

Expanding the Broadening Participation in Engineering Focus to Include Data on Nontraditional Students

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Introduction

As the need for more technically skilled workers in the U.S. engineering workforce increases, working adults are returning to college for degree attainment to advance their careers. Returning to college part-time has become more feasible for working adults with the increasing popularity of online courses [19],[10],[4],[14], [1], [2]. However, the higher education system was not designed for working adults with many obligations that can challenge bachelor's degree attainment. Family obligations and responsibilities, for example, along with financial concerns and employment obligations, can make enrolling in and completing a bachelor's program, as it is currently designed, difficult [4],[14],[11],[3]. For this discussion and this study, we can consider these working adults returning or continuing undergraduate students as *nontraditional students* (NTS), an often-overlooked student population in higher education [4]. Nontraditional students are students who are over age 24 years old enrolled in college or university. Nontraditional students are a growing population in higher education, yet they have the highest attrition rate compared to traditional students [7],[3]. The term "nontraditional students" has been replaced in recent years with the more inclusive label, *post-traditional students* [18]. Many terms exist for this student population, including "adult learners," "post-traditional students," and "new traditional students" [9]. However, for this study, this student population is referred to as nontraditional students since this is the term the United States Department of Education chose to identify this population [15]. Additionally, this study focuses on the lack of institutional data on nontraditional students [3],[6].

The National Center for Educational Statistics (NCES), along with Horn [12], [5], defined nontraditional students by seven criteria: 1) delayed enrollment, which is determined by students who Horn notes are "older than [the] typical age" of college students; 2) part-time enrollment, 3) financial independence, 4) full-time employment status while enrolled, 5) have dependents (any non-spouse dependents such as caring for elderly parents, other minors or legal dependents), 6) single parent and 7) did not receive standard high school diploma. If students fit at least one of these characteristics, they are considered nontraditional. However, the more characteristics a student possesses, subsequently, increases the student's nontraditional status. For instance, Horn [12] uses the scale of nontraditional status to classify students as minimally nontraditional (students possessing one nontraditional characteristic), moderately nontraditional (students possessing two or three nontraditional characteristics), and highly nontraditional (students possessing four or more nontraditional characteristics).

One of the significant challenges to persistence for nontraditional students is high attrition rates due to several factors. Time management and balancing multiple responsibilities contribute to attrition, with family and work obligations being the primary sources. Family obligations include caring for elderly dependents and childcare. Due to delayed enrollment, many nontraditional students struggle to transition back to an academic setting [11]. Many nontraditional students have not yet developed or have been away from notetaking skills, test-taking strategies, textbook reading techniques, writing and mathematics skills, and adherence to faculty expectations in the classroom. Fear and anxiety also contribute to high attrition rates [7],[14],[11]. Nontraditional students fear returning to the classroom due to attending class with younger, traditional students, missing family events, and family members not understanding their

academic demands. These factors contribute to 70% of nontraditional students dropping out after four months in the classroom [12],[8],[17].

Nontraditional students accounted for about 65% of the total undergraduate student population in 1986 and about 70% in 1992 [12]. In 2011-2012, nontraditional students comprised 74% of the total undergraduate student population [16]. The recent data show that 64% of students work while enrolled, and 40% of students have full-time employment [13]. These findings suggest that most undergraduate students would be considered nontraditional, making the traditional students (defined as students between 18-24 years old who enroll full-time in a degree program immediately after high school in the summer or fall) the minority population in higher education [11]. Yet, we note that much attention and resources are focused on supporting traditional students compared to nontraditional students [9],[11].

Investigating trends in retention and graduation rates for nontraditional students is challenging since the data sources for evaluating nontraditional status are fragmented. Currently, a national database that solely focuses on nontraditional student retention and graduation rates is not publicly available [3],[6]. This study aims to examine institutional student data for nontraditional engineering students at a large public minority-serving Institution for each of the seven characteristics. Our guiding research is: *What are the enrollment trends for nontraditional engineering students based on the seven characteristics at a large minority-serving institution?*

Methodology

Data Collection

The research site for this work-in-progress quantitative study is a large public, minority-serving institution in the southeast United States. The pseudonym State University (SU) was used to describe this institution. Aggregated, de-identified student data was gathered for engineering majors who initially enrolled at State University between Fall 2018 and Fall 2023. Of 120,375 engineering student records, 36,963 qualified as nontraditional undergraduate engineering students based on the seven factors articulated above. Aggregated, de-identified student data was gathered from the Free Application for Federal Student Aid (FAFSA), student enrollment, and student admission data. Data was included for students enrolled in an engineering degree program who were first-time college students (FTIC), community college transfer students (CC Transfer), other transfer students, and undergraduate non-FTIC. CC Transfer students refer to students who transferred from a community college in the state where State University is located. Other transfer students are students who transferred from a community college or a lateral transfer student from a four-year university. Undergraduate non-FTIC refers to international students specifically recruited to increase the number of international students at SU.

The database was organized into a Microsoft Excel file. The file includes the following data categories: academic year, academic plan, department, starting age, current age, student admission type, Pell Grant eligibility, marital status, dependent status, children status, adjusted gross income, standard earned income, enrollment status, gender, ethnicity, and highest degree level held. Table 1 lists the data categories for this data file and describes the category. To connect these categories to the seven characteristics of nontraditional students, Table 2 provides

a detailed description of the data source for the seven characteristics of nontraditional students. For example, for delayed enrollment, the starting age upon admission to the university will be used as a proxy for this characteristic.

Term Description (TERM_DESC) – describes the semester of enrollment.	Student Admission Type (STUDENT_ADM_TYPE) – student status upon admission	*Standard earned income (STD_EARNED_INCOME) – earned income of the student
Academic Year (ACAD_YR) – academic year of enrollment	*Pell Grant Eligibility (PELL_ELIGIBILITY) – student status as a Pell Grant recipient	Enrollment Status (ENROLLMENT_STATUS) – describes the student’s enrollment status
Academic Plan (ACAD_PLAN)	Marital Status (MARITAL_STAT) – student’s marital status	Gender (gender) – describes the gender the student selected (Male/Female/Not Reported)
Department (DEPARTMENT) – academic department	*Dependents (DEPENDENTS) – if the student has dependents or not	Ethnicity(ethnicity) – student ethnicity
Starting Age (START_AGE) – starting age when initially enrolling at the university	*Children (CHILDREN) – if the student has children or not	Highest level degree held (DEGR_HIGHLV_HELD_DESCR)- The highest degree the student held upon admission to the university.
Current Age (CURRENT_AGE) – current age when enrolled in current semester at the university	*Adjusted Gross Income (agi) – the adjusted gross income of the student	Academic sub plan (ACAD_SUB_PLAN) – Additional academic plan such as a minor or certificate program.

Table 1 – Data file categories of aggregated, de-identified nontraditional engineering students
(*these data points were collected from student responses to the FAFSA)

Seven Criteria of Nontraditional Students	Categories from the data set to determine the seven characteristics.
Delayed Enrollment	Starting Age, Highest Degree Held (proxy)
Part-Time Enrollment	Enrollment Status
Financial Independence	Pell Grant Eligibility, Standard Earned Income (proxy)
Full-Time Employment	Standard Earned Income (proxy)
Student has dependents	Dependents (any non-spouse dependents)
Student has children	Children
Student has alternative high school diploma	Highest Degree Held

Table 2. Matching dataset categories to seven characteristics of nontraditional students

Data Analysis

Descriptive statistics were gathered for students based on the available data described in Table 2. For the *part-time enrollment*, *students with dependents*, *students with children* and *students with alternative high school diploma*, data was extracted directly from the dataset. However, for delayed enrollment, financial independence, and full-time employment data, proxies were used

to estimate the descriptive data for these characteristics. For delayed enrollment, the starting age was set for students 25 years old or older where were enrolled in the current semester at SU. Nontraditional status is typically considered for students over 24 years old. Table 8 shows the number of students ages 25 and older for each semester in the study. For financial independence, Pell Grant eligibility was used with the student income threshold of \$26,000. This threshold amount aligns with the threshold used for full Pell Grant eligibility. Blank responses were omitted. For full-time employment, students that were not eligible for the Pell Grant and with a student income equal to or greater than \$26,000 were used as criteria to determine full-time employment status.

Results

Descriptive statistics were generated for undergraduates at SU meeting one or more of the seven defining nontraditional student criteria during the years specified above. The following tables (available in the appendix) provide data on part-time enrollment (Table 3), students with dependents (Table 4), students with children (Table 5), and the highest degree level attained upon enrolling in State University (Tables 6 & 7). One of the most salient findings is that, on average, part-time enrollment was about 40% for the six-year period. Figure 1 highlights this trend in part-time enrollment. The percentages of students with dependents and students with children have decreased for the six-year period. This percentage decrease is highlighted in Figures 2 & 3.

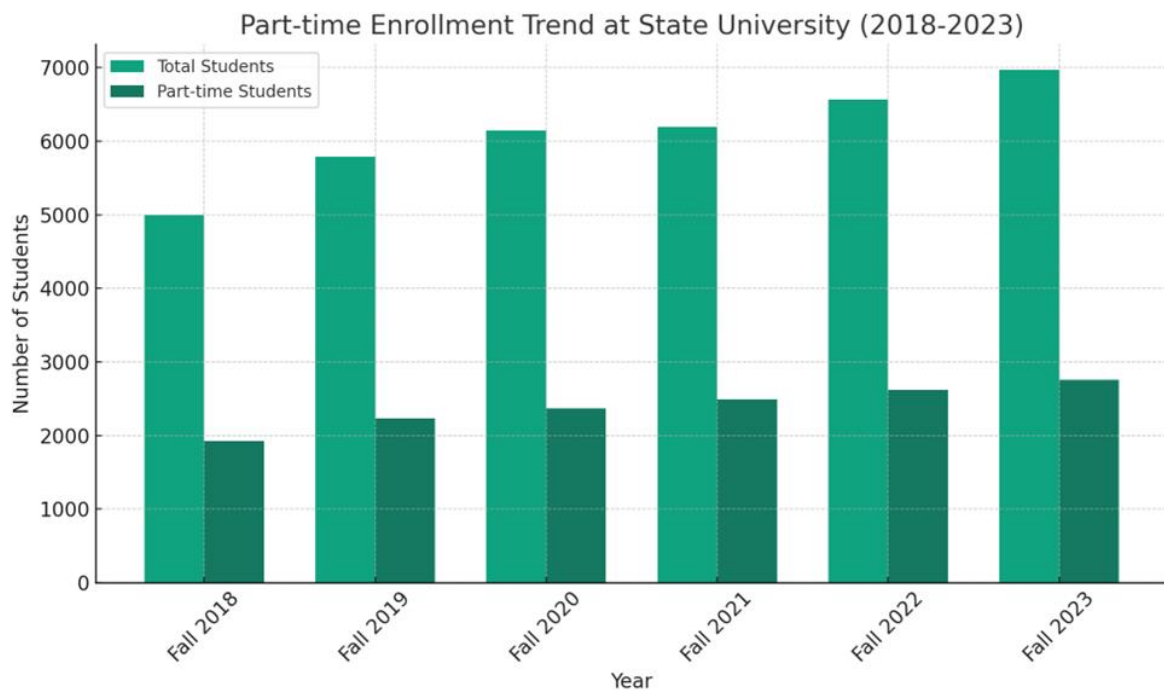


Figure 1. Part-time Enrollment Trend at State University (2018-2023)

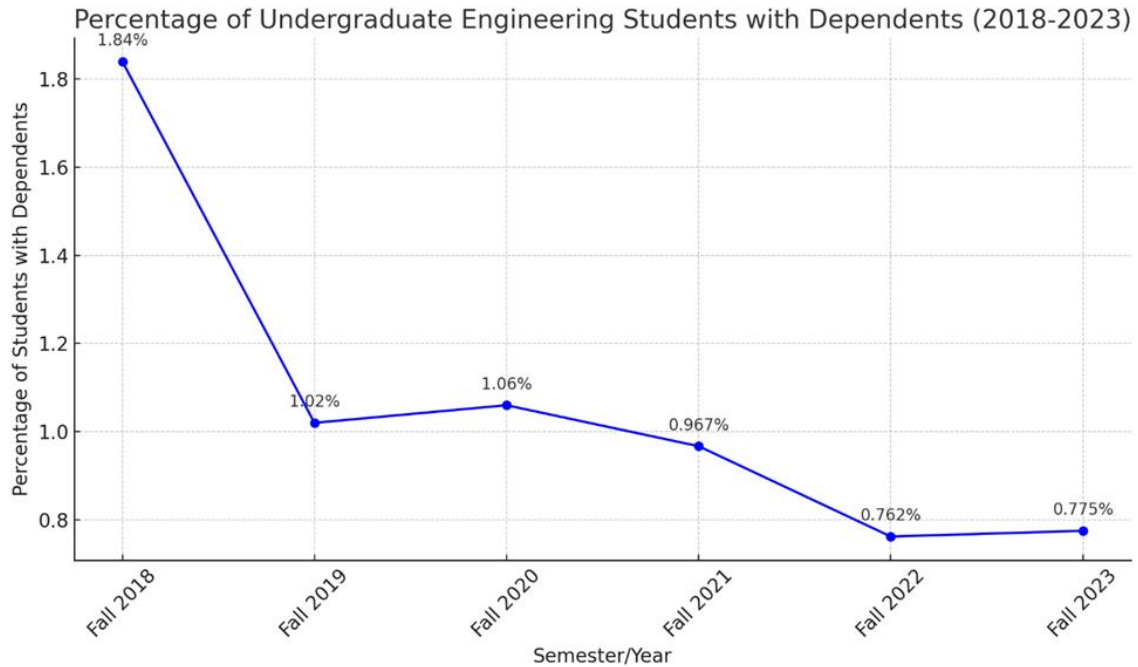


Figure 2. Percentage of Undergraduate Engineering Students with Dependents at State University (2018-2023)

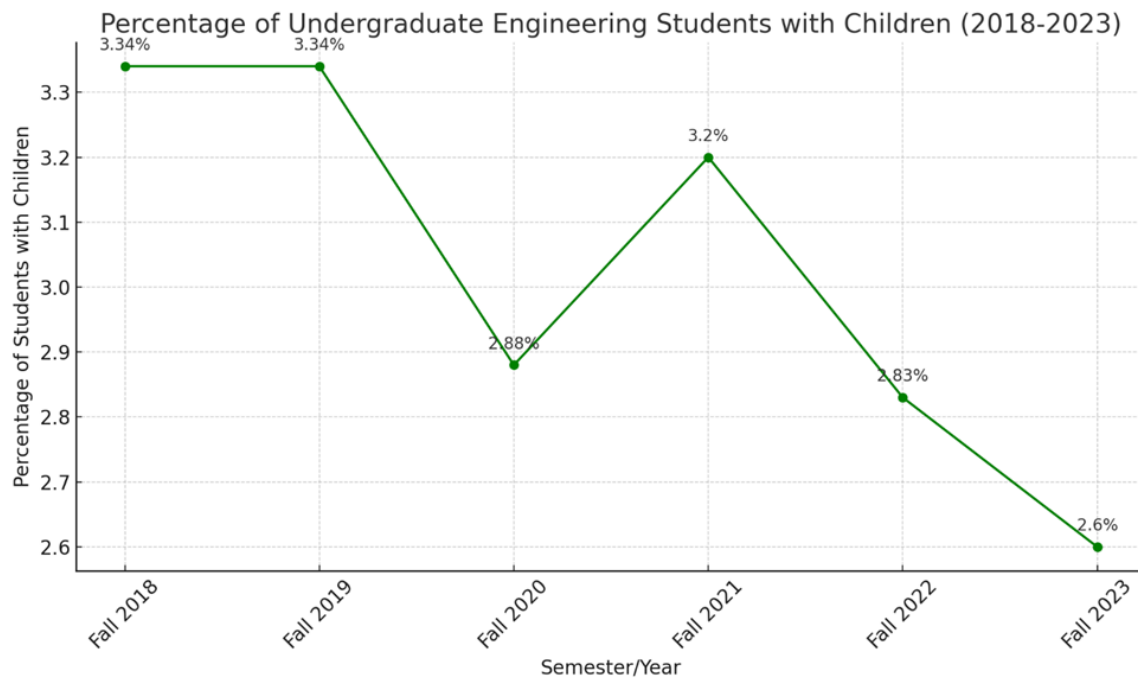


Figure 3. Percentage of Undergraduate Engineering Students with Children at State University (2018-2023)

Table 7 shows the average percentage of students with high school diplomas, associate degrees, and no degree (No Degree status means a student enrolled in the university through a special program (i.e., dual enrollment or transfer student) and did not require a degree to be admitted to SU. Figure 4 provides a comparison of no degree students with all students. During the years for which data was reported, on average around half (49%) of all nontraditional students entered with a high school diploma and about 40% entered with an associate degree. Figure 5 provides a comparison of the highest degree level upon entry to SU. However, it could not be determined if students entering State University with associate degrees received an alternative high school diploma. Further study is needed to determine their alternative high school diploma credentials. Over the six-year period, an average of 12% of post-traditional engineering students at SU entered with “no degree” (no high school diploma).

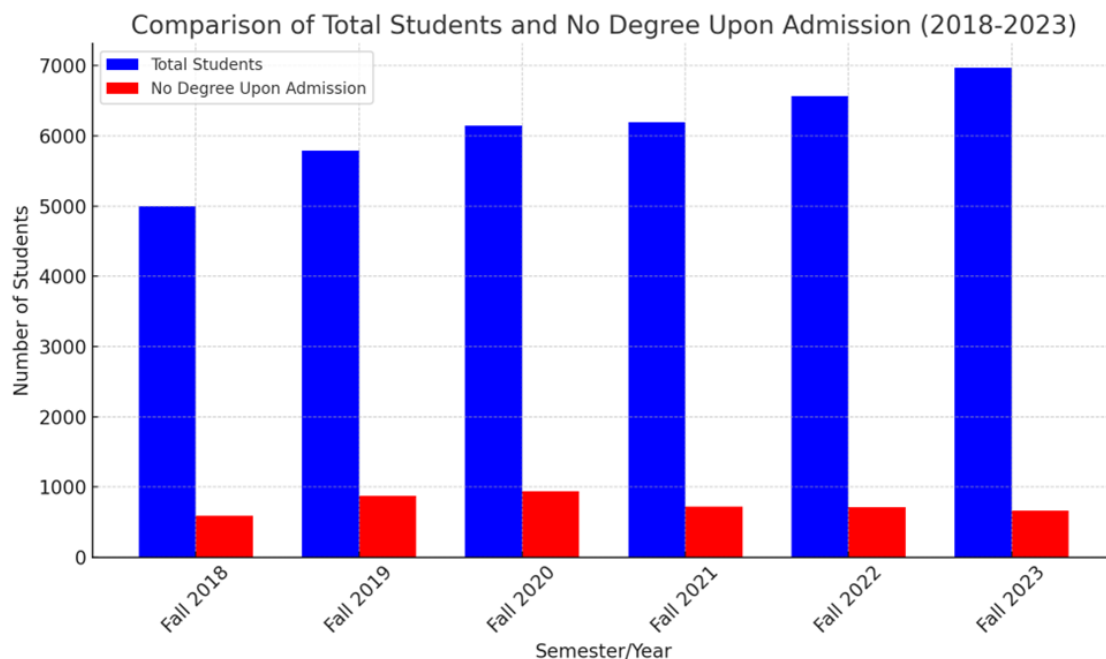


Figure 4. Comparison of Total Students and No Degree Upon Admission at State University (2018-2023)

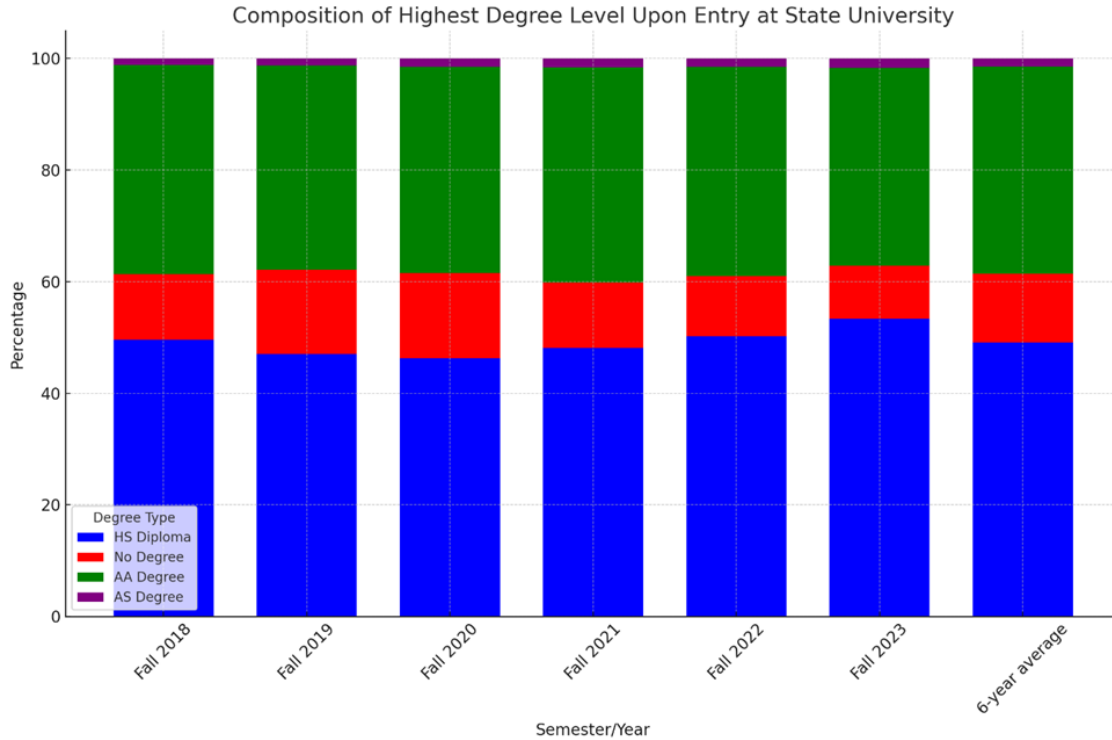


Figure 5. Comparison of Highest Degree Level Upon Entry at State University (2018-2023)

For delayed enrollment data, it could not be determined if the students had delayed enrollment between finishing high school and starting college but, the starting age was used as a proxy. Table 8 shows the number of students ages 25 and over. Figure 6 shows that most students are between the ages of 25 to 30. The average percentage of students who are ages 25 and over is 16.33%. For financial independence and full-time employment, Pell Grant eligibility and the standard earned income were used to calculate descriptive statistics for these criteria. Table 9 shows the amounts and percentages of students considered financially independent. Table 10 shows the amounts and percentages of students with a yearly income of \$26,000 or more. Figures 7 and 8 highlight a decrease in the number of students with incomes over \$26,000 and Pell Grant ineligible students starting in the Fall 2021 semester.

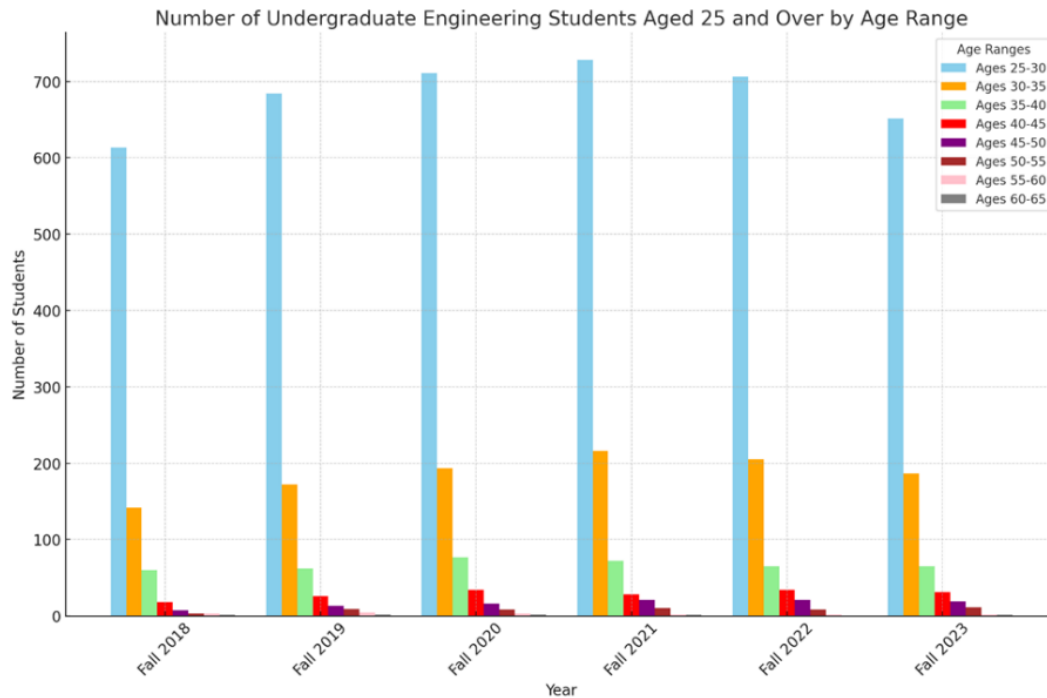


Figure 6. Number of Undergraduate Engineering Students Aged 25 and Over by Age Range at State University (2018-2023)

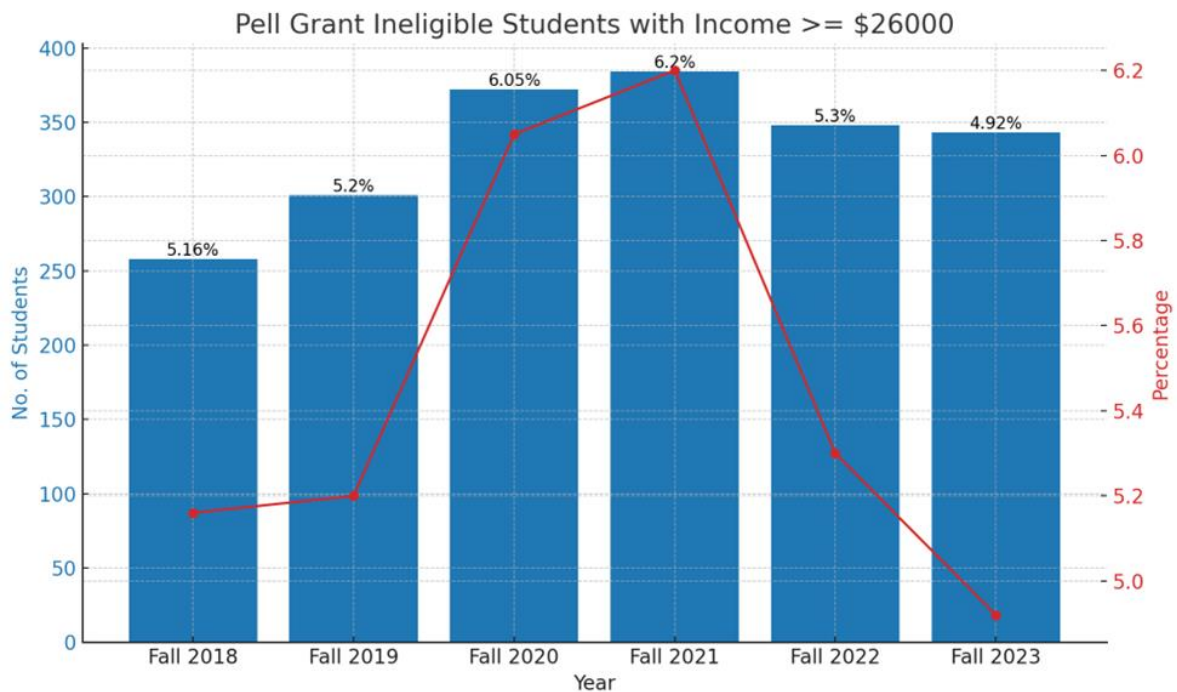


Figure 7. Pell Grant Ineligible Students with an Income \$26,000/year or more at State University (2018-2023)

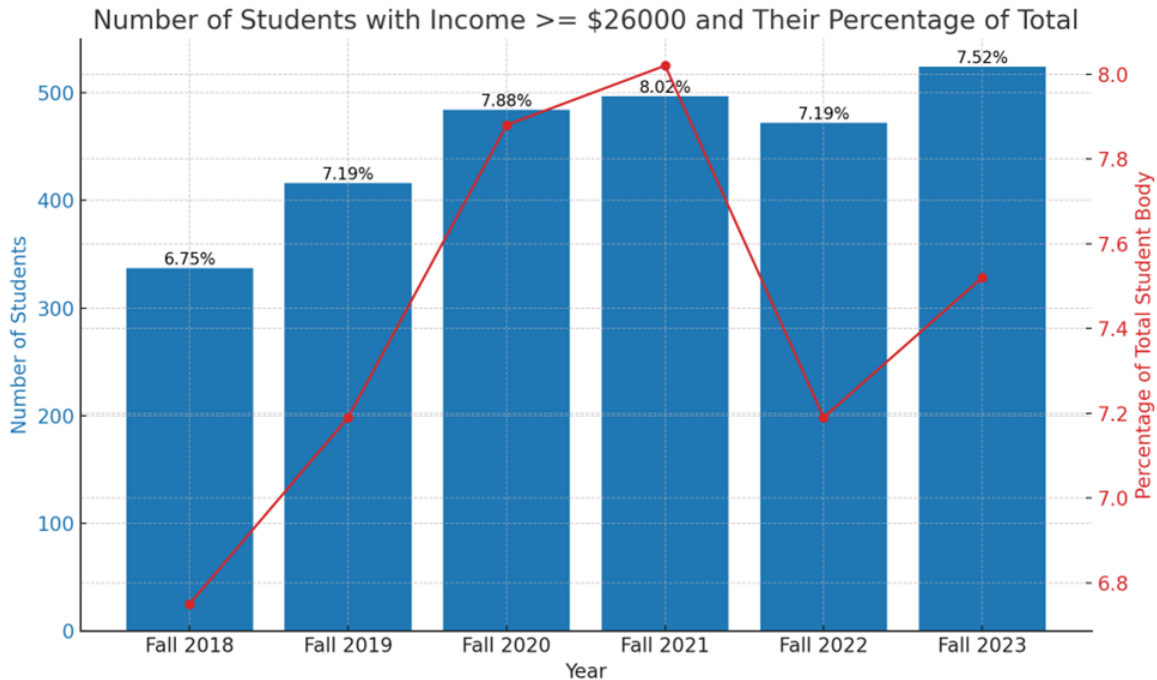


Figure 8. Number of Students with an Income \$26,000/year or more with Total Percentage at State University (2018-2023)

Discussion & Conclusion

Collecting and interpreting institutional data for nontraditional students is a challenge for several reasons. Firstly, three of the seven criteria are difficult to determine: delayed enrollment, full-time employment status, and financial independence all required proxies to approximate the descriptive statistics. Delayed enrollment was unknown for the “No degree” status students since the university's admission criteria are unknown. However, admissions records can tell us the age of the students when enrolled. This data can be a proxy for delayed enrollment. In addition, missing data from student responses to the FAFSA reduces the accuracy of the data collection for these criteria. Also, if a student does not complete the FAFSA, this will impact the accuracy of data collection.

Full-time employment and financial independence are closely tied but determining the specific income threshold can be difficult. The threshold was chosen based on criteria established by the standard for determining estimated family contributions (EFC) on the FAFSA application. However, \$26,000 may or may not be considered full-time employment depending on the number of hours worked. The number of hours worked by a student would need to be disclosed to determine a better approximation of full-time employment status. The remaining criteria (part-time enrollment, students with dependents, students with children and students with alternative high school diploma) can be easily determined from the dataset. In our future research, we plan to administer surveys to students at this and other universities to ascertain answers to these more idiosyncratic questions.

The average percentage of part-time students (39.23%) provides insight into the university's recruitment efforts to accommodate part-time students. Nearly a fourth of the students are age 25 or older, suggesting a substantial adult learner population. These implications suggest that recruiting part-time students and adult learners diversifies the student population to accommodate various students. Meanwhile, the data in our study mirrors the rise of non-traditional students on campus, which calls attention to better understanding and retaining non-traditional students in higher education. The sharp decline in the number of students ineligible for the Pell Grant may be attributed to the impact of the COVID-19 Pandemic. Students may have decided to forgo college to focus on their full-time employment and family obligations.

As this study continues to advance, we will extend this work to focus not only on these descriptive statistics, but on the retention/graduation rates of those who meet one or more of these criteria. This study highlights the importance of institutional data for nontraditional students in engineering and represents new work in advancing a more holistic understanding of these individuals.

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Appendix: Tables 3 to 10

Semester/Year	Total number of undergraduate engineering students at State University	Number of undergraduate engineering students at State University enrolled part-time	Part-time enrollment percentage for undergraduate engineering students at State University
Fall 2018	4996	1925	38.53%
Fall 2019	5786	2233	38.59%
Fall 2020	6146	2368	38.53%
Fall 2021	6195	2494	40.26%
Fall 2022	6563	2622	39.95%
Fall 2023	6971	2757	39.54%

Table 3. Part-time enrollment data for undergraduate engineering students at State University from Fall 2018 to Fall 2023

Semester/Year	Total number of undergraduate engineering students at State University	Number of undergraduate engineering students at State University with dependents	Number of undergraduate engineering students at State University without dependents	Number of blank responses	Students with dependents percentage for undergraduate engineering students at State University
Fall 2018	4996	92	3462	1446	1.84%
Fall 2019	5786	59	4013	1714	1.02%
Fall 2020	6146	65	4214	1867	1.06%
Fall 2021	6195	60	4370	1765	0.967%
Fall 2022	6563	50	4641	1872	0.762%
Fall 2023	6971	54	4957	1960	0.775%

Table 4. Data on dependents for undergraduate engineering students at State University from Fall 2018 to Fall 2023

Semester/ Year	Total number of undergraduate engineering students at State University	Number of undergraduate engineering students at State University with children	Number of undergraduate engineering students at State University without children	Number of blank responses	Students with children percentage for undergraduate engineering students at State University
Fall 2018	4996	167	3383	1463	3.34%
Fall 2019	5786	193	3879	1714	3.34%
Fall 2020	6146	177	4102	1867	2.88%
Fall 2021	6195	198	4232	1765	3.20%
Fall 2022	6563	186	4505	1872	2.83%
Fall 2023	6971	181	4830	1960	2.60%

Table 5. Data on students with children for undergraduate engineering students at State University from Fall 2018 to Fall 2023

Semester/Year	Total number of undergraduate engineering students at State University	Number of undergraduate engineering students at State University with no degree upon admission	No degree upon admission percentage for undergraduate engineering students at State University
Fall 2018	4996	590	11.81%
Fall 2019	5786	873	15.09%
Fall 2020	6146	936	15.23%
Fall 2021	6195	719	11.61%
Fall 2022	6563	709	10.80%
Fall 2023	6971	666	9.55%

Table 6. Data on no degree status upon admission for undergraduate engineering students at State University from Fall 2018 to Fall 2023.

Semester/Year	HS diploma percentage	No Degree percentage	AA percentage	AS percentage	Total associate degree percentage
Fall 2018	49.56%	11.81%	37.43%	1.20%	38.63%
Fall 2019	47.04%	15.09%	36.62%	1.24%	37.87%
Fall 2020	46.29%	15.23%	37.00%	1.48%	38.48%
Fall 2021	48.18%	11.61%	38.61%	1.60%	40.21%
Fall 2022	50.17%	10.80%	37.56%	1.46%	39.03%
Fall 2023	53.32%	9.55%	35.42%	1.71%	37.13%
6-year average	49.09%	12.35%	37.11%	1.45%	38.56%

Table 7. Percentages of highest degree level upon entering State University

	Total number of students who meet this criteria (percentage of total undergraduate student body that this represents)					
	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022	Fall 2023
Ages 25 to 30	613 (12.27%)	684 (11.82%)	711 (11.57%)	728 (11.75%)	706 (10.76%)	651 (9.34%)
Ages 30 to 35	142 (2.84%)	172 (2.97%)	193 (3.14%)	216 (3.49%)	205 (3.12%)	186 (2.67%)
Ages 35 to 40	60 (1.20%)	62 (1.07%)	77 (1.25%)	72 (1.16%)	65 (0.99%)	65 (0.93%)
Ages 40 to 45	18 (0.36%)	26 (0.45%)	34 (0.55%)	28 (0.45%)	34 (0.52%)	31 (0.44%)
Ages 45 to 50	7 (0.14%)	13 (0.22%)	16 (0.26%)	21 (0.34%)	21 (0.32%)	19 (0.27%)
Ages 50 to 55	3 (0.18%)	9 (0.16%)	8 (0.13%)	10 (0.16%)	8 (0.12%)	11 (0.16%)
Ages 55 to 60	3 (0.06%)	4 (0.07%)	3 (0.05%)	2 (0.03%)	2 (0.03%)	2 (0.03%)
Ages 60 to 65	1 (0.02%)	2 (0.03%)	2 (0.03%)	1 (0.02%)	0 (0%)	1 (0.01%)
Totals	853 (17.07%)	972 (16.80%)	1044 (16.99%)	1078 (17.40%)	1041 (15.86%)	966 (13.86%)

Table 8. Number of undergraduate engineering students at State University Ages 25 and over from Fall 2018 to Fall 2023

Semester/Year	Total number of undergraduate engineering students at State University	No. of Students who are Pell Grant Ineligible with a yearly standard earned income of \$26,000 or greater	Percentage of total undergraduate student body that this represents
Fall 2018	4996	258	5.16%
Fall 2019	5786	301	5.20%
Fall 2020	6146	372	6.05%
Fall 2021	6195	384	6.20%
Fall 2022	6563	348	5.30%
Fall 2023	6971	343	4.92%

Table 9. Number of undergraduate engineering students at State University who are Pell Grant Ineligible and with a yearly standard earned income of \$26,000 or greater. (Used to determine financial independence)

Semester/Year	Total number of undergraduate engineering students at State University	No. of Students with a yearly standard earned income of \$26,000 or greater	Percentage of total undergraduate student body that this represents
Fall 2018	4996	337	6.75%
Fall 2019	5786	416	7.19%
Fall 2020	6146	484	7.88%
Fall 2021	6195	497	8.02%
Fall 2022	6563	472	7.19%
Fall 2023	6971	524	7.52%

**Table 10. Number of Student with a yearly standard earned income of \$26,000 or greater.
(Used to determine full-time employment status)**