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Examining the NAF Academy Elements Associated with College Matriculation for High School Graduates

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Abstract
With the growing awareness of the value of earning postsecondary degrees to increase an individual's chances of attaining better workforce outcomes and a higher chance of gaining a quality life, school administrators have embraced a college and career readiness agenda. The adoption of career academies as a model for high schools across the nation is one strategy designed to provide the learning contexts students need to fulfill their quests to successfully transition from secondary schools to college and/or into the labor market, thus preparing them to be college and career ready. Using data from the National Student Clearinghouse, we examined the college enrollment likelihood and matriculation rates of 15,851 U.S. high school graduates who participated in NAF (formerly known as the National Academy Foundation) academies in 2019. We analyzed how these rates differ by NAF student characteristics, school programmatic quality measures, and student participation in dual enrollment courses. Multilevel modeling revealed that NAF academy students who completed NAF courses, internships, and participated in dual enrollment were significantly more likely than their NAF academy peers—who did not experience those components of the NAF academy model—to matriculate into college.

Keywords Career Academies · College Enrollment · Pandemic · Postsecondary Outcomes · Work-Based Learning

Nationwide, there is a growing awareness that students need postsecondary credentials—as research demonstrates that those credentials oftentimes lead to better job prospects and a higher chance at a better life (Carnevale et al., 2023; Zhang et al., 2024). Even further, the nation's economy depends on skilled employees, especially as technology exponentially expands. Nonetheless, compared to White and Asians, there remains substantial disparities in the rates of degree attainment for Black and Latinx individuals (Espinosa et al., 2019; Monarrez & Washington, 2020).

Given the personal, national, and societal benefits of narrowing the postsecondary attainment gap, research is critical on which school reform initiatives positively

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influence college matriculation. The development of career academies is one such secondary education reform initiative focused on improving youth's chances at matriculation into college and enhancing their career outcomes, particularly for Black and Latinx learners (Hemelt et al., 2019; National Career Academy Coalition, 2013). The modern goals of career academies also align with the Common Core Standards aimed at developing metrics to prepare all students to be successful in college and within their careers (Fletcher et al., 2018).

Career academies have been adopted in schools across the nation. Currently, there are over 8,000 career academies in existence serving 1,000,000 students (Lanford et al., 2019; National Career Academy Coalition, 2019). The career academy model features small learning communities that are embedded in schools. The curriculum emphasizes a college-preparatory coursework embedded within a career theme (e.g., engineering). Teachers within career academies integrate both core academic and career-themed content to increase rigor and relevancy to students' career preferences. School stakeholders build collaborative partnerships within the school and community (e.g., employer representatives and college faculty) to help ensure that students participate in career development (e.g., work-based learning activities such as internships) opportunities and college-going programming (e.g., accelerated learning initiatives such as dual enrollment – where students earn college credit for courses they complete in high school) (Castellano et al., 2012; Fletcher et al., 2018; Hemelt et al., 2019; Kemple & Snipes, 2000).

With the growing investment in building academies in high schools across the country, there are inequities in fidelity as schools attempt to implement the components of the comprehensive school reform initiative model. NAF (formerly known as the National Academy Foundation) is designed to help monitor the fidelity of schools adhering to the career academy model. As an organization that strives to improve the schooling of underrepresented and economically disadvantaged students, NAF began in 1982 with an academy of finance in New York City, and then grew to a national network of the following career themes: engineering, finance, health sciences, hospitality and tourism, and information technology (NAF, 2014; Stern et al., 2010). The NAF academy model has supported over 5,000 employer representatives who serve as mentors, facilitate paid internships for students, and serve on district and local schools' advisory boards. In 2019–20, there were 620 NAF academies in existence serving 120,000 students in 38 states, including D.C., Puerto Rico, and the U.S. Virgin Islands. The demographics of academy students are 47% female. Eighty percent of students are Black and Latinx. Sixty percent are eligible to receive free and/or reduced lunches (NAF, 2022).

Purpose of the Study

While the NAF model has expanded, research has not identified what elements of the student experience relates to student outcomes, particularly in regard to college matriculation. To our knowledge, there are no studies that have examined college matriculation among students who participate in NAF academies. We believe that this study is important given the investment of schools in comprehensive school

reform initiatives—such as NAF—and the expansion of schools to implement the model. In this manuscript, we used data from the National Student Clearinghouse of NAF academy high school graduates in 2019 to estimate the likelihood of NAF academy students to matriculate into college in 2020. To that end, we investigated the following research questions in our study:

1. How does participation in NAF programming (e.g., NAF course completion, dual enrollment and internship completion) relate to NAF academy graduates' likelihood of verified college enrollment?
2. Does the relationship between participation in NAF programming and the probability of being in college vary across academies?
3. How do high school NAF academy graduates' characteristics and academy characteristics relate to students' likelihood of matriculating into college?

Review of Literature

Postsecondary Degree Attainment Rates

There is a growing need in the United States for a more educated and skilled workforce, with more jobs requiring postsecondary education and/or training (Carnevale et al., 2023). However, gaps remain with the number of jobs requiring a postsecondary degree and the percentage of individuals attaining one, while disparities in degree attainment by race, ethnicity, and gender persist. Further, there has been a significant demographic shift in the nation's population with Asian and Latinx individuals representing the fastest growing communities. Furthermore, there has been an increasingly rising adult population earning postsecondary degrees. For example, in 2017, approximately 44% of adults aged 25 and older had acquired some type of postsecondary degree; this is a 31% increase from 1997. Yet, there remains a large disparity among individuals of different ethnic and racial backgrounds. The Latinx and Native American/Alaskan Native communities have the lowest rates of degree attainment, while the Asian community has the highest levels of educational attainment. In 2017, approximately 60% of Latinx individuals held a high school credential or less, 50% of Native American/Alaskan Natives, 46% of Native Hawaiians or other Pacific Islanders, 45% of Blacks, 35% of multi-racial, 34% of Whites, and 29% of Asians. As for gender, in 2017, approximately 46% (compared to 43% of men) of women had earned an associate's degree or higher (Espinosa et al., 2019). The challenges faced by students who come from economically disadvantaged backgrounds, under resourced communities/neighborhoods, and high exposure to crime, are numerous; these challenges often translate into students who have lower academic achievement (Sastry & Pebley, 2010), lower rates of postsecondary matriculation and lower labor market outcomes in adulthood (Duncan et al., 2007; Magnuson & Votruba-Drzal, 2009). Higher levels of postsecondary education is important because it generally results in greater earnings and economic stability, and individuals with higher levels of education are more likely to be healthier and live longer

(Carnevale et al., 2021; U.S. Department of Health and Human Services, 2023). Over their lifetime, individuals with a bachelor's degree earn 75% more than those with a high school diploma, and the longer that non-degree earners are in the workforce, the larger the earnings gap grows (Carnevale et al., 2021).

Factors Contributing to Postsecondary Attainment Gaps

When unpacking the reasons for postsecondary attainment gaps among ethnically and racially diverse individuals, it is important to acknowledge that the American K-12 school system in the United States is riddled with systemic racial imbalances. Such inequities can be detected based on school funding (Adamson & Darling-Hammond, 2011), the pool of qualified teachers (Adamson & Darling-Hammond, 2011), the segregation of schools (Fruchter et al., 2019), and inequitable access to a high quality and rigorous curriculum that prepares students to be both college and career ready (Fletcher et al., 2018; Lindstrom et al., 2022). Issues of institutional racism, white supremacy, and white privilege compound to prioritize white knowledge, skills, language, and dispositions within school contexts while discounting what is learned in non-dominant student home environments (Bonilla-Silva, 2021; Fruchter, 2007).

Addressing these inequities are important because they have resulted in vast opportunity gaps between ethnically and racially diverse and White students, and are perpetuated with colorblind mindsets and low academic expectations of many school personnel (Joseph et al., 2019). To that end, ethnically and racially diverse students often have negative schooling experiences and are likely deprived of a quality K-12 education. These issues lead to low student outcomes for ethnically and racially diverse students as it relates to postsecondary education and into the labor market.

Research on Dual Enrollment as a Program to Address Low Postsecondary Attainment Rates

Dual enrollment programs are designed to decrease the disparity of college attainment for underrepresented students – ethnically and racially diverse and economically disadvantaged learners (Allen & Dadgar, 2012; Velasco et al., 2024). Dual enrollment, which enables high school students to earn both high school and college credit simultaneously for a course, has been associated with numerous positive postsecondary outcomes, including college enrollment, early persistence, and degree attainment (An & Taylor, 2019; Schaller et al., 2023). In addition, Karp et al. (2007) found that dual enrollment participation was positively correlated with completion. Further, researchers have found that dual enrollment is negatively associated with time to degree (Schaller et al., 2023), indicating a higher likelihood of graduating within a four-year timeframe. Thus, dual enrollment is an important initiative as it enables access to college, increases the status of the secondary curriculum, and strengthens the connections between secondary schools and postsecondary institutions (Thomas et al., 2013; Velasco et al., 2024). Dual enrollment programs have

traditionally enrolled a larger proportion of White students with high-or-medium socioeconomic status (Museus et al., 2007; Pierson et al., 2017). However, researchers have found that students who are underrepresented in dual enrollment—such as males, Black students, and students with low socioeconomic status—may actually experience greater benefits from participation, including increases in college enrollment, postsecondary persistence, grade point average, and rates of degree attainment (Henneberger et al., 2022; Karp et al., 2007; Long et al., 2012; Rhine, 2022; Struhl & Vargas, 2012).

College and Career Readiness Standards for High Schools

Given the heightened national recognition for the critical need for postsecondary credentials coupled with Black and Latinx student disparities in degree attainment, the college and career readiness movement is a top priority for high schools in the country. While college and career readiness are primary foci of high schools across the nation, there is a lack of consensus regarding what it means. Many educational stakeholders think that college and career readiness constitutes raising the rigor and standards of the secondary curricula as well as emphasizing core academic (e.g., English, mathematics, and science) course taking (Achieve, 2010; Chester, 2018; Conley, 2010; McClarty et al., 2018). Some definitions focus on preparing learners for postsecondary education—without students needing remediation (National Center on Education and the Economy, 2007). The predominant perspectives seems to equate both college readiness with career readiness (Fletcher et al., 2018; Stone & Lewis, 2012). Stone and Lewis (2012) defined college and career readiness as students' mastery of academic knowledge (e.g., English, mathematics, science), and the development of employability and technical skills. First, academic knowledge in and of itself is not sufficient. Instead, high school graduates need to be able to apply what they learn through the occupational expression of academic knowledge. In essence, "graduates should know how to use mathematics or science to solve real workplace problems (Stone & Lewis, 2012, p. 15)." Second, many refer to employability skills as "twenty-first century skills" or "soft skills." These skills include capabilities such as responsibility, collaboration, and critical thinking/problem solving. Third, technical skills are specific competencies needed for each occupational area. We use Stone and Lewis' (2012) definition of college and career readiness within the context of this study.

The NAF Academy Model

To align with college and career ready standards, some school administrators seek to revise their curricula. The career academy model is a comprehensive secondary reform program designed to promote students' readiness to transition from high school to college and careers (Fletcher et al., 2018). The NAF model addresses both postsecondary preparation/access and college and career readiness standards as defined by Stone and Lewis (2012). NAF, a non-profit organization, partners with schools nationwide to establish NAF academies/career

pathway programs (NAF, 2022). These academies focus on three key areas: developing and structuring the academy itself, integrating curriculum and structure across subjects, and providing work-based learning experiences for students (NAF, 2022).

The first component regarding academy development and structure is when school stakeholders create small learning communities by cohorting students and establishing career-themed and sequenced classes. Academies are structured using school-within-school models or are designed as whole school/wall-to-wall programs (the entire student population belongs to one or more academies). The objective is to reduce larger schools into smaller learning communities where learners benefit from having the same teachers for their four years in school. Researchers have found that this structure has enabled learners to bond as a family within a caring learning environment (Fletcher et al., 2019; Stern et al., 2010). Educators receive pedagogical supports and technical guidance from NAF aligned with industry standards. The structure of each academy enables students to engage with educators and student peers in a small learning environment with individuals who share career related interests.

The curriculum is also integrated as it ties career and academic content centered on a career theme (e.g., finance, engineering, health sciences, hospitality and tourism, information technology). Educators in career academies connect occupational contexts with college preparatory courses to promote learning core academics using an applied approach. Curricular integration includes methods to tie skills, themes, concepts, and topics in an interdisciplinary fashion (Pierce & Hernández-Gantes, 2015). The benefits for students reside in learning theories, concepts, and ideas that promote learning across disciplines (Klein, 2010). Researchers found in the math-in-CTE (career and technical education) experimental study that the curricular integration of mathematical concepts in CTE courses – teaching mathematics in an occupational context – resulted in significantly higher scores on two of the three mathematical examinations. Yet, the scores within the third test failed to produce significantly different achievement compared to that of the control group (Stone & Lewis, 2012; Stone et al., 2008). Relatedly, NAF also aims to prepare students to transition into postsecondary education by encouraging academy students to participate in dual enrollment classes (Pierson et al., 2017).

Work-based learning is another component of NAF. The academy model provides students with learning opportunities within specific career contexts to ensure the relevance of their learning experiences. This enables learners to gain meaning from their classes (Newmann & Wehlage, 1995; Stipanovic et al., 2012). The work-based learning aspect provides students with opportunities to explore careers (e.g., field trips job shadowing) in 9th and 10th grades, and to gain real-world experience (e.g., industry certifications, paid internships) in 11th and 12th grades. According to Papadimitriou (2014), work-based learning offers students the valuable opportunity to not only put their knowledge into practice in real-world settings, but also gain valuable exposure, preparation, and experience relevant to their interested career path.

Effects of Career Academies on Students' Educational and Labor Market Outcomes

Researchers have studied the academy model in terms of its effects on student outcomes; however, findings focusing on student participation outcomes of academy and non-academy students have resulted in mixed results. Maxwell and Rubin (2002), using a single-district and across-district (national) databases, found that academy students were disproportionately learners with academic challenges, higher rates of Black, Latinx, and students with English as a second language. They also found that academy students were more likely to enroll in college after graduating from high school compared to students who concentrated their high school students in vocational and general education curricula. Notably, Maxwell and Rubin found no significant difference in college enrollment between academy and college preparatory students.

Researchers from the MDRC examined the effects of participation in academies on educational and labor market outcomes. In a randomized control study, the researchers utilized career academies with lottery-based student admission processes for approximately 1,800 students (54% were academy students) in nine high schools across the country (Kemple & Willner, 2008). Over a 15-year time period, spanning from 1993 to 2008, they found that student participation in career academies had no effect on graduation rates and postsecondary outcomes (Kemple & Snipes, 2001). In terms of labor market outcomes, male academy students had significantly higher (17%) earnings compared to non-academy students. Kemple and Snipes (2000) found variation in student outcomes based on programmatic variables within their study.

There is some evidence that career academies may improve high school graduation rates and enrollment in postsecondary education, especially for male students (Hemelt et al., 2019; Maxwell & Rubin, 2002). However, researchers have also found that standardized test scores (Hemelt et al., 2019; Kemple & Snipes, 2000), college matriculation (Hemelt et. al, 2019), and degree attainment (Kemple, 2008) of academy students were not significantly different from non-academy peers. Hemelt et al. (2019), who utilized a lottery-based school admission system of one school district, found that academy participants had significantly higher graduation (by 8%) and college enrollment rates for male graduates.

Fernandez and Sun (2015) conducted a quasi-experimental study with three large school districts using student- and academy-level data. They examined how NAF implementation fidelity influences student outcomes, and the effect of student participation on student performance compared to non-NAF students. Fernandez and Sun found that NAF academies with high fidelity benefitted from higher math performance. They found that higher levels of advisory board implementation was positively correlated with graduation rates. In addition, they found that NAF students had significantly higher performance in terms of on time high school graduation. Findings were particularly pronounced for males, Latinos, English language learners, and economically disadvantaged students.

Researchers have also examined how high school students' enrollment in career and technical education (CTE) fields of study is associated with postsecondary

matriculation and obtaining a postsecondary credential (Xu & Backes, 2024). They used longitudinal, student level administrative data from Kentucky and found "that focusing on health coursework in.

high school is associated with an increased likelihood of enrolling in and graduating from a health major in college, as well as a significantly reduced likelihood of enrolling in another field of study." (p. 453)Based on a review of literature, there are gaps in the knowledge base related to investigating academy students' participation in academies to postsecondary outcomes, namely, college matriculation. Researchers focusing on college and career readiness have tended to focus on the following student outcomes: academic achievement, accelerated course taking, graduation rates, SAT/ACT exam scores, and students' understanding about college and careers (Detgen et al., 2021). However, there is a lack of research on postsecondary (e.g. college matriculation, persistence, and/or completion). Even further, few studies have examined the NAF model, NAF student experiences in high school, and issues related to fidelity to the model (Fernandez & Sun, 015; Fletcher & Tan, 2024). In this study, we address this gap in the knowledge base by examining what types of student experiences (e.g., dual enrollment, internships, NAF courses) and quality metrics for academies (e.g., NAF quality evaluation categories) relate to students' college matriculation. With the growing investment in building career academies in high schools across the country, it is critical that we have a better understanding of how NAF academy students fare post high school.

Method

Sample and Data

Our primary analysis aimed to investigate the likelihood of college matriculation by considering various characteristics of high school academies and student participation. We used 16,975 postsecondary education records for the 2019 cohorts of NAF academy graduates from 507 NAF academies, as provided by the National Student Clearinghouse data in 2022. To handle missing data, we eliminated 824 cases with missing values in college enrollment and gender, along with 23 academies comprising 300 students with no information on the community stress index variable (an academy-level variable to assess stress levels across five domains—economic, education, health, housing, and crime—in the students' neighborhoods). These exclusions resulted in an analytical sample of 15,851 high school graduates across 406 NAF academies. The average number of individuals per academy was 32.75.

Similar to the gender and racial composition of the NAF academy student body, 45.80% of our sample comprised female students, and almost 80% of the participants were from ethnically and racially diverse backgrounds, including Asian (6.50%), Black/African American (29.54%), Latinx (38.41%), Other/Multiracial (5.90%), and White (19.66%). The sample also included representatives from 484

NAF academies, with a primary focus on engineering (17.19%), finance (27.04%), health sciences (15.49%), hospitality (11.68%), IT (22.04%), and other (6.55%). The majority of academies met certified level standards (44.05%), followed by distinguished (20.10%), disaffiliated (18.26%), member (10.69%), and model (6.90%), respectively. On average, the community stress level at academy level was 38.60 ($SD = 5.58$). In total, the 484 academies were distributed across 97 school districts and 27 U.S. states.

Measures

We considered *the current college enrollment status* as the binary dependent variable in our analysis. To determine students' enrollment status, we initially identified NAF academy graduates who were currently enrolled in or had graduated from colleges/universities based on their enrollment status in 2022, categorizing them as "Yes." Subsequently, individuals who had never enrolled or had initially enrolled but then dropped out were categorized as "No." Consequently, the college/university enrollment status of the students was either classified as "Yes" or "No."

Student NAF Academy Experiences were assessed through three activity statuses: dual enrollment, completion of NAF courses, and internship participation. Dual enrollment status was determined based on whether individuals enrolled in college before high school graduation (Yes or No). Therefore, we used participation in prior college enrollment as a proxy for dual enrollment. The completion status of NAF courses was operationalized as a measure of dosage, identifying students who completed four courses that met NAF requirements for inclusion in a program of study (Yes or No). NAF internship completion was determined based on whether the student participated in and completed an internship (Yes or No). NAF data were collected from the NAF network dataset.

Student-level variables include gender and ethnic and racial background. The gender variable consists of both male and female. Initially, the ethnic and racial background variable consists of Asian, Black, Latinx, Native American/Alaskan Native, Multi-Racial, Other, Pacific Islander, unknown, and White. However, due to limited sample sizes in specific minority groups (e.g., Native American/Alaskan Natives, Other/Multi-Racial, Pacific Islander, and unknown), we combined these five categories into an "Other/Multiracial" category, resulting in five categories: White, Asian, Black/African American, Latinx, and Other/Multiracial.

Academy-level variables include academy theme, academy quality designation, and community stress index. The academy theme variable consists of six categories: Engineering, Finance, Health Science, Hospitality, Information Technology, and Other. The academy quality designation variable comprises five categories: Disaffiliated, Member, Model, Certified, and Distinguished. Academies' level of implementation fidelity was determined by NAF representatives who conducted academy site visits using a rubric covering seven domains: NAF in the School, Leader Engagement, Student Engagement, College and Career Readiness, Career Themed Integration,

Advisory Board Engagement, and NAFTrack Engagement. Review team members tally the number of criteria met within each domain during the visit to determine the academy's designation. Distinguished academies meet all criteria within the seven domains; model academies meet all but one; and certified academies miss two or more criteria. The member designation applies to academies new to NAF and not yet evaluated.

Additionally, a community stress index was included as an academy-level variable to assess stress levels across five domains—economic, education, health, housing, and crime—in the students' neighborhoods. Given the limitation of relying solely on a single indicator such as free or reduced-price lunch to represent challenges within schools or communities, this index was developed to more accurately identify the difficulties students face within their communities (Lesser & Minar, 2022). This index consolidates data from communities surrounding approximately 23,000 public high schools in the United States. In this study, we used composite scores derived from the five domains of the community stress index. The index score ranges from 1 to 100, with higher scores indicating more stressful community conditions.

Analytic Strategies

To address our research questions, we employed a multilevel logistic regression modeling approach, examining how students' college/university enrollment status is associated with factors such as dual enrollment status, NAF course completion, NAF internship completion, ethnicity, gender, academy theme, academy quality, and community stress index. We opted for a multilevel modeling approach due to the hierarchical structure of students nested within academies. Considering the random intercepts and slopes accounting for variability across different academies provides a better understanding of the relationship between the specified variables and students' college enrollment probabilities (see Raudenbush & Bryk, 2002). Specifically, we expressed our multilevel logistic regression model as:

$$\text{Level 1: } \eta_{ij} = \log\left[\frac{\pi_{ij}}{1-\pi_{ij}}\right] = \beta_{0j} + \beta_{1j} dual_{ij} + \beta_{2j} course_{ij} + \beta_{3j} internship_{ij} + \beta_{qj} \boldsymbol{X}_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} theme_j + \gamma_{02} quality_j + \gamma_{03} CSI_j + u_{oj}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

where η_{ij} represents the logit link capturing the probability of enrolling in college for the ith student in the jth academy, β_{0j} corresponds to the random intercepts, β_{qj} is the fixed slopes, $\boldsymbol{X}_{ij}$ represents a vector of individual-level variables, γ_{00} is the overall average logit or log odds of enrolling in college across all academies, γ_{0j} represents the overall average slope when other academy-level slope coefficients are zero, u_{oj} is an error term associated with the random intercept, γ_{10} is the slope for dual enrollment, and u_{1j} signifies the error term associated with the random slope.

Results

Descriptive Results

In Table 1, we present descriptive statistics of our analytical variables by college enrollment. The overall findings indicate significant demographic and academic distinctions between students who have never enrolled and those currently enrolled. Notably, a higher proportion of males (58.39%) are never enrolled in college, while a larger percentage of females (51.85%) are currently enrolled in college. Differential enrollment patterns are also evident based on ethnicity, with a majority of White and Asian students currently enrolled, whereas a substantial proportion of other ethnicities remain unenrolled in college. Participation in NAF activities, including dual enrollment, course completion, and internship participation, is associated with higher current college enrollment rates. For instance, a relatively substantial percentage of those currently enrolled (28.88%) have experienced dual enrollment, compared to a lower percentage among those who have not enrolled (12.81%). Examining academy themes, finance stands out with the highest percentage in college enrollment, although the distribution across other themes may vary. Regarding academy quality designation, students in academies with a distinguished quality level exhibit a higher likelihood of college enrollment. The Community Stress Index is marginally lower for the "Currently enrolled" group (37.57) compared to the "Never enrolled" group (39.32). This suggests that students attending academies with lower community stress level indices are more inclined to enroll in college compared to their counterparts.

Multilevel Results of NAF Student College Enrollment

We first estimated the intraclass correlation coefficient (ICC) for the unconditional multilevel logistic model to examine whether NAF student college enrollment vary across NAF academies. The ICC value was 0.235, indicating that 23.5% of the total variance is ascribed to academies (see Snijders & Bosker, 2012). This suggests that the likelihood of verified college enrollment is more akin within academies, emphasizing a pronounced NAF academy effect and providing robust justification for employing a multilevel analysis.

To explore the relationship between participation in NAF activities and the likelihood of college enrollment, we introduced three individual-level variables—dual enrollment status, NAF course completion status, and internship completion—to the unconditional model. The log-likelihood ratio test, comparing Model 1 to the unconditional model, indicates that Model 1 better fits the data, $\chi^2(3) = 650.25$, $p < 0.001$. The results of Model 1 demonstrated that all NAF activities are significantly associated with the likelihood of enrolling in college, implying that participation in NAF activities is more likely to increase the odds of college enrollment (see Table 2). Specifically, the odds of being enrolled in college for students who participated in

Table 1 Descriptive results of main variables

	Never enrolled ($n=9,363$)		Currently enrolled ($n=6,488$)		Total ($n=15,851$)	
	n	%	*n*	%	*n*	%
Individual Level						
Gender						
Male	5,467	58.39	3,124	48.15	8,591	54.20
Female	3,896	41.61	3,364	51.85	7,260	45.80
Ethnicity						
White	1,307	13.96	1,809	27.88	3,116	19.66
Asian	409	4.37	621	9.57	1,030	6.50
Black/African American	3,113	33.25	1,569	24.18	4,682	29.54
Latinx	3,962	42.32	2,126	32.77	6,088	38.41
Other/Multiracial	572	6.11	363	5.59	935	5.90
Dual Enrollment						
No	8,164	87.19	4,614	71.12	12,778	80.61
Yes	1,199	12.81	1,874	28.88	3,073	19.39
NAF-Course Completion						
No	7,428	79.33	4,223	65.09	11,651	73.50
Yes	1,935	20.67	2,265	34.91	4,200	26.50
NAF-Internship Completion						
No	8,045	85.92	4,787	73.78	12,832	80.95
Yes	1,318	14.08	1,701	26.22	3,019	19.05
School Level						
Academy Theme						
Engineering	1,571	16.78	1,154	17.79	2,725	17.19
Finance	2,331	24.90	1,955	30.13	4,286	27.04
Health Science	1,349	14.41	1,107	17.06	2,456	15.49
Hospitality	1,256	13.41	595	9.17	1,851	11.68
Information Technology	2,167	23.14	1,327	20.45	3,494	22.04
Other	689	7.36	350	5.39	1,039	6.55
Academy Quality Designation						
Member	979	10.46	715	13.14	1,694	10.69
Disaffiliated	1,849	19.75	1,045	16.11	2,894	18.26
Model	677	7.23	417	6.43	1,094	6.90
Certified	4,283	45.74	2,700	41.62	6,983	44.05
Distinguished	1,575	16.82	1,611	24.83	3,186	20.10
Community Stress Index	39.32[a]	5.15[b]	37.57[a]	5.99[b]	38.60[a]	5.58[b]

Note. [a] indicates a mean, [b] indicates a standard deviation

dual enrollment are 2.75 times as large as the odds for nonparticipants in dual enrollment. Completion of both NAF courses (OR = 1.64) and internships (OR = 1.63) also elevates the odds of enrolling in college.

Table 2 Multilevel logistic regression of college enrollment on student demographic and naf academy related variables (n = 15,851)

	Null			Model 1			Model 2			Model 3		
	Estimate	SE	OR	Estimate	SE	OR	Estimate	SE	OR	Estimate	SE	OR
Fixed Effects												
Intercept	−0.37***	0.06	0.69	−0.87***	0.06	0.42	−0.88***	0.06	0.41	1.00**	0.37	2.72
Dual Enrollment				1.01***	0.05	2.75	1.04***	0.06	2.84	0.99***	0.06	2.68
NAF Course Completion				0.50***	0.06	1.64	0.50***	0.07	1.65	0.47***	0.07	1.60
NAF Internship Completion				0.49***	0.06	1.63	0.49***	0.06	1.63	0.47***	0.06	1.61
Gender (Ref: Male)										0.48***	0.04	1.61
Ethnicity (Ref: White)												
Asian										0.38***	0.09	1.46
Black/African American										−0.42***	0.07	0.66
Latinx										−0.45***	0.06	0.64
Other/Multiracial										−0.17	0.10	0.84
Academy Theme (Ref: Hospitality)												
Engineering										0.46**	0.17	1.58
Finance										0.43**	0.16	1.54
Health Sciences										0.43	0.18	1.53
Information Technology										0.24	0.17	1.27
Other										0.28	0.23	1.33
Academy Quality (Ref: Member)												
Disaffiliated and other										−0.12	0.19	0.89
Certified										−0.18	0.16	0.84
Model										−0.59**	0.22	0.55
Distinguished										−0.08	0.18	0.92
Community Stress Index										−0.05***	0.01	0.95

Table 2 (continued)

	Null			Model 1			Model 2			Model 3		
	Estimate	SE	OR	Estimate	SE	OR	Estimate	SE	OR	Estimate	SE	OR
Random Effects												
Between-Academy Var	1.01***	0.05		0.95***	0.09		1.01***	0.10		0.69***	0.07	
Slope Var. (Dual Enrollment)							0.28**	0.09		0.26**	0.09	
Cov. (Academy: Dual Enrollment)							−0.16	0.08		−0.10	0.07	
df	2			5			7			22		
Log Likelihood	−9749.37			−9424.25			−9414.68			−9232.19		
AIC	19,502.75			18,858.49			18,843.35			18,508.38		
BIC	19,518.09			18,896.85			18,897.05			18,677.14		

Note. Ref indicates a reference group. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Although not presented in Table 2, we initially included the random effects of participation in NAF activities to Model 1 in order to estimate variances in intercepts and slopes, along with the covariance among them, before estimating Model 2. Contrary to our expectations, the random components of both NAF course and internship completion, and their associated covariances, were not statistically significant, suggesting that NAF course and internship completion do not vary across NAF academies. Consequently, we opted to only specify the random slope of dual enrollment and its covariance with the random intercept (see Model 2 in Table 2). The log-likelihood test also supported our decision to omit the random effect of both NAF course and internship completion, $\chi^2(7) = 8.99$, $p = 0.25$. With regard to the random effects, Model 2 demonstrated that the slope variance for dual enrollment (0.28) is statistically significant, indicating that students' dual enrollment status varies across academies. Moreover, the intercept variance was statistically significant (1.01) whereas the covariance between the intercept and the slope was not statistically significant (−0.16).

In Model 3, we introduced demographic variables of gender and ethnicity, and academy characteristic variables of academy theme, academy quality designation, and community stress level to Model 2. As anticipated, the effects of NAF academy activities (i.e., dual enrollment and NAF course and internship completion) remained statistically significant after holding both individual and academy-level variables constant. For instance, the odds of enrolling in college for students who participated in dual enrollment and completed NAF courses and internships are 2.68, 1.60, and 1.61, respectively, as great as the odds for those who did not participate in NAF activities, consistent with the findings of Model 2. Additionally, the logit coefficient for gender (0.48) was significantly related to the probability of being in college enrollment, suggesting that the odds of being enrolled in college for NAF female students were 1.61 times the odds for NAF male students. While the odds of enrolling in college for Asian students are 1.46 times as great as the odds for White students, the odds of enrolling in college for Black and Latinx students were 0.66 and 0.64, respectively, as great as the odds for White students. In other words, Black and Latinx students, compared to White students, decreased the odds of being enrolled in college by 34.0% and 36.0%, respectively. At the academy level, the odds of enrolling in college for students in Engineering and Finance were 1.58 and 1.54 times greater, respectively, than those of students in Hospitality. However, the odds of enrolling in college for those in academies with model qualification were 0.55 times the odds for those in academies with member qualification, meaning that being in academies with model qualification decreased the odds of enrolling in college by 45.0%. Lastly, the logit coefficient for community stress index was statistically significant (−0.05; OR = 0.95), indicating that a one-unit increase in the community stress index level is associated with a 5% decrease in the odds of college enrollment.

After incorporating student demographic and academy characteristic variables into Model 3, the between-academy variance decreased from 1.01 to 0.69, representing a 31.68% reduction in between-academy variance from Model 2 to Model 3. The log-likelihood ratio test, comparing Model 3 to Model 2, indicates that Model 3 better fits the data, $\chi^2(15) = 364.97$, $p < 0.001$. The values of AIC and BIC

also demonstrate that Model 3 fits the data better than Model 2. Since students' dual enrollment status significantly varies across academies, we further examined whether the relationship between students' dual enrollment and the probability of enrolling in college varies across academy-level variables by introducing the interaction terms of dual enrollment with academy-level variables to Model 3. However, no significant interaction effects were found, resulting in the exclusion of interaction terms from Model 3.

Discussion

With the growing awareness of the value of earning postsecondary degrees to increase an individual's chances of enhanced workforce outcomes and an increased chance at a higher quality of life, school administrators have embraced the college and career readiness agenda. The adoption of the career academy model for schools across the nation has increased as a strategy to provide the learning contexts students need to prepare for making the transition from high school to college and/or the workforce. In this manuscript, using data from the National Student Clearinghouse, we examined student participation in NAF academies and assessed the likelihood of the graduates to enroll in college. More specifically, we examined how different components of the NAF model are associated with college matriculation and how context influences that (e.g., student demographics, community stress, the pandemic). Our findings mirror reports that there are still disparities in postsecondary enrollment for Black and Latinx students as well as for males (Espinosa et al., 2019; Monarrez & Washington, 2020). It is important to note that a limitation in our study and other findings from prior literature is our lack of understanding regarding the postsecondary outcomes of individuals who are gender nonconforming. We also found a relationship between the NAF academy experience to college enrollment as students who completed NAF courses, internships, and dual enrollment opportunities increased their odds of matriculating into college.

We found a lower likelihood of Black and Latinx students to enroll in college compared to their Asian and White student counterparts. This finding is quite disturbing given the national consensus of the need for students to earn postsecondary degrees. This is especially concerning as Black and Latinx students—with the exception of Asians—are significantly less likely than Whites to pursue college (Chatterji & Li, 2021). These findings are consistent with our study's results, indicating that NAF academy Asian students were more likely to pursue college compared to any other ethnic and racial group. Latinx students represent the highest participation of learners (45%) in NAF academies, yet Latinx students have the lowest rates of college enrollment nationwide (Espinosa et al., 2019). Researchers have found that these postsecondary attainment gaps exists based on various factor, including inequities in school funding, the pool of qualified teachers, the segregation of schools, and access to a high quality and rigorous curriculum that prepares students to be both college and career ready (Adamson & Darling-Hammond, 2011; Fletcher et al., 2018; Fruchter et al., 2019).

In fact, participation in dual enrollment was the largest contributor – based on the variables that we included in our model – to college enrollment. Given that students who come from communities with higher stress factors are less likely to enroll in college, dual enrollment could provide access and help equalize and narrow disparities compared to Asian students. This is probable, as many states have enacted policies including free tuition, books, and fees for students who participate in dual enrollment (Thomas et al., 2013). Further, prior research findings have demonstrated that many underrepresented dual enrollment students benefit from higher rates of high school graduation, enrollment in college, and persistence in college (Karp et al., 2007). Researchers have also noted that it helps learners adjust psychologically from high school to college, demystify what college is like and promote greater understanding of college expectations, increase students' confidence in their abilities to complete college coursework, lessons the expense in earning a degree, and reduces the time needed to earn a degree (Allen & Dadgar, 2012).

Based on our findings, we recommend that administrators and personnel in NAF academies/schools include an emphasis on creating partnerships between high schools and their local postsecondary institutional partners to form articulation agreements and create dual enrollment courses. In some schools, students have the opportunity to earn their associate's degree in high school along with their high school diploma. Relatedly, we recommend that administrators and personnel in NAF academies/schools track both the quality and dosage of student participation in dual enrollment courses, particularly for diverse learners, to ensure they are able to identify gaps in participation of Black and Latinx students. This can help assist school personnel in creating initiatives to promote student participation in these high impact practices.

We also found that the NAF student experience, including NAF course and internship completion, seemed to be related to the likelihood of NAF academy students to enroll in college. Students who completed NAF courses had odds of being enrolled in college 1.63 times as large as those who did not. Additionally, completing internships increased the odds of enrolling in college by 1.65 times, compared to non-completers. This finding is important as the NAF prioritizes internships and its implementation of initiatives to ensure that all NAF students leave high school with an internship experience. To that end, prior literature suggests that work-based learning, particularly the internship experience, enables learners to transfer their knowledge in real-world contexts, while exposing them to learning experience within their career path and/or college major of interest (Papadimitriou, 2014).

However, we found that the relationship between quality of the academy—measured by NAF staff members' academy quality review visit evaluations—and college matriculation was counter to our expectations. More specifically, being in academies with model qualification decreased the odds of enrolling in college by 45.0% compared to being in academies with member qualification. This finding should be interpreted with the caveat that we had also controlled for NAF experiences, the quality of which was likely an important contributor to a school's NAF designation. In other words, some of the elements that are reflected in determining a school's quality designation (e.g., internship completion) have already been taken into consideration, possibly leaving unmeasured elements that were also related to academy quality.

Nonetheless, it is also plausible that our finding might reflect the fact that the NAF has moved away from hiring external consultants to evaluate academies and have opted to conduct quality review visits internally. This decision may have negative consequences, particularly if the academy quality reviews are subjective in manner (e.g., based on preferences because of prior relationships with academy stakeholders, political tensions due to the quality designation). Therefore, to rule out of this possibility, we recommend that the NAF examine their rubrics used to assess the quality of academies as well as the reviewers involved in the process to determine whether the measures and assessors used in the quality review process accurately measures its intended outcomes.

While our findings point to certain NAF academy initiatives and student experience factors related to college matriculation, there remains gaps in our understanding of other factors that predict college matriculation. Hence, there is a need for future research to examine the effects of student participation in NAF academies on postsecondary outcomes. First, we recommend that researchers examine other postsecondary outcomes such as degree attainment and major declared. Second, we recommend that researchers incorporate other important college readiness activities such as advanced placement (AP), honors, and international baccalaureate program participation as well as achievement measures (e.g., ACT/SAT scores, grades, GPAs).

Conclusion

Our findings point to the elements of the NAF academies that are most associated with college enrollment, particularly internships, NAF courses, and dual enrollment opportunities. We also find that quality ratings do not seem to be associated with college enrollment. This is a concerning issue given that researchers have argued that quality ratings are an improvement over existing accountability structures (Fletcher & Tan, 2024). At present, our study provides some evidence for the potential of NAF academies to improve rates of college matriculation, particularly for students who also complete dual enrollment courses. It is also important to note that academies have goals beyond college enrollment. The strongest evidence of the impact of career academies has come from examination of labor market outcomes (Kemple & Snipes, 2000). This study examined impacts of components of the college matriculation of students, which is only one of the intended outcomes of career academies.

Limitations and Future Direction

While our study includes a large sample of NAF academy students with a high rate of Black and Latinx individuals, our study has several limitations. Readers should exercise caution in generalizing the findings of this descriptive study as there are potential confounders given that we relied on a secondary dataset to answer our research questions. We did not have access to academic achievement student level

variables that are likely to relate to college matriculation. Further, we are only able to observe students who matriculate into college one year after completing high school. Given that many students enter college later in life, we are unable to capture this phenomenon in this analysis. In addition, students who enroll in dual enrollment and complete NAF courses may be more motivated to succeed and have higher academic performance in formal education, and therefore are more likely to matriculate into college. Future studies with a more nuanced design can help clarify this. In addition, it is important to note that in some schools with multiple academies, the academy quality designation referred to the highest quality designation that may not accurately reflect the quality of other academies within the school. Yet, we believe that mapping the matriculation rates of students from different backgrounds is useful in identifying different rates of college going is important given the investment of schools in comprehensive school reform initiatives – such as NAF – and the rapid expansion of schools to implement the NAF academy model. Nonetheless, our study did not allow for a causal conclusion because of the nature of our data. Future studies utilizing a causal design can help discern the causality between academy experiences and college enrollment for NAF academy students.

Authors Contribution All authors whose names appear on the submission.
1) made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work;
2) drafted the work or revised it critically for important intellectual content;
3) approved the version to be published; and.
4) agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data Availability Our data source was from the National Student Clearinghouse. We plan to ensure that our data (from the National Student Clearinghouse) are accessible for the general public, including researchers, to reuse for further research purposes, conduct methodological studies, test alternative theories or hypotheses, and explore other research questions as we desire to maximize the impact of our research. We expect to share our data and any associated documentation (e.g., descriptions of variables in a dataset) upon reasonable request.

Declarations

Competing Interests The authors declare that they have no competing interests.

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