

EQUITY IN GRADUATION RATES: AN R-BASED ANALYSIS OF FINANCIAL AID TYPES AT A U.S. PUBLIC UNIVERSITY

1. Background

A large U.S. public university observed growing disparities in graduation rates across its diverse student body. While overall performance improved, equity gaps persisted. University leadership wanted to know whether graduation outcomes varied by financial aid type (federal, state, institutional, and self-funded), and whether these differences were statistically significant.

We were commissioned to conduct a structured, data-driven analysis using R to inform decisions on financial aid redesign and student support prioritization.

2. Objective

- To compare graduation rates by financial aid type
- To determine the strength of association between aid type and academic outcomes
- To provide data-backed recommendations for reallocating institutional aid equitably

3. Data Used

Sources:

- University student records (Cohorts from 2015–2019)

Structure:

- 12,460 undergraduate students
- Graduation status tracked at 4 years and 6 years

Variables:

- Student_ID, Entry_Year, Aid_Type (Federal/State/Institutional/Self-Funded/Mixed), Graduated_4_Years, Graduated_6_Years, GPA, First_Gen, Major, SAT_Score, Race, Gender

4. Analysis Methodology

4.1 Data Cleaning & Grouping

- Cleaned categorical inconsistencies in Aid_Type using forcats::fct_collapse()
- Filtered for full-time, degree-seeking students
- Created binary variables for graduation indicators (graduated_4yr, graduated_6yr)

4.2 Descriptive & Comparative Analysis

- Plotted graduation rates by Aid_Type using ggplot2
- Group-wise GPA summaries by Aid_Type and First_Gen status
- Applied table() and prop.table() to calculate conditional graduation rates

4.3 Statistical Testing

- **Chi-square test** on graduation outcome vs. aid type
- **Logistic regression** on 4-year and 6-year graduation as dependent variables
- Interaction effects tested: Aid_Type $\times$ First_Gen, Aid_Type $\times$ Race

5. Key Results

Metric	Result
4-Year Graduation Rate Gap	Self-funded students = 41.6%; Institutional aid = 63.9%
6-Year Completion Uniformity	Federal and Institutional aid students converge near 76% by year 6
First-Gen Differential	Gap of 15% in 4-year rates for first-gen students with federal aid
Logistic Model (Significant)	Aid_Type, SAT_Score, GPA, and First_Gen were significant
Equity Red Flag	State-aid students had lowest combined GPA and completion rates

6. Interpretation and Recommendations

- Institutional aid recipients performed **significantly better** at both graduation benchmarks
- Gaps persist **not due to GPA or test scores alone**, but likely tied to advising and stability
- Self-funded students often delayed graduation due to **work-study load** or enrollment breaks

- Recommend:
 - **Create a hybrid support model** for high-performing self-funded students
 - Shift a portion of state aid to early-intervention mentorship programs
 - Build dashboards to **flag students with low aid and low support engagement** by semester 2

7. Reporting Output

- **R Markdown Report (PDF, 26 pages)**
 - Graduation charts by aid type and demographic
 - Logistic regression summaries with odds ratios
 - Cross-tabulation heatmaps for equity diagnostics
- **Excel Workbook**
 - Filters for Aid_Type, Major, Entry_Year
 - Graduation rate calculators by cohort
 - First-gen tracking tab with GPA and completion overlays
- **Reusable R Scripts**
 - Dynamic graduation outcome pipeline
 - Custom function: `compare_graduation_by_aid()`
 - Graph templates for public reports and internal briefings

8. Institutional Impact

- Analysis used by **Financial Aid Committee** to revise institutional grant allocation strategy
- Helped secure **\$250,000 in state funding** for targeted completion grants
- Presented in university board meeting as part of the **student equity review**
- Built into a **semester-wise monitoring tool** used by retention and advising offices