Increasing Scholarly Productivity for Earliest-Career Tenure Track Faculty: A Cohort Analysis (2011-2021)

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The pressure to "publish or perish" is well-established. However, empirical longitudinal trends of scholarly activity among recent doctoral graduates in their earliest stages of research careers remains underexplored. Understanding the pressures of scholarly dissemination for researchers within the first three years post-graduation would be a positive step toward shifting the academic culture and support the sustainable development of early-career talent. The study included analysis of the scholarly output of 65,251 doctoral graduates (i.e., cohorts with degree year of 2011–2021) who successfully transitioned to tenure-track positions. Scholarly outputs (i.e., journal articles, books, book chapters, conference proceedings) were tracked through three years post-graduation. OLS regression and Mann-Whitney U tests were employed to assess shifts in publication counts and to disentangle productivity by broad field of study. Scholarly production by earliest-career scholars rose significantly over the decade. The mean cumulative journal article counts for successful candidates increased 25.8%, from 7.72 to 9.72 articles per person, while book and chapter production declined by 25.1% and 44.8%, respectively. This was primarily driven by collaborative (middle-author) publications. Disciplinary mechanisms varied: in Agricultural, Health, and Biological Sciences, growth was driven by intensity. Conversely, in Education and the Humanities, growth was driven by participation, with a ~15% increase in the proportion of candidates who are publishing any works. Lastly, in fields such as Physical and Mathematical Science, we found a shift in mode of dissemination away from articles and towards conference proceedings. These findings suggest that earliest career research now demand significantly more scholarly production in articles and conference proceedings in many disciplines, characterized by an increase in collaboration and team science. Emphasis on the publication of books and book chapters has waned.

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1. Introduction

Faculty frequently report strong pressure to publish research findings, a phenomenon long characterized as “publish or perish”. This expectation has increasingly been extended to doctoral education, where publication during candidature is often encouraged (Kamler, 2008). Research indicates that scholars who publish during doctoral studies achieve higher subsequent research productivity and greater lifetime citation counts compared with peers who do not publish during their Ph.D. (Horta & Santos, 2016). These findings imply that early publication functions both as a mechanism for developing scholarly skills and as a signaling device in competitive academic labor markets.

Earliest-career, the window from doctoral candidate to tenure-track faculty, represents a common transition phase in the modern academic pipeline. Evidence suggests that the proportion of faculty hired directly out of graduate school has steadily declined (Bauldry, 2013). This compels future faculty to spend more time navigating temporary academic appointments, such as postdoctoral fellowships, visiting assistant professorship, or faculty-lecturer appointments. Success during this specific window is predictive of long-term academic retention. For instance, scholarly production and impact (i.e., citations to publications) during postdoctoral appointments have been shown to be stronger determinants of future faculty success than the prestige of a scholar's doctoral institution (Duan et al., 2025). Further, longitudinal bibliometric studies demonstrate that highly productive scholars often maintain their high productivity throughout their academic lifespans (Kwiek & Roszka, 2023). Thus, assessing productivity metrics in the earliest-career phase offers a means of forecasting subsequent research output, shifting academic norms, and long-term scholarly impact.

The purpose of this study was to analyze longitudinal shifts in the production of scholarship produced during the earliest-career stage, defined as the immediate three-year period following doctoral degree completion. By examining these trends across a decade of cohorts, this research evaluates how institutional, demographic, and disciplinary factors shape the productivity of scholars in the modern academic landscape. Specifically, this study answered the following research questions:

RQ1: How has earliest-career scholarly productivity changed between 2011 and 2021, and to what extent do institutional and demographic characteristics moderate these longitudinal trends?

RQ2: How has authorship composition shifted for earliest-career researchers over this same decade?

RQ3: In what ways do these longitudinal shifts in publication diverge across broad academic disciplines?

2. Methods

2.1 Data Cleaning

This study employed a comprehensive longitudinal dataset of U.S. Ph.D.-granting institutions provided by Academic Analytics, LLC (AcA). The dataset comprised of records of tenure-track faculty who earned a Ph.D. between 2011 and 2021. Non-tenure-track and alternative academic ranks, along with those who hold a terminal degree other than a Ph.D. (e.g., Ed.D., D.Sc.) were excluded. Faculty metrics include year of degree conferral, institution of degree conferral, and measures of scholarly production (published journal articles, conference proceedings, books, and book chapters). Scholars were categorized into broad academic fields using a standardized taxonomy based on classification by membership of an institutional department. Institutional metrics include Carnegie Research Activity designation (i.e., R1 and R2), Association of American Universities (AAU) membership, and public/private institutions.

The primary dependent variables were calculated as three-year cumulative production scores, capturing the total number of journal articles, conference proceedings, books, and book chapters published by each scholar up to and within the first three years following degree conferral. AcA uses a semi-automated process when matching faculty to scholarly work. Journal articles and conference proceedings are pulled from publications indexed in CrossRef matched to their DOIs (https://www.crossref.org/). Book publications and chapters are compiled from Baker & Taylor and other manually collected sources using ISBN. To address extreme outliers and the highly skewed distribution of

scholarly publishing activity across individuals, scholars comprising the top one percent of publishers for each scholarly output type were removed.

2.2 Data Analysis

Faculty rosters from the AcA database years 2011-2024 were used for the analyses. Prior to analysis, descriptive statistics were calculated to assess cohort size (i.e., the number of scholars ever hired into a tenure-track position by degree year), cohort by current academic rank (i.e., assistant, associate, full professor), and the number of scholars by broad field for the 2011-2021 window.

To descriptively assess longitudinal shifts in productivity, mean cumulative output for each subsequent cohort was calculated and expressed as a percentage change relative to the 2011 baseline. Then, Ordinary Least Squares (OLS) regression models were estimated to determine the influence of institutional and demographic factors on production of scholarly output. The models tested the main effects of cohort year on cumulative publication output. Subsequently, interaction models were constructed to evaluate whether the trajectory of earliest-career productivity varied significantly based on Carnegie research activity classification, AAU membership status, public versus private degree institutions, and gender.

Next, authorship composition and changes in collaboration were examined. Non-parametric Mann-Whitney U tests were conducted to compare the absolute volume of lead-authored publications and collaborative (i.e., middle-authored) publications between the 2011 and 2021 cohorts. Additionally, a proportional metric was calculated for each scholar to represent the percentage of their total portfolio in which they served as the first author. This allowed for an assessment of whether the concentration of lead-authored work within individual portfolios shifted over time (compared to increased authorship through coauthoring, i.e., being added as an author to a publication one did not primarily write). The authorship composition analysis was restricted solely to individuals with complete authorship records, removing around eight percent with incomplete authorship metrics.

Lastly, analyses were disaggregated by 12 broad academic fields to account for heterogeneous publication norms. For each specific field, Mann-Whiney U tests were

utilized to evaluate statistically significant differences in publication volume between the 2011 and 2021 cohorts. This comparison of volume was paired with an analysis of participation rates, measuring the change in the proportion of the cohort that published at least one scholarly work. Additionally, to capture disciplinary variations in collaboration, the analysis assessed shifts in authorship composition by calculating the change in the proportion of lead-authored publications within each field across the two cohorts.

3. Results

The analyses comprised of 65,251 tenure track faculty members who earned their doctorates between 2011 and 2021. An analysis of cohort sizes revealed that earlier graduating classes were larger, peaking with the 2012 cohort (n = 7,985) and gradually declining to the 2021 cohort (n = 3,775), Figure 1. This observed decline is primarily attributable to the natural lag of the academic job market, and it is expected that the representation of the most recent cohorts will continue to increase in the coming years as those graduates' complete postdoctoral appointments and secure tenure track employment. Across twelve broad academic fields, the highest concentrations of faculty were in Social and Behavioral Sciences (n = 12,172), Physical and Mathematical Sciences (n = 11,773), and Engineering (n = 9,569). As expected, current academic rank was stratified by cohort year. Faculty from the earliest cohorts held predominantly Associate and Full Professor positions, whereas the most recent cohorts were composed of Assistant Professors.

[Insert Figure 1 Here]

Baseline descriptive analyses indicated an upward trend in publication volume of articles and conference proceedings, and a decrease in publication volume of books and book chapters compared to the 2011 baseline (Figure 2). Descriptive statistics of publication metrics are presented in Table 1. For the 2011 cohort, the mean number of cumulative journal articles published within the first three years post-graduation was 7.75. By the 2021 cohort, this average increased to 9.87. A similar trajectory was observed for conference proceedings, which grew from a mean of 1.18 in 2011 to 2.24 in 2021.

Conversely, the production of books and book chapters declined over the same period. The remaining analyses focused on production of journal articles and conference proceedings.

[Insert Figure 2 Here]

[Insert Table 1 Here]

Ordinary Least Squares (OLS) regression models were estimated to examine longitudinal cohort scholarly production trends, along with institutional and demographic influences, as reported in Table 2. For journal articles, the cohort year positively predicted article output (B=0.269, p<0.001), indicating a steady longitudinal increase. Institutional and demographic factors also served as significant predictors. Faculty at AAU member institutions (B=0.645, p<0.001), R1 institutions (B=1.166, p< 0.001), and public institutions (B=0.340, p<0.001) produced significantly more articles. Female faculty produced significantly fewer articles compared to their male counterparts (B= -1.558, p< 0.001).

[Insert Table 2 Here]

In the interaction model, which tested whether longitudinal growth varied by these characteristics, only the interaction between cohort year and gender was statistically significant (B=0.156, p<0.001). This shows that while male faculty maintained higher overall output, the rate of publication growth across the decade was steeper for female faculty. Interactions for Carnegie classification, AAU status, and public institution status were not statistically significant.

[Insert Figure 3 Here]

The same analysis was conducted for conference proceedings. The main effects model revealed significant positive associations for cohort year (B=0.104, p<0.001), AAU membership (B=0.304, p <0.001), R1 institutions (B=0.343, p<0.001), and public institution status (B=0.155, p<0.001). Female faculty produced significantly fewer conference proceedings than their male peers (B= -1.353, p<0.001). The interaction

model again revealed a significant moderation effect for gender (B= -0.056, p<0.001), however, the negative interaction indicates the production of conference proceedings is increasing faster for male faculty, widening the gender gap. In line with journal article production, interactions for Carnegie classification, AAU status, and public institution status were not statistically significant.

[Insert Table 3 Here]

[Insert Figure 4 Here]

Changes in authorship composition were assessed by examining the absolute volume of first-authored and collaborative publications alongside the proportion of a portfolio in which a scholar served as the lead author, Table 4. Growth was primarily driven by collaborative increases rather than lead-authored research. For the 2011 cohort, scholars published a mean of 6.07 total articles, composed of 3.07 first-authored and 3.00 collaborative publications. By 2021, mean total articles increased to 7.62. However, first-authored publications grew only marginally to 3.30, while collaborative publications surged to 4.31. Consequently, the average lead authorship proportion of earliest career portfolios steadily declined from 58.49 percent in 2011 to 52.03 percent in 2021.

[Insert Table 4 Here]

Mann Whitney U tests were utilized to evaluate differences in publication volume and participation between the 2011 and 2021 cohorts across 12 broad academic fields, Table 5. For journal articles, significant increases in volume were observed in nearly all fields. Agricultural Sciences demonstrated the largest absolute growth, increasing by 6.90 articles. Health Professions Sciences and Biological and Biomedical Sciences also saw substantial increases of over 4.5 articles. Physical and Mathematical Sciences was the only field that did not exhibit a statistically significant change in total article volume. Humanities and Education also increased participation rates (17% and 15%, respectively) between the two cohorts.

[Insert Table 5 Here]

For conference proceedings, Physical and Mathematical Sciences experienced the largest absolute growth, increasing by 2.9 proceedings, alongside a 20% increase in participation of scholarly production. Business (1.2 proceedings), Engineering (1.2 proceedings), and Education (1.1 proceedings) also demonstrated statistically significant increases in conference proceeding output. Education also increased participation in at least one conference proceedings by 34% in the ten-year period.

[Insert Table 6 Here]

4. Discussion

Results indicate a significant longitudinal increase in the volume of journal articles and conference proceedings produced by earliest-career scholars, alongside a decrease in book production. These patterns align with previous research indicating a systemic move away from monographic publications in favor of shorter, more rapid forms of dissemination (Savage & Olejniczak, 2021). Institutional characteristics, including R1 classification, AAU membership, and public status, significantly predicted higher overall publication volume. This finding supports the premise that faculty at research-intensive institutions benefit from labor advantages and larger research teams that facilitate higher output (Zhang et al., 2022). However, the lack of significant interaction effects between institutional markers and cohort year suggests that productivity is increasing at a relatively uniform rate across the academic landscape. For earliest-career scholars, this indicates that the pressure for productivity is a systemic trend.

Gender remains a significant factor in earliest-career productivity. Gender remains a significant factor in earliest-career productivity, as female faculty produced fewer journal articles and conference proceedings than their male counterparts across the decade. Despite this persistent baseline difference, the findings reveal diverging longitudinal trajectories. Female faculty are increasing their journal article production at a faster rate than male faculty, suggesting a narrowing of the gender gap in article output. Conversely, the gender gap for conference proceedings is widening as male faculty increased their output more rapidly. This divergence may be attributed to gendered

professional networks and disparities in invitations to present at conferences, which often serve as the primary gateway for proceeding publications (Haghani et al., 2022).

While the number of first-authored publications increased slightly between 2011 and 2021, the growth in collaborative (i.e., middle-authored) publications was substantially higher. This shift reflects the broader expansion of team science that has characterized academic research for several decades (Wuchty et al., 2007). Earliest-career researchers appear to be strategically boosting their scholarly portfolios by engaging in collaborative projects with larger research groups. Because teams generally produce more research than individuals, this reliance on collaboration allows scholars to meet increasing productivity demands (Zhang et al., 2022). However, this trend also suggests that the modern earliest-career portfolio is becoming increasingly defined by collective efforts rather than independent, sole-authored contributions.

[Insert Table 3 Here]

[Insert Figure 4 Here]

Broad field comparisons indicate that while rising productivity is nearly universal, growth patterns vary by academic culture. For journal articles, Agricultural Sciences and Health Professions Sciences saw the largest absolute increases, reflecting a systemic shift toward article-based dissemination even in historically diverse fields (Savage & Olejniczak, 2021). Physical and Mathematical Sciences remained stable in article volume but experienced the highest growth in conference proceedings, suggesting that some STEM fields are channeling productivity pressures into faster dissemination cycles. Notably, participation rates increased in the Humanities and Visual and Performing Arts, suggesting that scholars in monographic disciplines are increasingly supplementing their portfolios with alternative publication types to remain competitive (Marwick et al., 2025). Finally, Education was unique as the only field to experience increased productivity through first-authorship for both articles and proceedings, likely due to the rise of manuscript-style dissertations that prioritize independent, publishable units (Anderson et al., 2021).

[Insert Table 4 Here]

The findings of this study highlight a transformative period for earliest-career scholarship marked by rising volume and shifting authorship norms. The transition from doctoral student to independent faculty member is now defined by a higher baseline of productivity that is increasingly collaborative. As the metrics of the modern Ph.D. become the standard for the academic job market, earliest-career scholars must navigate a landscape where high volume and strategic collaboration are essential for professional survival. These shifts have profound implications for graduate education and the criteria used to evaluate the next generation of the professoriate.

5. Limitations

Several limitations should be considered when interpreting these findings. First, the cohorts likely underrepresent the total number of scholars from recent cohorts who will eventually secure tenure-track positions. Due to the increasing duration of postdoctoral appointments and the extended nature of the academic job market, many productive researchers from recent cohorts may not have yet obtained the tenured/tenure track faculty roles required for inclusion. While these cohort sizes will grow as more individuals secure employment, it is unlikely their inclusion diminishes observed trends. Additionally, this study focused exclusively on faculty at four-year Ph.D.-granting institutions, and the results do not reflect the earliest-career productivity of scholars in non-tenure-track roles, community colleges, or sectors outside of academia.

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1. Figures

Figure 1. Cohort Descriptives

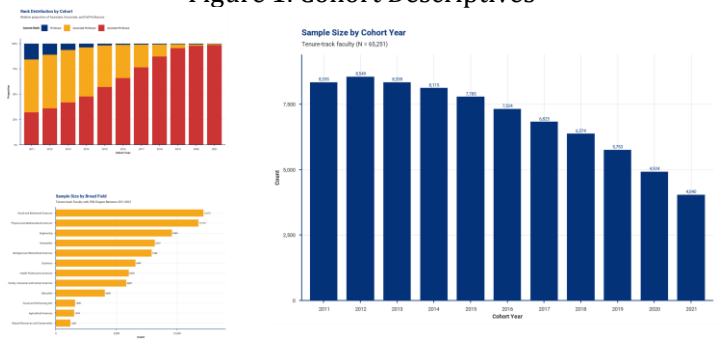


Figure 2. Productivity Change Since 2011

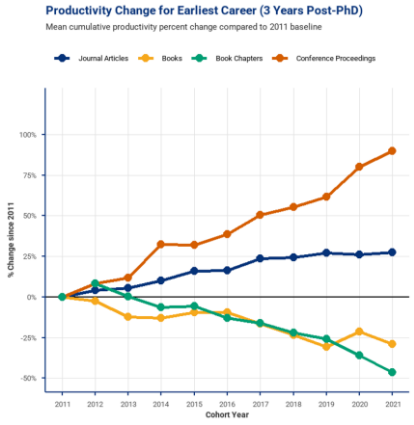


Figure 3. Moderation Analysis of Journal Article Production

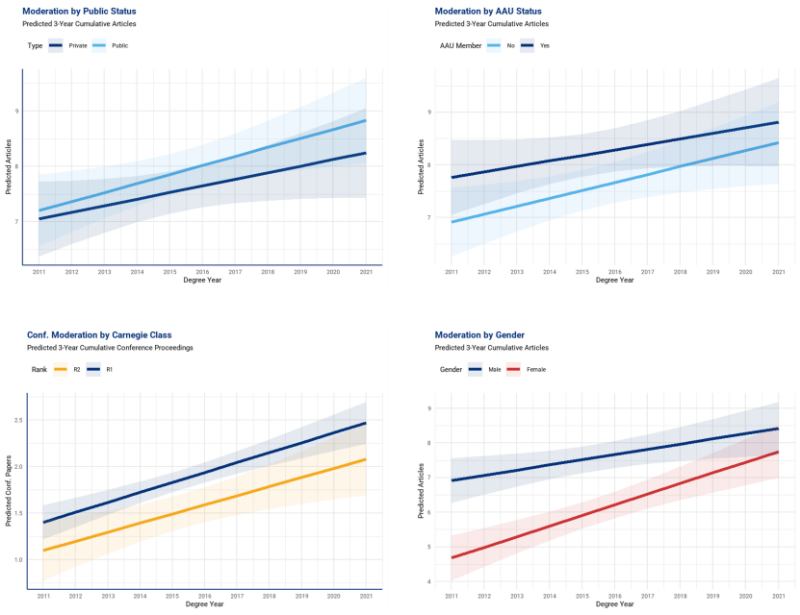
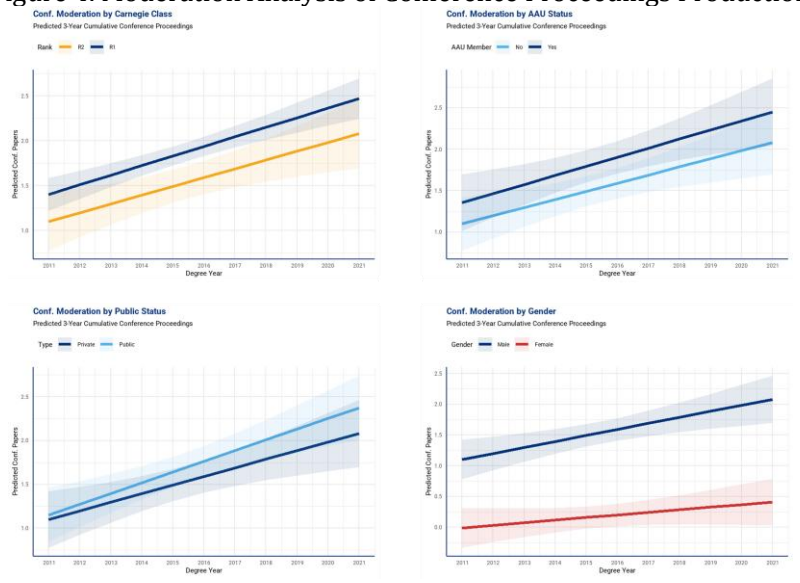


Figure 4. Moderation Analysis of Conference Proceedings Production



2. Tables

TABLE 1
Descriptive Statistics of Cohort Production Metrics

Cohort	Median	Mean

	Articles	Articles	Books	Chapters	Conference Proceedings
2011	5	7.75	0.08	0.46	1.18
2012	5	8.05	0.07	0.50	1.28
2013	6	8.17	0.07	0.46	1.32
2014	6	8.51	0.07	0.43	1.57
2015	6	8.94	0.07	0.43	1.58
2016	6	9.00	0.07	0.40	1.67
2017	7	9.53	0.06	0.39	1.8
2018	6	9.60	0.06	0.36	1.84
2019	7	9.79	0.05	0.34	1.93
2020	7	9.73	0.06	0.29	2.16
2021	6	9.87	0.05	0.25	2.24

TABLE 2

OLS Regression Results for Earliest-Career (3-Year Cumulative) Journal Article Production

	B (SE)	*p*
Main Effects		
Intercept	-535.291 (25.474)	<.001
Year	0.269 (0.013)	<.001
R1	1.166 (0.192)	<.001
AAU	0.645 (0.088)	<.001
Public	0.340 (0.087)	<.001
Female	-1.558 (0.076)	<.001
Interactions		
Year × R1	0.068 (0.064)	.291
Year × AAU	-0.032 (0.029)	.270
Year × Public	0.043 (0.029)	.133
Year × Female	0.156 (0.025)	<.001

Note. (B) = unstandardized regression coefficient; (SE) = standard error.

TABLE 3

Regression Results for Earliest-Career (3-Year Cumulative) Conference Proceedings Production

	B (SE)	p
Main Effects		
Intercept	-207.687 (12.162)	<.001
Year	0.104 (0.006)	<.001
R1	0.343 (0.092)	<.001
AAU	0.304 (0.042)	<.001
Public	0.155 (0.042)	<.001
Female	-1.353 (0.036)	<.001

	B (SE)	p
Interactions		
Year × R1	0.009 (0.031)	.774
Year × AAU	0.011 (0.014)	.417
Year × Public	0.024 (0.014)	.079
Year × Female	-0.056 (0.012)	<.001

TABLE 4

Longitudinal Comparison of Authorship Composition (2011 vs. 2021)

Authorship Metric	2011 Mean	2021 Mean	Absolute Change	p
Total Publication Volume	6.07	7.62	1.55	<.001
First-Author Publications	3.07	3.3	0.23	<.001
Collaborative(Middle-Authored) Publications	3	4.31	1.31	<.001
Solo-Author Publications	0.62	0.61	-0.01	0.64
Portfolio Lead Authorship (%)	58.50%	52.00%	-6.50%	<.001

TABLE 5

Broad Field Comparison for Journal Articles (2011 vs. 2021)

Broad Field	2011 Mean	2021 Change	2011 Participation Rate (%)	2021 Participation Change (%)	Portfolio Lead Authorship Change (%)
Agricultural Sciences	8.56	6.9***	92.4	5.4%	-6.4
Health Professions Sciences	9.26	4.6***	90.8	1.4%	0.1
Biological and Biomedical Sciences	11.40	4.5***	97.6	0.1%	-2.6
Education	3.44	3.5***	74.8	14.6%	3.3
Family, Consumer and Human Sciences	7.54	2.9***	89.7	5.0%	-3.7
Natural Resources and Conservation	10.10	2.8**	98.1	0.3%	-12.7
Engineering	10.20	2.6***	95.2	2.5%	-13.1
Social and Behavioral Sciences	6.36	2.4***	89.6	3.3%	-7.8
Humanities	2.44	0.9***	75.2	9.0%	-3.9
Visual and Performing Arts	1.77	0.6**	59.9	16.6%	-8.0
Business	4.00	0.5*	87.3	4.6%	-6.1
Physical and Mathematical Sciences	9.87	-0.40	95.1	0.5%	-7.4

Note. *p<.05, **p<.01, ***p<.001.

TABLE 6

Broad Field Comparison for Conference Proceedings (2011 vs. 2021)

Broad Field	2011 Mean	2021 Change	2011 Participation Rate (%)	2021 Participation Change (%)
Physical and Mathematical Sciences	3.05	2.9***	41.6	19.9
Business	0.66	1.2***	21.0	19.0
Engineering	5.15	1.2***	66.4	9.7
Education	0.16	1.1***	7.5	34.5
Agricultural Sciences	0.15	0.3	9.4	6.9
Family, Consumer and Human Sciences	0.26	0.3**	13.4	6.0
Biological and Biomedical Sciences	0.18	0.2***	9.1	11.8
Visual and Performing Arts	6.36	0.2*	4.6	6.5
Social and Behavioral Sciences	2.44	0.1***	4.4	4.8
Humanities	1.77	0.4**	2.1	3.0
Health Professions Sciences	4.00	0.3	8.1	1.9
Natural Resources and Conservation	9.87	0.01	7.7	2.3

Note. *p<.05, **p<.01, ***p<.001.