along with HSGPA increased the amount of variance that was accounted for in modeling that was used to predict the GPA of college sophomores. These studies suggest that, where available, standardized testing data may have value as a diagnostic tool, if not as a criterion for admissions decision-making.

Some scholars have found that first term (FTGPA) and freshman year GPA (FYGPA) are also valuable indicators of success (Barkley and Forst, 2004; Gayles, 2012; Gershenfeld et al., 2016). Barkley and Forst (2004) found that standardized test results were useful in predicting FTGPA, but FTGPA was more useful in predicting grades for the second academic term. As the authors put it "the college record, once it

becomes available at the end of the first semester, becomes paramount in explaining grades in subsequent semesters" (Barkley and Forst, 2004, p. 440). Tracking FTGPA has the added benefit of giving an early indication of student performance at the collegiate level, meaning that faculty and staff can intervene early for students who show signs of distress. According to Gershenfeld et al. (2016) FTGPA was a statistically significant factor in predicting whether under-represented students would graduate within six years from a public university in the mid-west.

Scholars of higher education are in universal agreement that facilitating on-time graduation, especially for groups from under-represented and low-access backgrounds, has a huge impact on their future life chances (Turner and Thompson, 2014; Tinto, 1993). The need for qualified graduates to fill positions in AFNR fields is also a matter of great importance to the health of our economy and world (Alston et al., 2019; Goecker, 1982).

Theoretical Framework

This study uses Vincent Tinto's Interactionalist Theory of Student Departure (1975). Many authors have noted that the relatively high rate of attrition among students who enter four-year colleges is an urgent matter that has adverse effects for students, universities and society at large (Turner and Thompson, 2014; Tinto, 1993). Concern around this phenomenon led Tinto (1975) to posit his seminal theory: that an undergraduate's level of success in becoming integrated into the social and academic systems of their school depends on student characteristics including "family background, individual attributes, and pre-college schooling" (1975). According to the author, student success, and therefore retention, depends on successful integration into the university environment. In other words, students who attain a high degree of integration in the social and academic environment of college will remain in college. In this paper we seek to draw a detailed demographic profile of the students in the target cohort which will help us to gain a better understanding of the student characteristics that impact success or hardship.

Methods

In order to characterize the target cohort of students for this study, information from each student's applications and transcripts was drawn from North Carolina State University's Enrollment Services and Management Office. The data analysis was conducted with the approval of the university's Internal Review Board (IRB). This study followed an observational, non-experimental approach (Privitera 2014). The findings cannot and are not intended to be interpreted through the lens of causation. We instead wish to present 1) a clearer demographic profile of the CALS student body, and 2) a suggestion of some of the groups who show signs of thriving and others that may be struggling. To accomplish this, we amassed a detailed dataset on the fall 2013 cohort of CALS students. We selected this group so that students could be tracked from entry through departure or graduation over a six-year timeline and to intentionally exclude cohorts of students whose graduation may have been impacted by the pandemic. The Enrollment Services and Management Office maintains the applications of students who were accepted and enrolled but not unsuccessful applicants nor students who did not enroll. Thus, we could examine only the applications from the 505 students who enrolled in the fall of 2013. This study is limited in that it deals with just one cohort of CALS students. The experiences of these students are subject to a particular historical context that may limit the degree to which their experiences are comparable to students from subsequent cohorts (Privitera, 2019).

These students' applications are the best available fit for determining what student characteristics coincide with academic success as defined by First Term GPA and graduation within six-years of first enrollment. We took a census, rather than sampling, approach and included all of the admitted students who enrolled and for whom we had complete application data, 505 students total, to ensure that the range of realities present in the cohort were available for analysis (Polit & Beck, 2012). We do not have access to information about students who either were not accepted or who were accepted but did not enroll.

We used descriptive statistics to describe subsets of students available in the cohort and to connect these student profiles with graduation rates. Previous studies informed the development of dyads for comparison as well. As the data in student applications is largely ordinal in nature, frequencies were appropriate for analysis while measures that require ratio data were not.

Results and Discussion

As has been documented at other COAs, the gender makeup of the undergraduate student population in CALS is heavily skewed female (Archibeque-Engle and Gloeckner, 2016; Buchanan, 2008; Dyer et al. 1999; Geocker, 1982; Peffer, 2010). We found that of the 505 students in the cohort, 328 of them were female, meaning that female students accounted for about 65% of the students entering CALS in fall 2013. Correspondingly there were only 177 male students enrolled, accounting for 35% of the cohort.

In keeping with other authors that have long found that the low levels of representation for racial and ethnic minoritized student groups in COAs at 1862 Land Grant universities, the cohort was found to be overwhelmingly White as well (Archibeque-Engle and Gloeckner, 2016; Dyer et al., 2002; George, 1978). We used the state population as a point of comparison to gauge the representativeness of the student population at CALS as detailed in Figure 1. We found that in comparison to the 64.5% of North Carolina residents who identified as non-Hispanic White according to 2013 census estimates (Census Bureau, 2021), about 80.4% or 406 of the CALS cohort students identified as non-Hispanic White. Asian and Pacific Islander students were also over-represented in the CALS cohort, accounting for 5% or 25 students, compared to 2.5% of the state population (Census Bureau, 2021).

The racial and ethnic groups underrepresented in the CALS population included African American, Native American, and Latinx students. An estimated 21.4% of the

[State] population identified as African American in 2013 (Census Bureau, 2021) compared to just 3.2% of the cohort or 16 students. Similarly, 8.7% of the state population was Latinx (Census Bureau, 2021) while just 3.4% of the cohort or 17 students identified this way. Only a single individual in the cohort identified as Native American accounting for less than 1% of the student population, compared with the 1.1% of [State residents] who identified as Native American in 2013 (Census Bureau, 2021).

These numbers portray an alarmingly low rate of representation for most minoritized racial and ethnic groups in CALS. This situation likely has ripple effects in the low rates of representation in AFNR professions requiring a bachelor's degree or higher (Alston et al., 2019). The dearth of minoritized students may also create an atmosphere where students of color feel less supported and empowered and are, therefore, less able to successfully integrate themselves into the academic and social systems of the college and achieve success (Terenzini and Pascarella, 2005).

As shown in Table 1, we also analyzed data on the number of students from North Carolina counties with low, moderate, and high levels of economic development and compared the rates at which these groups were represented in the state population and in CALS. North Carolina employs a county tier designation system whereby each of its 100 counties are categorized as being in Tier 1, 2, or 3. County tier designation is based on four factors: average unemployment rate, median household income, percentage growth in population, and adjusted property tax base per capita ([State] Department of Commerce, 2020). The 40 counties considered the least developed according to these criteria are termed Tier 1 counties, the second least developed 40 counties are termed Tier 2, and the most developed 20 counties are termed Tier 3. We found that among the students who were assigned a tier designation, there was a higher rate of representation of students from Tier 3 counties as compared to the overall North Carolina population by nearly ten percentage points.

Further, we tracked student group dyads that have been established elsewhere in the literature as experiencing elevated levels of academic difficulty or success due to experiential and background factors as presented in Figure 2. Our literature review led us to identify in-state vs. out-of-state students (Burk et al., 2013; Archibeque-Engle and Gloeckner, 2016), traditional vs. nontraditional (Burk et al., 2013; Murtaugh et al., 1999; Lancaster and Robinson, 2011; Goings, 2016), transfer vs. first-year (Archibeque-Engle and Gloeckner, 2016), first generation vs. continuing generation (Archibeque-Engle and Gloeckner, 2016; Stephens et al. 2012; Terenzini and Pascarella, 2005), and Pell Grant recipient vs. non-recipient students (Archibeque-Engle and Gloeckner, 2016, Schudde and Scott-Clayton, 2016) as groups of interest in determining those thriving in CALS or experiencing elevated levels of hardship.

Student Performance Profiles

We have assembled student academic profiles which include indicators for the student groups of interest. The data is provided as a cross tabulation in Table 2 for ease of comparison between groups. It should be noted that many of these groups inevitably overlap and intersect with one another. We do not intend to imply a causal link between membership in any one of these groups and outcomes such as graduation. Rather, our intention is to give a basis for comparison between groups to show where targeted intervention might be considered based on more in depth and specific future analysis of the factors impacting performance for each of the respective groups. We followed the example of past researchers in selecting academic indicators which included mean unweighted high school

Figure 1.

Racial and Ethnic Representation of CALS and North Carolina Populations

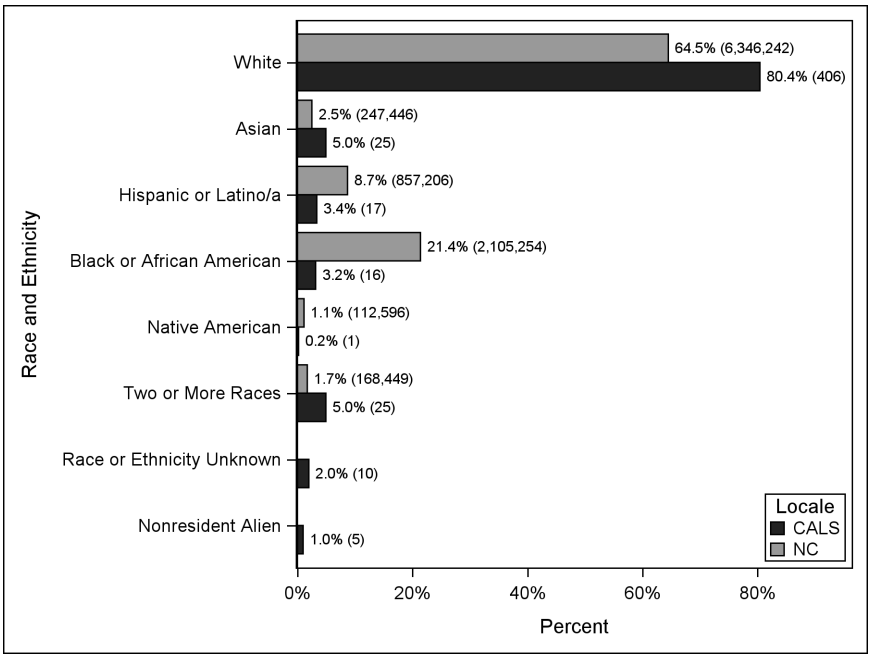


Table 1.

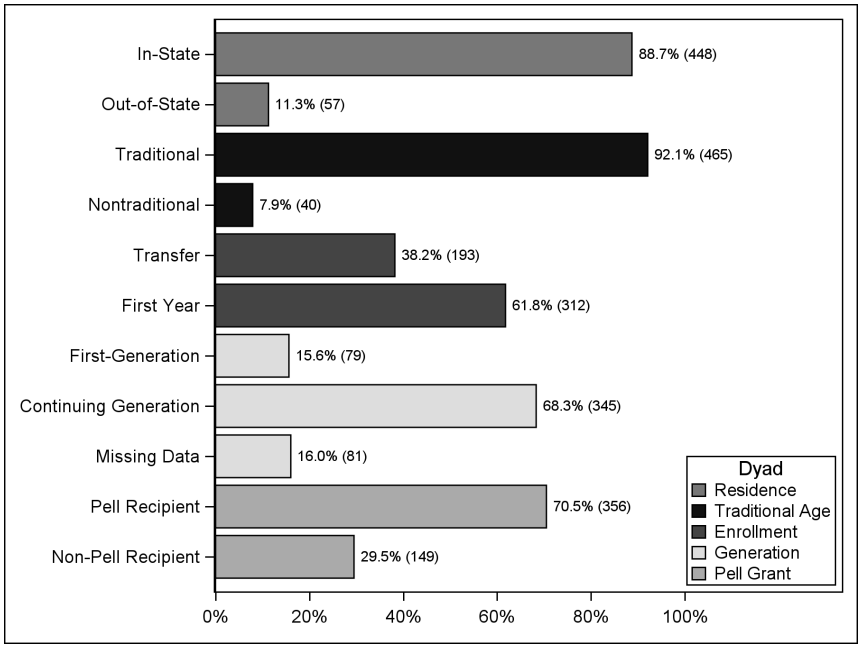
Tier Designations of CALS and North Carolina Populations

	CALS Population		NC Population	
Tier Designation for County of Origin	**Count**	**%**	**Count**	**%**
1 (Least Development)	48	11.1	1504129	15.3
2 (Medium Development)	138	32.0	3717782	37.8
3 (Most Development)	245	56.8	4619937	46.9

Note. Table does not include 74 students in the cohort with no tier designation

Figure 2.

Student Dyads



GPA on a 4.0 scale (HSGPA) (Allensworth and Clark, 2020; Geiser and Santelices, 2007; Zwick and Himelfarb, 2011), highest SAT score (High_SAT) (Garton et al., 2002), and first academic term North Carolina GPA (FTGPA) (Barkley and Forst, 2004). We used four, five, and six-year graduation rates (as a percent) to demonstrate the outcomes that student groups experience (Turner and Thompson, 2014; Tinto, 1993).

Based on our comparison, the gap in representation between male and female students may extend to academic performance and graduation rates as well. Male students underperformed their female counterparts across mean HSGPA, High_SAT, and FTGPA. The gap between FTGPA was particularly wide between male and female students, with females earning a mean of 3.06 and males earning a mean of 2.85. Males also lagged behind in terms of graduation rates across all three years. In both years four and five the gap was 8%. In year six it narrowed only slightly to 7%.

Among the racial groups in our target cohort, Latinx students presented the greatest cause for concern. As a group Latinx students performed across the three academic indicators at a level which appears comparable to (and in some cases better than) the other student ethnic and racial groups. However, the graduation rate for Latinx students was much lower than the other groups. As compared to the overall mean four-year graduation rate for all of CALS, which was 67%, the four-year graduation rate for Latinx students was just 53%, a difference of fourteen percentage points. As a group Latinx students stagnated between years five and six, remaining at a graduation rate of just 65%. Once again, this appears to be drastically lower than the overall graduation rate for the college which climbed from 79% in year five to 82% in year six. According to Nuñez and Murakami-Ramalho (2012) Latinx students are a fast-growing portion of the undergraduate student population in the US, but the hostile policy environment at the national level toward this group may be negatively impacting their ability to persist to graduation in many cases.

There appear to be no major differences between the students grouped according to North Carolina's county tier designations. All three of the groups perform at a level which

is comparable to the CALS average across the academic indicators and in terms of graduation rate.

Among the student dyad groups where we looked for opportunity gaps, in state vs. out-of-state and traditional vs. nontraditional students posed the largest disparities in graduation rates after six years. However, the in-state vs. out-of-state student dyad presented a contradiction since the out-of-state students performed at a higher rate across the academic indicators (HSGPA, High_SAT, and FTGPA) as compared to their in-instate peers, yet they lagged behind in terms of graduation rate. After six years, only 70% of the out-of-state students had graduated as compared to the CALS average of 82% and the in-state average of 83%. Nontraditional students lagged behind across all three academic indicators. The six-year graduation rate was just 68% as compared to their traditional student peers who had a mean graduation rate of 83% and the college-wide mean of 82%. Nontraditional students are a fast -growing group among the undergraduate population and have been demonstrated to be at elevated risk of not completing a

Table 2.

Academic Profiles

				Graduation		
	HSGPA	**High_SAT**	**FTGPA**	**4yr**	**5yr**	**6yr**
	Mean (SD)	Mean (SD)	Mean (SD)	%	%	%
Overall	3.55 (0.38)	1168 (122)	2.99 (0.80)	67	79	82
Gender						
Female	3.61 (0.36)	1175 (120)	3.06 (0.77)	70	82	84
Male	3.44 (0.41)	1156 (127)	2.85 (0.85)	62	74	77
Race and Ethnicity						
White	3.57 (0.37)	1168 (123)	2.99 (0.78)	68	81	83
Two or More Races	3.65 (0.25)	1116 (103)	2.91 (0.64)	56	68	72
Asian	3.40 (0.47)	1243 (109)	2.71 (1.09)	60	72	80
Latinx	3.55 (0.48)	1160 (122)	2.92 (0.92)	53	65	65
Black/African American	3.36 (0.47)	1090 (157)	2.95 (1.13)	75	81	81
Race/Ethnicity Unknown	3.47 (0.41)	1167 (79)	3.41 (0.43)	80	90	90
Nonresident Alien	-	-	-	-	-	-
Native American	-	-	-	-	-	-
Tier Designation						
1 (Least Development)	3.64 (0.30)	1116 (118)	2.81 (0.86)	69	79	81
2 (Medium Development)	3.63 (0.35)	1145 (115)	2.87 (0.88)	66	78	82
3 (Most Development)	3.45 (0.42)	1175 (123)	2.98 (0.77)	69	82	85
Student Dyads						
In-State	3.54 (0.39)	1160 (121)	2.94 (0.81)	67	81	83
Out-of-State	3.70 (0.29)	1225 (120)	3.36 (0.61)	63	70	70
Transfer	3.20 (0.44)	1077 (125)	2.68 (0.89)	71	75	77
First-Year	3.69 (0.25)	1211 (95)	3.17 (0.68)	65	82	85
First Generation	3.50 (0.35)	1118 (131)	2.77 (0.74)	58	72	77
Continuing Gen.	3.59 (0.37)	1183 (120)	3.09 (0.75)	71	84	86
Non-Traditional	2.93 (0.55)	1106 (147)	2.81 (1.04)	63	65	68
Traditional	3.57 (0.37)	1169 (122)	3.00 (0.78)	67	81	83
Pell Recipient	3.50 (0.44)	1148 (127)	2.94 (0.86)	66	77	79
Non-Pell	3.58 (0.36)	1175 (121)	3.01 (0.78)	67	81	83

degree (Burk et al., 2013; Murtaugh et al., 1999; Lancaster and Robinson, 2011; Goings, 2016).

Recommendations

Leadership in CALS must continue to work hard to identify opportunity gaps within the college. As Archibeque-Engle and Gloeckner (2016) noted these gaps pertain not only to the academic achievements and graduation rates for students who enroll in the college but also in the rates of representation of the college population as compared to the general population of the state the college serves. In terms of gender, race, and ethnicity CALS and other COAs should strive for equity. The fact that we found that there were far more women enrolled at CALS than men may help to correct inequities in terms of gender representation in AFNR career fields in the years to come. However, more work needs to be done to understand why male students are not enrolling in COAs at a comparable rate to their female peers and to correct the imbalance in the future. This applies to the apparent gap in academic performance and graduation rates as well. COAs are encouraged to examine how they recruit undergraduate students and programs in place to support them during their academic careers. Further, additional research should identify programs with graduation rates that are representative of their states and compare student experiences in those programs to student experiences in COAs.

There is an urgent need to close the opportunity gap for minoritized racial and ethnic groups at CALS. The low rates of representation that we observed for all groups aside from Asian Pacific Islanders and Whites is a matter of serious importance for the future viability and credibility of CALS and other 1862 Land Grant COAs. CALS should work in tandem with other institutions of higher learning in the state that have academic programs in AFNR to make representation a top priority.

Central to this could be deepening ties, sharing data and resources with North Carolina's historically Black Land Grant University, North Carolina A&T. Doing so could be a crucial first step toward creating an atmosphere at CALS and NC State where students of color do not feel marginalized. Facilitating greater ease in allowing and encouraging students to take classes between the universities could reduce the isolation that students from minoritized student groups - especially Black students - often feel in the context of a majority White school (Terenzini and Pascarella, 2005). Strengthening these ties would also give students at North Carolina A&T access to the resources and opportunities that are only available at the state's largest public university. Although it is outside of the scope of this project, CALS leadership should also make a deliberate effort to increase collaboration in research between faculty and graduate students at the two institutions to build deeper relationships.

Future research should be conducted to evaluate the opportunity gap that Latinx students at CALS are facing in terms of graduation rates. The low number of students in our target cohort (just 17) means that the observed rate of underperformance could be due to random chance. However, if it is not, addressing the needs of these students is of paramount importance for CALS going forward. As has been noted, Latinx students are at the leading edge of a demographic shift which will profoundly change the pool of students that CALS recruits, trains, and sends out into the world. Finding ways of addressing this population's needs will be central to the college's success going forward. We encourage in-depth studies of the experiences of Latinx students in CALS to determine what supports could enhance their graduation rates.

Finally, more research should be done to identify other at-risk populations in the college. Out-of-state students and nontraditional students performed the worst among the student dyad groups that we collected data on. Further research should identify group specific interventions that could help retain these students until graduation.

Summary

This study was conducted to give a stronger basis for understanding the demographic makeup of CALS. We found that the target cohort of CALS students in our study was disproportionately female, White, and from more economically developed counties as compared to the general North Carolina state population. We also found that male students, Latinx students, out-of-state students, and nontraditional students graduated at rates which appeared to be low relative to their peers in the college as a whole. We hope that our findings will inform the efforts of faculty and staff at North Carolina State University and at similar institutions around the country as they work to recruit a new, more diverse, generation of AFNR undergraduate students. We hope that this research will help to guide efforts at these institutions to more effectively target resources to continue to facilitate success for student groups who are thriving and to better support those who are experiencing hardship.

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