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Digital Divide or Digital Bridge? Analyzing the Impact of Online Education on Career Outcomes and Professional Success Among Bachelor's Degree Recipients

Osasohan Agbonlahor[1]

[1]Department of Leadership Studies and Adult Education, North Carolina Agricultural and Technical State University, 1601 East Market Street, Greensboro, North Carolina, 27411 United States; oagbonlahor@ncat.edu.

ORCID iD:

[1]https://orcid.org/0000-0002-0667-1994

Address for Correspondence:

Osasohan Agbonlahor, Department of Leadership Studies and Adult Education, North Carolina Agricultural and Technical State University, 1601 East Market Street, Greensboro, North Carolina, 27411 United States. (oagbonlahor@ncat.edu)

Abstract	This study examines long-term career implications of online versus traditional education using nationally representative data from the Baccalaureate and Beyond Longitudinal Study (B&B:08/18). Drawing from a sample of 6,480 bachelor's degree recipients, the research investigates multiple dimensions of career quality, including employment duration, income, job satisfaction, and education-job match. Online program graduates demonstrated greater employment stability, spending approximately 7.1% more time employed over the ten-year period than traditional graduates. However, they earned modestly less, with an adjusted income gap of 3.9% after controlling for demographic factors, field of study, and geographic location. Despite this income differential, online and traditional graduates reported nearly identical job satisfaction levels. Regarding education-job match, online graduates showed no significant difference in the likelihood of holding jobs requiring a bachelor's degree, but were significantly more likely to work in jobs related to their field of study. Results suggest online education serves as a "digital bridge" for employment stability and field-relevant work despite modest income disadvantages.
Keywords	Online education; career outcomes; education-job match; signaling theory; higher education; educational delivery mode

1. Introduction

The landscape of U.S. higher education has undergone a profound transformation over the past two decades, with online education emerging as a significant alternative to traditional face-to-face instruction. This shift has been driven by technological advancements, changing student demographics, increasing costs of traditional education, and most recently, global disruptions such as the COVID-19 pandemic (Agbonlahor, 2024; Lukashe et. al, 2024). The National Center for Education Statistics reports that even before the pandemic, nearly 35% of undergraduate students had taken at least one online course, with many completing their entire degrees through virtual platforms (NCES, 2019). This rapid expansion has raised important questions about the long-term career implications of online education relative to traditional in-person instruction.

Despite the growing prevalence of online education, empirical evidence regarding its career outcomes remains limited and often contradictory (Adams et.al 2007; Deming et.al 2016; Salama & Hinton, 2023). Early skepticism about the quality and rigor of online programs has gradually given way to more nuanced assessments, yet employers' perceptions and graduates' actual career trajectories continue to be subjects of ongoing debate. This uncertainty is particularly concerning given that career advancement is a primary motivation for many students pursuing bachelor's degrees, especially for non-traditional students who often select online programs specifically for their flexibility and accessibility while balancing work and family responsibilities.

The ambiguity surrounding online education's career implications reflects a deeper tension in higher education discourse. Some view online education as creating a potential "digital divide" that widens inequalities by providing a lower-quality educational experience that limits career opportunities and economic mobility. Others see it as a "digital bridge", democratizing access to higher education by overcoming geographical, financial, and scheduling barriers, thereby expanding career opportunities for populations traditionally underserved by conventional institutions. These competing narratives carry significant implications for educational policy, institutional practice, and individual decision-making in an increasingly digital educational landscape (Agbonlahor, 2025; Garcia-Penalvo, 2021; Gentile et.al 2023).

Most existing research on this topic suffers from three key limitations (Deming et.al, 2016; Goodman et.al, 2019; Xu & Jaggars, 2014; Robst, 2007; Youssef et.al 2019). First, many studies rely on short-term employment outcomes, examining graduates' transitions into the workforce but failing to capture longer-term career development patterns. Second, the literature often focuses narrowly on starting salaries or employment rates, neglecting other important dimensions of career quality such as job satisfaction, employment stability, and education-job match. Third, previous research frequently treats online education as a monolithic entity, overlooking potential variations in outcomes across different fields of study and demographic groups.

This study addresses these limitations by examining the long-term career outcomes of bachelor's degree recipients from online and traditional programs using nationally representative longitudinal data spanning a decade after graduation. By analyzing multiple dimensions of career quality and exploring field-specific variations, this research provides a more comprehensive understanding of how educational delivery mode relates to career trajectories in the contemporary labor market.

The primary research question guiding this investigation is: How do career outcomes differ between graduates of online degree programs and traditional face-to-face programs? More specifically, this study seeks to determine whether online education serves as a "digital divide" that potentially limits career prospects or as a "digital bridge" that enhances career opportunities for graduates. To address this overarching question comprehensively, five specific research questions are examined:

1. Does the mode of educational delivery (online versus traditional) influence employment duration after degree completion?
2. Are there significant income differences between graduates of online and traditional programs, and if so, to what extent?
3. How does job satisfaction compare between online and traditional program graduates?
4. Is there a difference in education-job match (both in terms of credential level and field of study) between online and traditional program graduates?
5. Do these relationships vary across different fields of study?

This study utilizes data from the Baccalaureate and Beyond Longitudinal Study (B&B:08/18), following a nationally representative cohort of bachelor's degree recipients from graduation in 2007-2008 through 2018. This dataset is particularly valuable as it captures graduates' experiences through the economic recession of 2008-2009 and subsequent recovery, providing insights into how different educational pathways influence resilience and adaptability in changing labor market conditions. The ten-year timeframe allows for examination of not just immediate employment outcomes but also career progression and stability over time.

By examining multiple dimensions of career outcomes across different fields and demographic groups, this research moves beyond simplistic assessments of whether online education is "better" or "worse" than traditional education. Instead, it provides a nuanced understanding of the specific contexts and career domains in which different educational delivery modes may offer advantages or disadvantages. This approach acknowledges the heterogeneity of both educational programs and career trajectories, offering more targeted insights for stakeholders navigating an increasingly diverse higher education landscape.

The findings of this study have significant implications for multiple stakeholders. For prospective students and their families, understanding the long-term career implications of different educational pathways can inform more strategic educational investments. For higher education institutions, insights about field-specific variations in career outcomes can guide program development and student support services. For policymakers, evidence regarding employment stability, income, and job satisfaction can inform decisions about accreditation, financial aid, and other regulatory frameworks. For employers, this research provides empirical context for evaluating candidates from different educational backgrounds. Collectively, these insights contribute to a more evidence-based discourse about the role of online education in contemporary higher education and labor markets.

2. Theoretical Framework

This study can be understood through an integrated theoretical framework combining three complementary theories: human capital theory, signaling theory, and social capital theory. Each of these perspectives offers unique insights into the complex relationship between educational delivery mode and career outcomes.

Human capital theory, originated by Becker (1964) and Schultz (1961), conceptualizes education as an investment in skills, knowledge, and abilities that enhance individual productivity and earnings potential. This framework views education primarily as a process of skill acquisition and competency development that directly increases an individual's economic value in the labor market. Through this lens, the effectiveness of educational delivery modes can be evaluated based on their capacity to develop relevant human capital.

While human capital theory focuses on skill development, signaling theory (Spence, 1973) emphasizes education's role as an information signal to employers about unobservable candidate qualities. From this perspective, educational credentials serve as signals of underlying traits like intelligence, perseverance, and conformity to social norms, rather than directly contributing to productivity through skill development. Social capital theory (Coleman, 1988; Bourdieu, 1986) emphasizes the resources embedded in social networks and relationships that can be mobilized for economic advantage. Through this lens, educational institutions serve not only as venues for human capital development and credential signaling but also as sites for building valuable professional networks and social connections. Together, these perspectives provide complementary lenses for understanding the complex relationship between educational delivery mode and career outcomes.

3. Methodology

3.1 Data and Sample

This study utilizes data from the Baccalaureate and Beyond Longitudinal Study (B&B:08/18), a nationally representative sample of bachelor's degree recipients who completed their degrees during the 2007-2008 academic year and were subsequently followed through 2018. The B&B study, conducted by the National Center for Education Statistics (NCES), provides comprehensive information on graduates' educational experiences, employment outcomes, and demographic characteristics.

The B&B:08/18 dataset is particularly valuable for this research as it captures the early adoption period of online education while providing sufficient follow-up time to observe meaningful career development patterns. The ten-year timeframe allows for examination of not just immediate employment outcomes but also career progression and stability over time. Additionally, the period covered includes both the economic recession of 2008-2009 and the

subsequent recovery, providing insights into how graduates from different educational modalities navigated challenging labor market conditions.

To create the analytical sample, I implemented several inclusion criteria. First, I limited the sample to individuals with complete data on key variables including program delivery mode, employment duration, income, job satisfaction, education-job match indicators, demographic characteristics (race/ethnicity and gender), major field of study, and geographic region. This approach allowed me to maintain a consistent sample across different analyses and avoid potential biases from systematic patterns of missing data.

After applying these criteria, the primary analytical sample consisted of 6,480 bachelor's degree recipients, with 4,200 (64.81%) from traditional programs and 2,280 (35.19%) from online programs. For analyses involving income and job satisfaction, the sample was further restricted to 5,730 respondents who provided complete information on these additional measures. All sample sizes reported are unweighted and rounded to the nearest 10 to protect confidentiality.

This analytical approach makes three key novel contributions to the literature on online education and career outcomes. First, it provides a multidimensional career assessment by examining employment duration, income, job satisfaction, and education-job match rather than focusing solely on traditional metrics like starting salaries. Second, it enables field-specific analysis through interaction models that reveal how online education's effects vary across different academic disciplines rather than treating online education as a monolithic entity. Third, it leverages a long-term longitudinal perspective with ten years of follow-up data to capture career development patterns rather than just immediate post-graduation outcomes.

3.2 Variables

This study examined four primary career outcome measures as dependent variables. Employment duration was measured as the number of months employed between bachelor's degree completion and the B&B:08/18 interview conducted in 2018. This variable (b3memp) was transformed using the natural logarithm (log_months_emp) to address skewness and facilitate interpretation of regression coefficients as approximate percentage changes. Income was captured through annual income reported at the time of the 2018 follow-up survey (b3inc18). To mitigate the influence of extreme values, the income variable was winsorized at the 99th percentile (income_clean). Additionally, a log-transformed version (log_income) was created to normalize the distribution and interpret coefficients as percentage changes.

Job satisfaction was constructed as a composite index by averaging respondents' satisfaction ratings across six dimensions of their current job: benefits (b3cjben), work challenge (b3cjchal), compensation (b3cjpay), importance of work (b3cjimp), job security (b3cjsec), and work-life balance (b3cjbal). Each dimension was rated on a 5-point Likert scale from 1 (very dissatisfied) to 5 (very satisfied). The resulting job satisfaction index has possible values ranging from 1 to 5, with higher values indicating greater overall job satisfaction. Education-job match was represented by two binary indicators: education level match (education_level_match), which indicates whether the respondent's job requires a bachelor's degree or higher (coded as 1) or not (coded as 0); and education field match (education_field_match), which indicates whether the respondent's job is related to their major field of study (coded as 1) or not (coded as 0).

The primary independent variable was program delivery mode (online_program), coded as 1 for online programs and 0 for traditional face-to-face programs, derived from the original B&B survey variable b2conline. To account for potential confounding factors, several control variables were included. Demographic characteristics encompassed race/ethnicity (race), categorized as White, Black or African American, Hispanic or Latino, Asian, American Indian or Alaska Native, Native Hawaiian/Pacific Islander, Other, and More than one race; and gender (gender), coded as Male or Female. Academic background was captured through major field of study (major_field), categorized into ten groups: Computer/Information Sciences, Engineering/Engineering Technology, Biological/Physical Sciences, General Studies, Social Sciences, Humanities, Health Care, Business, Education, and Other Applied fields. Geographic location was measured by region of residence as of the 2018 interview (b3region), categorized as Northeast, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountains, Far West, Outlying areas, and Not in U.S. or U.S. territory. For models predicting job satisfaction, income was also included as a control variable to isolate the direct relationship between program delivery mode and satisfaction beyond income effects.

3.3 Analytical Approach

A multi-method analytical strategy was employed to comprehensively examine the relationship between online education and career outcomes. The analyses progressed from descriptive statistics to increasingly sophisticated multivariate techniques designed to account for selection bias and examine complex relationships. Initially, descriptive analyses were conducted to characterize the sample and identify broad patterns in the data. These included summary statistics for all outcome variables stratified by program delivery mode, frequency distributions of categorical variables, and cross-tabulations between program type and key variables such as major field of study, education-level match, and education-field match. These descriptive analyses provided an initial assessment of differences between online and traditional program graduates while informing subsequent modeling decisions.

To more rigorously assess the relationship between program delivery mode and career outcomes while controlling for potential confounding factors, a series of multivariate regression models were estimated. For continuous outcomes (employment duration, income, and job satisfaction), Ordinary Least Squares (OLS) regression with robust standard errors was used to account for heteroskedasticity. For employment duration and income, log-transformed dependent variables were used to facilitate interpretation of coefficients as approximate percentage changes. For binary outcomes (education-level match and education-field match), logistic regression models were employed, reporting odds ratios to facilitate interpretation. The general form of the base models was:

$Y\_i = \beta_0 + \beta_1(\text{Online\_Program})\_i + \beta_2 X\_i + \varepsilon\_i,$

Where:

Y_i represents the outcome variable for individual i,

Online_Program_i indicates whether individual i graduated from an online program

X_i is a vector of control variables, and ε_i is the error term.

To assess whether the relationship between program delivery mode and career outcomes varies by field of study, models that included interaction terms between program delivery mode and major field were estimated:

$Y\_i = \beta_0 + \beta_1(\text{Online\_Program})\_i + \beta_2(\text{Major\_Field})\_i + \beta_3(\text{Online\_Program} \times \text{Major\_Field})\_i + \beta_4 X\_i + \varepsilon\_i.$

These interaction models allowed for identification of differential effects of online education across various academic disciplines, providing more nuanced insights into when online education might be particularly beneficial or potentially detrimental to career outcomes.

Recognizing that students who select online programs may differ systematically from those who choose traditional programs in ways that could affect career outcomes, propensity score matching (PSM) was implemented to address potential selection bias. The PSM approach matched online program graduates with similar traditional program graduates based on observable characteristics including major field, geographic region, race/ethnicity, and gender. Specifically, propensity scores representing the probability of enrolling in an online program were estimated using a probit model, online program graduates were matched to traditional program graduates with similar propensity scores using nearest-neighbor matching with a caliper of 0.25 standard deviations, balance on covariates between the matched groups was assessed, and the average treatment effect on the treated (ATT) for each outcome was estimated.

To explore potential mechanisms through which program delivery mode might influence job satisfaction, a mediation analysis was conducted to determine whether income mediates the relationship between program type and satisfaction. This involved regressing job satisfaction on program delivery mode (total effect), regressing income on program delivery mode (path a), and regressing job satisfaction on both program delivery mode and income (path b and direct effect). To test the joint significance of program delivery mode across multiple outcomes simultaneously, seemingly unrelated regression (SUREG) was employed. This approach accounts for potential correlations among error terms across different outcome equations, providing a more efficient estimation and allowing for joint hypothesis testing across models. All analyses use unweighted data, with sample sizes rounded to the nearest 10 for confidentiality protection.

4. Results

4.1 Descriptive Statistics

Table 1 presents descriptive statistics for the key employment outcome variables by program delivery mode. Online program graduates showed higher employment duration, with an average of 106.43 months employed between bachelor's degree completion and the 2018 interview, compared to 96.78 months for traditional program graduates. This suggests that online graduates spent approximately 10% more time employed over the ten-year follow-up period.

Conversely, traditional program graduates reported higher annual incomes, with a mean of $86,725.80 compared to $74,250.54 for online program graduates. This substantial difference of approximately $12,475 represents about 14.4% lower earnings for online graduates. However, this raw difference does not account for important factors such as field of study, demographics, or geographic location that might explain part of this disparity.

Interestingly, job satisfaction was nearly identical between the two groups, with both reporting mean satisfaction scores of 3.95 on a 5-point scale. This suggests that despite income differences, online and traditional graduates experienced similar levels of job satisfaction. Regarding education-job match, the proportion of graduates whose jobs required a bachelor's degree or higher was slightly lower among online program graduates (73%) than traditional program graduates (74%). However, online program graduates were more likely to work in jobs related to their field of study (33%) compared to traditional program graduates (29%).

The distribution of graduates across fields of study differed markedly by program type, as shown in Table 2. Traditional programs had a substantially higher concentration in Biological/Physical Sciences (35 % vs. 19.7% for online programs), while online programs had higher concentrations in Education (13.6% vs. 6.7%), Business (11 % vs. 6.9%), and Health Care (9.7% vs. 4.5%). These differences highlight the importance of controlling for field of study in subsequent analyses.

Table 1: Employment Quality Metrics by Program Type

Outcome Variable	Traditional Programs		Online Programs	
	Mean	SD	Mean	SD
Months employed between BA completion and 2018 interview	96.78	28.12	106.43	25.68
Annual Income (Winsorized at 99th percentile)	$86,725.80	$59,327.48	$74,250.54	$43,678.34
Job Satisfaction Index	3.95	0.71	3.95	0.71
Job requires BA or Higher	0.74	0.44	0.73	0.45
Job related to major	0.29	0.45	0.33	0.47
N	4,200		2,280	

Note: Sample sizes are unweighted and rounded to the nearest 10.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

Table 2: Distribution of Graduates by Field of Study and Program Type

Field of Study	Traditional Programs		Online Programs	
	N	%	N	%
Computer/Info Sciences	100	2.4	80	3.5
Engineering/Eng Tech	290	6.9	130	5.7
Bio/Physical Sciences	1,470	35.0	450	19.7
General Studies	90	2.1	70	3.1
Social Sciences	620	14.8	310	13.6

Humanities	460	11.0	210	9.2
Health Care	190	4.5	220	9.7
Business	290	6.9	250	11.0
Education	280	6.7	310	13.6
Other Applied	390	9.3	270	11.8
Total	4,200	100.0	2,280	100.0

Note: Sample sizes are unweighted and rounded to the nearest 10.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.2 Employment Duration

Table 3 presents results from the employment duration regression models. After controlling for demographic characteristics, field of study, and geographic region, online program graduates exhibited significantly longer employment duration than traditional program graduates. The coefficient for online program ($\beta = 0.0712$, $p < 0.01$) in the log-transformed model indicates that online program graduates spent approximately 7.1% more time employed during the ten-year follow-up period compared to traditional program graduates with similar characteristics.

Several other factors were significantly associated with employment duration. Black ($\beta = -0.134$, $p < 0.01$), Hispanic/Latino ($\beta = -0.071$, $p < 0.01$), and Asian ($\beta = -0.215$, $p < 0.01$) graduates experienced shorter employment durations compared to White graduates. Field of study also played an important role, with Engineering/Engineering Technology ($\beta = 0.104$, $p < 0.01$), Business ($\beta = 0.047$, $p < 0.05$), and Education ($\beta = 0.082$, $p < 0.01$) graduates showing longer employment durations, while Biological/Physical Sciences graduates ($\beta = -0.131$, $p < 0.01$) experienced shorter employment durations relative to Social Sciences graduates.

The interaction model examining whether the effect of online education varied by field of study (Table 6) revealed no statistically significant interactions, suggesting that the employment duration advantage of online education was relatively consistent across different fields of study. The propensity score matching analysis (Table 8) confirmed these findings, with matched online graduates showing 2.19 more months of employment on average compared to similar traditional graduates, although this difference was not statistically significant in the matched sample (t = 0.81).

Table 3: Impact of Online Education on Employment Duration (OLS Regression Results)

Variable	Log of Months Employed	SE
Program Delivery (ref: Traditional)		
Online	0.0712***	(0.0117)
Race/Ethnicity (ref: White)		
Black or African American	-0.134***	(0.0238)
Hispanic or Latino	-0.0711***	(0.0218)
Asian	-0.215***	(0.0279)
American Indian or Alaska Native	-0.149	(0.2041)
Native Hawaiian / Pacific Islander	-0.00772	(0.0552)
Other	-0.0778	(0.0865)
More than one race	0.00399	(0.0364)
Gender (ref: Male)		
Female	0.0181	(0.0127)
Field of Study (ref: Social Sciences)		
Computer/Info Sciences	0.0359	(0.0466)

Engineering/Eng Tech	0.104***	(0.0220)
Bio/Physical Sciences	-0.131***	(0.0171)
General Studies	-0.00518	(0.0369)
Humanities	0.00524	(0.0193)
Health Care	0.0335	(0.0264)
Business	0.0466**	(0.0234)
Education	0.0817***	(0.0191)
Other Applied	0.00177	(0.0252)
Region (ref: Northeast)		
Mideast	-0.0351	(0.0219)
Great Lakes	-0.0176	(0.0231)
Plains	-0.00728	(0.0251)
Southeast	-0.0207	(0.0207)
Southwest	-0.0507*	(0.0270)
Rocky Mountains	-0.0176	(0.0309)
Far West	-0.0448*	(0.0240)
Outlying areas	-0.437**	(0.1900)
Not in U.S. or U.S. territory	-0.160**	(0.0734)
Constant	4.597***	(0.0238)
N	6,480	
R^2	0.0737	

*Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Sample sizes are unweighted and rounded to the nearest 10. Analyses are based on unweighted data*

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.3 Income

Results from income regression models are presented in Table 4. After adjusting for demographic characteristics, field of study, and geographic region, online program graduates earned significantly less than traditional program graduates. The coefficient for online program (β = -0.0393, $p < 0.05$) in the log-income model indicates that online program graduates earned approximately 3.9% less than comparable traditional program graduates.

This adjusted income gap is substantially smaller than the raw difference observed in descriptive statistics (14.4%), suggesting that much of the raw income disparity can be attributed to differences in fields of study, demographic characteristics, and geographic distribution rather than program delivery mode itself.

The income models also revealed substantial variations by other characteristics. Women earned approximately 19.3% less than men with similar qualifications (β = -0.193, $p < 0.01$). Relative to White graduates, Black graduates earned 14.5% less (β = -0.145, $p < 0.01$) and Hispanic/Latino graduates earned 8.7% less (β = -0.0867, $p < 0.01$), while Asian graduates earned 14.5% more (β = 0.145, $p < 0.01$).

Field of study was strongly associated with income. Compared to Social Sciences graduates, those in Computer/Information Sciences (β = 0.268, $p < 0.01$), Engineering/Engineering Technology (β = 0.324, $p < 0.01$), Biological/Physical Sciences (β = 0.206, $p < 0.01$), Health Care (β = 0.195, $p < 0.01$), and Business (β = 0.108, $p < 0.01$) earned significantly more, while those in Humanities (β = -0.184, $p < 0.01$), Education (β = -0.136, $p < 0.01$), and Other Applied fields (β = -0.0971, $p < 0.01$) earned significantly less.

The interaction model (Table 6) revealed important field-specific effects of online education on income. Online program graduates in Health Care showed a particularly favorable outcome, earning about 24.5% more (β = 0.245, p < 0.01) than would be expected based on the main effects of program type and field alone. This suggests that online education in Health Care may provide unique advantages, potentially through greater flexibility to maintain employment while studying or better alignment with industry demands.

The propensity score matching analysis (Table 8) corroborated these findings. Before matching, online graduates earned $12,475 less than traditional graduates (t = -8.31). After matching on major field, region, race, and gender, this difference was substantially reduced to $2,054 in favor of online graduates, although this difference was not statistically significant (t = 0.46).

Table 4: Impact of Online Education on Income and Job Satisfaction (OLS Regression Results)

Variable	Log Income	SE	Job Satisfaction	SE
Program Delivery (ref: Traditional)				
Online	-0.0393**	(0.0171)	0.0128	(0.0197)
Race/Ethnicity (ref: White)				
Black or African American	-0.145***	(0.0271)	-0.0678**	(0.0342)
Hispanic or Latino	-0.0867***	(0.0314)	0.0355	(0.0356)
Asian	0.145***	(0.0330)	-0.0755*	(0.0388)
American Indian or Alaska Native	-0.0591	(0.1642)	0.0242	(0.1862)
Native Hawaiian / Pacific Islander	-0.316**	(0.1572)	-0.194	(0.2490)
Other	-0.327	(0.2069)	-0.212	(0.1708)
More than one race	-0.0805	(0.0567)	-0.0114	(0.0569)
Gender (ref: Male)				
Female	-0.193***	(0.0184)	0.0417**	(0.0208)
Field of Study (ref: Social Sciences)				
Computer/Info Sciences	0.268***	(0.0532)	-0.0141	(0.0643)
Engineering/Eng Tech	0.324***	(0.0376)	0.0532	(0.0422)
Bio/Physical Sciences	0.206***	(0.0266)	-0.00193	(0.0320)
General Studies	-0.0997*	(0.0533)	-0.0409	(0.0639)
Humanities	-0.184***	(0.0340)	-0.0446	(0.0397)
Health Care	0.195***	(0.0373)	0.0570	(0.0429)
Business	0.108***	(0.0353)	0.0530	(0.0411)
Education	-0.136***	(0.0299)	0.0453	(0.0384)
Other Applied	-0.0971***	(0.0319)	-0.0139	(0.0386)
Region (ref: Northeast)				
Mideast	-0.00138	(0.0344)	-0.0577	(0.0444)
Great Lakes	-0.0888**	(0.0360)	-0.0536	(0.0462)
Plains	-0.128***	(0.0404)	0.0196	(0.0478)
Southeast	-0.140***	(0.0338)	-0.0114	(0.0422)
Southwest	-0.0572	(0.0409)	-0.0214	(0.0498)
Rocky Mountains	-0.0552	(0.0497)	-0.0400	(0.0556)
Far West	0.0138	(0.0373)	-0.110**	(0.0458)

Outlying areas	-0.668***	(0.1164)	-0.132	(0.1571)
Not in U.S. or U.S. territory	-0.385***	(0.1041)	-0.0692	(0.1048)
Annual Income (Winsorized)	—		0.00000284***	(0.0000002)
Constant	11.27***	(0.0384)	3.733***	(0.0491)
N	5,730		5,730	
R²	0.133		0.0513	

*Note: * p < 0.10, ** p < 0.05, *** p < 0.01.* Sample sizes are unweighted and rounded to the nearest 10. Analyses are based on unweighted data

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.4 Job Satisfaction

Despite the income differences, job satisfaction analyses (Table 4) revealed no significant difference between online and traditional program graduates after controlling for relevant factors (β = 0.0128, p > 0.10). This suggests that lower income did not translate into lower job satisfaction for online program graduates. Income itself was positively associated with job satisfaction (β = 0.00000284, p < 0.01), indicating that higher earners generally reported greater job satisfaction. Women reported slightly higher job satisfaction than men (β = 0.0417, p < 0.05), while Black (β = -0.0678, p < 0.05) and Asian (β = -0.0755, p < 0.10) graduates reported lower satisfaction than White graduates.

Interestingly, field of study showed limited associations with job satisfaction after controlling for income and other factors, suggesting that the substantial income differences across fields did not necessarily translate into corresponding satisfaction differences. The interaction model examining field-specific effects of online education on job satisfaction (shown in Table 6) found no statistically significant interactions, indicating that the relationship between program delivery mode and job satisfaction did not vary meaningfully across fields of study.

The mediation analysis exploring whether income mediated the relationship between program type and job satisfaction yielded interesting insights. In the base model predicting job satisfaction, program type had no significant effect (β = -0.0000172, p = 0.999). However, program type significantly predicted income (β = -0.0767, p < 0.001), and income significantly predicted job satisfaction (β = 0.274, p < 0.001). When including both program type and income in the model predicting job satisfaction, program type showed a small positive but non-significant effect (β = 0.0210, p = 0.274), while income remained significant. This suggests a pattern of inconsistent mediation, whereby program type's negative indirect effect through income suppresses a potential positive direct effect on satisfaction.

Table 5: Impact of Online Education on Education-Job Match (Logistic Regression Results)

Variable	Education Level Match	SE	Education Field Match	SE
Program Delivery (ref: Traditional)				
Online	0.909	(0.0715)	1.124*	(0.0701)
Race/Ethnicity (ref: White)				
Black or African American	0.670***	(0.0767)	1.073	(0.1096)
Hispanic or Latino	1.174	(0.1493)	1.018	(0.1129)
Asian	1.101	(0.1925)	0.853	(0.1090)
American Indian or Alaska Native	0.887	(0.5761)	0.922	(0.4284)
Native Hawaiian / Pacific Islander	3.666	(3.5105)	1.177	(0.6949)
Other	0.764	(0.4709)	0.728	(0.4336)
More than one race	0.926	(0.2212)	0.959	(0.1828)
Gender (ref: Male)				

Female	1.613***	(0.1298)	1.135*	(0.0748)
Field of Study (ref: Social Sciences)				
Computer/Info Sciences	0.750	(0.1805)	3.842***	(0.7659)
Engineering/Eng Tech	1.709***	(0.3529)	2.040***	(0.2738)
Bio/Physical Sciences	1.660***	(0.1961)	1.445***	(0.1471)
General Studies	0.986	(0.3303)	0.673	(0.1765)
Humanities	0.971	(0.1458)	0.748**	(0.0972)
Health Care	1.236	(0.2180)	3.438***	(0.4794)
Business	0.917	(0.1490)	2.063***	(0.2632)
Education	1.671***	(0.2624)	1.470***	(0.1918)
Other Applied	0.860	(0.1262)	1.556***	(0.1945)
Region (ref: Northeast)				
Mideast	0.891	(0.1848)	0.804	(0.1343)
Great Lakes	0.938	(0.1996)	0.869	(0.1531)
Plains	0.870	(0.1940)	1.194	(0.2006)
Southeast	0.914	(0.1845)	0.922	(0.1485)
Southwest	0.745	(0.1651)	1.054	(0.1778)
Rocky Mountains	0.752	(0.1807)	1.251	(0.2324)
Far West	0.643**	(0.1337)	1.160	(0.1818)
Outlying areas	0.869	(0.4891)	0.906	(0.4258)
Not in U.S. or U.S. territory	0.876	(0.3507)	0.435**	(0.1783)
Annual Income (Winsorized)	1.00002***	(0.000002)	1.000002***	(0.0000006)
N	5,730		5,730	
Pseudo R^2	0.104		0.0371	

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. Sample sizes are unweighted and rounded to the nearest 10. Analyses are based on unweighted data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.5 Education-Job Match

Results from the education-job match analyses are presented in Table 5. After controlling for relevant factors, online program graduates showed no significant difference in the likelihood of holding jobs requiring a bachelor's degree or higher compared to traditional program graduates (odds ratio = 0.909, p > 0.10). However, online program graduates were significantly more likely to work in jobs related to their field of study (odds ratio = 1.124, p < 0.10).

When expressed as odds ratios, online program graduates had 1.12 times higher odds of working in jobs related to their field of study compared to traditional program graduates with similar characteristics.

Several demographic factors were associated with education-job match. Women had significantly higher odds of both education-level match (odds ratio = 1.613, p < 0.01) and education-field match (odds ratio = 1.135, p < 0.10) compared to men. Black graduates had lower odds of education-level match (odds ratio = 0.670, p < 0.01) but no significant difference in education-field match compared to White graduates.

Field of study showed strong associations with education-job match. Engineering/Engineering Technology, Biological/Physical Sciences, and Education graduates had significantly higher odds of both education-level and education-field match compared to Social Sciences graduates. Computer/Information Sciences, Health Care, and

Business showed particularly strong associations with education-field match, suggesting that these fields provide more direct pathways to related employment.

The interaction models (Table 6) revealed some field-specific effects of online education on education-job match. Most notably, online program graduates in Education had significantly higher odds of education-level match (odds ratio = 1.995, $p < 0.05$, representing odds 1.99 times higher) beyond what would be expected from the main effects of program type and field alone. Additionally, online program graduates in Engineering/Engineering Technology and Health Care had significantly higher odds of education-field match (odds ratio = 2.152, $p < 0.01$ and odds ratio = 1.842, $p < 0.05$, respectively, representing odds 2.15 and 1.84 times higher) compared to what would be expected based on the main effects.

Table 6: Field-Specific Effects of Online Education on Career Outcomes (Interaction Terms Only)

Field of Study	Log of Months Employed	Log Income	Job Satisfaction	Education Level Match (Odds Ratio)	Education Field Match (Odds Ratio)
Main effect of Online	0.0735***	-0.104**	0.0609	0.769	0.973
	(0.0259)	(0.0416)	(0.0539)	(0.1418)	(0.1755)
Interaction effects (Online × Field)					
Computer/Info Sciences	-0.0872	0.164	-0.199	1.177	0.880
	(0.0981)	(0.1051)	(0.1318)	(0.5265)	(0.3231)
Engineering/Eng Tech	0.0591	0.0251	-0.0263	0.634	2.152***
	(0.0381)	(0.0784)	(0.0877)	(0.2571)	(0.6214)
Bio/Physical Sciences	0.0215	0.0227	-0.0379	0.976	0.973
	(0.0371)	(0.0567)	(0.0654)	(0.2165)	(0.2056)
General Studies	-0.104	0.152	-0.186	1.365	0.989
	(0.0737)	(0.1071)	(0.1310)	(0.6420)	(0.4868)
Social Sciences (ref)	—	—	—	—	—
Humanities	0.0090	0.0560	-0.0404	1.338	1.147
	(0.0392)	(0.0683)	(0.0860)	(0.3823)	(0.3352)
Health Care	0.0350	0.245***	-0.111	1.161	1.842**
	(0.0522)	(0.0738)	(0.0874)	(0.4138)	(0.5125)
Business	0.0028	0.0627	-0.0848	1.240	1.085
	(0.0460)	(0.0705)	(0.0840)	(0.3767)	(0.2977)
Education	-0.0177	0.0896	-0.102	1.995**	1.235
	(0.0384)	(0.0594)	(0.0785)	(0.6182)	(0.3235)
Other Applied	-0.0687	0.0844	0.0451	1.327	1.016
	(0.0505)	(0.0630)	(0.0805)	(0.3711)	(0.2705)
Control variables	Yes	Yes	Yes	Yes	Yes
N	6,480	5,730	5,730	5,730	5,730
R^2/Pseudo R^2	0.0752	0.135	0.0527	0.106	0.0394

*Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models include controls for race/ethnicity, gender, field of study main effects, and region. Job satisfaction model also controls for income. For binary outcomes*

(education match variables), values are odds ratios. Sample sizes are unweighted and rounded to the nearest 10. Analyses are based on unweighted data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.6 Joint Analysis of Multiple Outcomes

The correlation analysis among employment quality measures revealed significant but modest relationships. Employment duration was negatively correlated with income (r = -0.0406, p < 0.05) but positively correlated with job satisfaction (r = 0.0833, p < 0.05). Education-level match was positively correlated with employment duration (r = 0.2174, p < 0.05), income (r = 0.2256, p < 0.05), and job satisfaction (r = 0.1717, p < 0.05). Education-field match showed similar but weaker positive correlations with all three measures.

The seemingly unrelated regression (SUREG) analysis examining income, employment duration, and job satisfaction simultaneously confirmed the individual model findings while accounting for correlations among outcomes. The results (Table 9) indicated that online program status was significantly associated with lower income (β = -5,471.55, p < 0.001) and higher employment duration (β = 6.45, p < 0.001) but not significantly related to job satisfaction (β = -0.0027, p = 0.892).

Table 7: Correlation Matrix of Employment Quality Measures

Variable	Employment Duration	Income	Job Satisfaction	Education Level Match	Education Field Match
Employment Duration	1.000				
Income	-0.0406*	1.000			
Job Satisfaction	0.0833*	0.1996*	1.000		
Education Level Match	0.2174*	0.2256*	0.1717*	1.000	
Education Field Match	0.0768*	0.0658*	0.0488*	0.0303*	1.000

*Note: * indicates significance at p < 0.05 level. Analyses are based on unweighted data.*

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

Table 8: Propensity Score Matching Results for Career Outcomes

Outcome	Sample	Treated (Online)	Controls (Traditional)	Difference	S.E.	t-stat
Log Income	Unmatched	11.054	11.167	-0.113	0.018	-6.18***
	ATT	11.054	11.038	0.016	0.059	0.27
Income (Winsorized)	Unmatched	74,250.54	86,725.80	-12,475.26	1,501.43	-8.31***
	ATT	74,250.54	72,196.75	2,053.79	4,483.30	0.46
Employment Duration	Unmatched	106.43	96.78	9.65	0.71	13.60***
	ATT	106.43	104.24	2.19	2.71	0.81

*Note: ATT = Average Treatment Effect on the Treated. The propensity score model included major field, region, race, and gender. * p < 0.10, ** p < 0.05, *** p < 0.01. Sample sizes are unweighted and rounded to the nearest 10. Analyses are based on unweighted data.*

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

Table 9: Seemingly Unrelated Regression (SUREG) Results - Career Outcomes

Variable	Income	Months Employed	Job Satisfaction
Online Program			
Online	-5,472***	6.449***	-0.003
	(1,292)	(0.625)	(0.020)
Demographics			
Female	-16,338***	1.567**	-0.005
	(1,574)	(0.668)	(0.021)
Black or African American	-12,061***	-4.399***	-0.102***
	(1,889)	(1.197)	(0.034)
Hispanic or Latino	-7,143***	-3.086***	0.015
	(2,334)	(1.144)	(0.036)
Asian	13,034***	-14.128***	-0.039
	(3,234)	(1.375)	(0.040)
Selected Fields of Study			
Computer/Information Sciences	23,214***	8.574***	0.052
	(4,734)	(1.808)	(0.066)
Engineering/Engineering Tech	27,045***	7.104***	0.130***
	(3,288)	(1.315)	(0.042)
Health Care	14,830***	3.444***	0.099**
	(2,826)	(1.293)	(0.043)
Education	-12,316***	7.820***	0.010
	(1,826)	(1.072)	(0.039)
Controls			
Field of study	Yes	Yes	Yes
Region	Yes	Yes	Yes
Race/ethnicity	Yes	Yes	Yes
Model Statistics			
N	5,730	5,730	5,730
R^2	0.142	0.158	0.011

*Note: Robust standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The model uses seemingly unrelated regression to estimate relationships between online education and career outcomes simultaneously. Sample sizes are unweighted and rounded to the nearest 10. Reference category: Social Sciences. Income and months employed variables are in levels (not logged).*

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18).

4.7 Summary of Key Findings

The comprehensive analyses revealed a nuanced picture of how online education relates to career outcomes. Online program graduates spent approximately 7.1% more time employed over the ten-year follow-up period compared to similar traditional program graduates, suggesting greater employment stability among online degree recipients. This finding remained consistent across different fields of study, as interaction models revealed no significant field-specific variations in the employment duration advantage of online education. Regarding income, online program graduates earned approximately 3.9% less than comparable traditional program graduates after controlling for demographic characteristics, field of study, and geographic region. This adjusted income gap was substantially smaller than the raw difference of 14.4% observed in descriptive statistics, indicating that much of the earnings disparity can be attributed

to differences in fields of study, demographic characteristics, and geographic distribution rather than program delivery mode itself. Moreover, the income gap varied considerably by field of study, with online Health Care graduates showing particularly favorable income outcomes compared to their traditional counterparts.

Despite income differences, online and traditional program graduates reported similar levels of job satisfaction, suggesting that lower income did not translate into lower job satisfaction for online graduates. Mediation analysis revealed an interesting pattern whereby program type's negative indirect effect through income may suppress a potential positive direct effect on satisfaction, resulting in overall non-significant differences in satisfaction between program types. In terms of education-job match, online program graduates showed no significant difference in the likelihood of holding jobs requiring a bachelor's degree or higher compared to traditional program graduates. However, online program graduates were significantly more likely to work in jobs related to their field of study, with 1.12 times higher odds of education-field match after controlling for relevant factors. This advantage varied by field, with online Education graduates showing better education-level match and online Engineering/Technology and Health Care graduates showing better education-field match compared to their traditional counterparts in the same fields.

The seemingly unrelated regression analysis examining multiple outcomes simultaneously confirmed these findings while accounting for correlations among outcomes, indicating that online program status was significantly associated with lower income and higher employment duration but not significantly related to job satisfaction. Correlation analysis further revealed significant but modest relationships among employment quality measures, with education-level match positively correlated with employment duration, income, and job satisfaction. While propensity score matching suggested these differences may be sensitive to model specification, the consistent direction of effects across multiple analytical approaches supports the overall pattern of trade-offs. Collectively, these findings suggest that online education may indeed serve as a "digital bridge" for employment stability and field-relevant work, despite modest income disadvantages compared to traditional education. The results highlight the importance of considering multiple dimensions of career outcomes beyond income alone when evaluating the value of online education, as well as the field-specific nature of online education's career implications. This nuanced understanding of how online education relates to various career outcomes can inform educational policy, institutional practice, and individual decision-making in an increasingly digital higher education landscape.

5. Theoretical Implications

Human capital theory helps explain the employment duration advantage observed among online graduates. The finding that online program graduates spent approximately 7.1% more time employed over the ten-year follow-up period suggests they may develop valuable forms of human capital that contribute to employment stability. Online education typically requires and cultivates self-discipline, time management, technological proficiency, and autonomous learning – skills increasingly valued in contemporary workplaces characterized by remote work, technological change, and independent project management. These competencies may enable online graduates to maintain consistent employment even during challenging economic periods such as the 2008-2009 recession captured in the study timeframe.

However, the modest income disadvantage experienced by online graduates (approximately 3.9% after controlling for relevant factors) suggests possible limitations in other dimensions of human capital development. Traditional face-to-face education may offer advantages in developing certain interpersonal skills, leadership abilities, and communication competencies through sustained in-person interaction. These social and communication skills might command premium compensation in many organizational contexts, potentially explaining part of the observed income differential despite similar employment stability.

Signaling theory provides complementary insights into these patterns, particularly the differential outcomes across career dimensions. The persistent (albeit modest) income gap despite comparable employment stability suggests that online degrees may still carry somewhat weaker signaling power in labor markets where employers harbor uncertainty about the quality or rigor of online education. This signaling disadvantage could translate into lower starting salaries or reduced promotion opportunities, affecting cumulative earnings over time.

Interestingly, the finding that online graduates were more likely to work in jobs related to their field of study (with 1.12 times higher odds of education-field match) indicates a potential signaling advantage in specific contexts. This suggests that online education may send a particularly strong signal of focused commitment and interest in a specific field, especially given that online students often select their educational path while already employed or with more life

experience. This focused, field-specific signal may be especially valuable to employers seeking specialists with demonstrated interest in their sector.

Social capital theory further enriches this interpretation, particularly regarding the field-specific variations observed. The finding that online education showed particularly favorable outcomes in Health Care (higher income), Education (better education-level match), and Engineering/Technology (better education-field match) suggests that different forms of social capital may be especially valuable in different professional contexts. In fields like Health Care, where professional communities of practice and applied skills networks are particularly important, the workplace-embedded social capital developed during online education may be especially valuable for both securing field-relevant employment and negotiating favorable compensation.

These field-specific patterns in career outcomes align with prior research on academic performance in online education. Xu and Jaggars (2014) found significant variation in performance gaps between online and face-to-face courses across different academic subject areas, with particularly pronounced gaps in social sciences and applied professions. Bettinger et al. (2017) similarly observed that the impact of online education on student success varies considerably by course type and student characteristics. These findings suggest that the labor market value of online credentials may be domain-specific, with some fields placing greater emphasis on technical skills that can be effectively developed online. The consistency between our observed field-specific employment outcomes and previous research on field-specific learning outcomes suggests that both employers and educators recognize genuine differences in how well various disciplines translate to online formats.

The integrated theoretical framework reveals that these mechanisms operate simultaneously and interactively rather than in isolation. The findings that online graduates experience longer employment duration but modestly lower income, with better field-specific matching in certain disciplines, reflect the combined influence of different configurations of human capital, differential signaling value across labor market segments, and varied forms of social capital accumulation. This integrative perspective moves beyond simplistic questions of whether online education is "good" or "bad" for careers, instead highlighting the specific mechanisms through which educational delivery mode influences various dimensions of career quality in different contexts.

6. Practical Implications

These findings have important implications for multiple stakeholders navigating an increasingly diverse higher education landscape. For prospective students, the results suggest that online education may offer distinct advantages for certain career priorities and in specific fields. Those prioritizing employment stability, field-relevant work, and the ability to maintain employment while studying may find online education particularly valuable, especially in fields like Health Care, Education, and Engineering/Technology where field-specific outcomes were especially favorable. However, individuals focused primarily on maximizing earnings may need to consider the modest income disadvantage, though this gap appears substantially smaller than raw comparisons would suggest and varies considerably by field.

For higher education institutions, these findings highlight the importance of targeted program development and support services. Rather than viewing online education as a universal substitute for traditional instruction, institutions might strategically develop online offerings in fields where the career outcomes appear particularly favorable, such as Health Care. Additionally, career services for online students could emphasize strategies for leveraging the specific human capital developed through online learning (such as technological proficiency and self-discipline) while providing targeted support for developing the social and communication skills that might be less naturally cultivated in virtual environments.

For policymakers, these results suggest the need for more nuanced approaches to accreditation, financial aid, and regulatory frameworks. The finding that online education relates differently to various dimensions of career quality argues against one-size-fits-all policies regarding online program approval or funding. Instead, field-specific considerations and multidimensional assessments of program quality and outcomes may better serve students and institutions alike.

For employers, these findings provide empirical context for evaluating candidates from different educational backgrounds. The observation that online graduates demonstrate greater employment stability and better field-specific matching in certain domains suggests that employers might benefit from more sophisticated evaluation

frameworks that consider the specific human capital relevant to their organizational needs rather than relying on generalized assumptions about credential quality.

7. Limitations and Future Research

Several limitations of the current study suggest important directions for future research. First, while the study examines a diverse range of career outcomes, it does not capture all relevant dimensions of career quality, such as work autonomy, advancement opportunities, or work-life balance. Future research could expand the range of outcomes examined to provide an even more comprehensive assessment of how educational delivery mode relates to various aspects of career quality.

Second, although the study spans a decade after graduation, it cannot determine whether the observed patterns persist beyond this timeframe or how they might evolve over even longer career trajectories. Longitudinal research tracking graduates over extended periods would provide valuable insights into the long-term career implications of educational delivery mode.

Third, despite the use of propensity score matching to address selection effects, unobserved factors affecting both program selection and career outcomes may still influence the results. Future research utilizing natural experiments or instrumental variable approaches could further strengthen causal inference in this domain.

Fourth, this study examines graduates from the 2007-2008 cohort followed through 2018, which precedes the COVID-19 pandemic and its dramatic acceleration of online education adoption. The pandemic fundamentally altered employer perceptions and acceptance of online education, potentially changing the signaling value and career implications of online degrees. Future research examining post-pandemic cohorts would provide valuable insights into whether the modest income disadvantage observed for online graduates persists in a labor market where online education has become more normalized and widely accepted. Additionally, the pandemic-driven shift toward remote work may have enhanced the value of the technological competencies and self-directed learning skills typically developed through online education, potentially altering the career advantage patterns observed in this study.

In conclusion, this study reveals that online education's relationship to career outcomes is neither uniformly advantageous nor disadvantageous, but rather characterized by distinct trade-offs that vary across different dimensions of career quality and fields of study. This nuanced understanding offers important insights for navigating educational choices in an increasingly diverse higher education landscape. Rather than asking whether online education is "better" or "worse" than traditional education for careers, a more productive approach focuses on understanding the specific contexts in which different educational delivery modes offer advantages for particular career priorities, fields, and individual circumstances.

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Author Biography

Dr. Osasohan Agbonlahor is an Assistant Professor of Leadership Studies at North Carolina Agricultural and Technical State University. Her research interests include postbaccalaureate outcomes, international student experiences and trajectories, doctoral education, and the representation of underrepresented minorities in STEM fields.