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Who Are Our First-Generation Undergraduate Students? A Multidimensional Analysis of the Class of 2025

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Abstract*– First-generation undergraduate students, those whose parents have not completed a bachelor´s degree, represent a priority population for equity-driven initiatives in higher education. This study presents a multidimensional profile of first-generation students graduating in the class of 2025 at a private university in Latin America, with the objective of identifying areas of opportunity to define institutional strategies that support student well-being, academic success, and early career development. First-generation students (N=243) were compared with the overall graduating cohort (N=4316) across different dimensions including gender, place of origin, academic school and program, financial aid, international experience, cumulative GPA and academic distinctions. Descriptive statistics, GPA distribution analysis, and chi-square tests of independence were employed. Results show that first-generation students, who represent 5.63% of the graduating class, exhibit academic performance comparable to their continuing-generation peers. Statistically significant but small associations were found between first-generation status and gender, place of origin, and international experience, while no meaningful differences were found in financial aid receipt or academic honors. Overall, the findings challenge deficit-based narratives and highlight the importance of targeted institutional strengths-based initiatives, particularly in expanding access to high-impact experiences such as studying abroad.

***Keywords*—First-generation Students, Higher Education, Educational Innovation, Engineering Education, Student Success**

I. Introduction

First-generation undergraduate students, commonly defined as students whose parents have not earned a bachelor's degree, are a diverse population of increasing interest for higher education systems worldwide. Understanding the characteristics, experiences and outcomes of first-generation students has become essential for universities to design equitable and effective educational practices. While research has documented structural barriers faced by this population, it also emphasizes the resilience and academic potential of first-generation students. Within this context, institutional analyses play a relevant role in moving beyond generalized assumptions to develop data-driven strategies that respond to local strategies. Understanding the profile of first-generation students at the point of graduation is valuable to allow institutions to examine not only access and persistence, but also academic performance, participation in high-impact experiences and readiness for the transition to professional life.

The objective of this paper is to analyze the profile of first-generation undergraduate students graduating in the class of 2025 at Tecnologico de Monterrey. By examining demographic, academic, and experiential dimensions and comparing first-generation students with the overall graduating cohort, this study seeks to identify patterns that can inform institutional initiatives aimed at supporting students' well-being, academic success, and the development of successful career pathways. This work contributes to a strengths-based understanding of first-generation students within an engineering context.

II. Literature Review

First-generation undergraduate students have been the subject of growing scholarly attention across higher education and engineering education research. Prior literature has consistently documented disparities in persistence, sense of belonging, and access to institutional resources between first-generation and continuing-generation students. However, recent work increasingly challenges deficit-based framings and instead emphasizes heterogeneity, resilience, and the role of institutional context in shaping student outcomes.

Traditional descriptions of first-generation students often emphasize academic and psychological shortcomings. In contrast, [1] found no meaningful differences between first-generation and continuing-generation students in their ideal selves, ought selves, or perceived self-discrepancies. Drawing on Higgins's self-discrepancy theory, their longitudinal analysis demonstrated that first-generation students do not perceive themselves as further from their aspirations or obligations than their peers. These findings challenge assumptions of inherent psychological disadvantage and underscore the importance of reframing first-generation status outside of deficit models.

The transition to higher education remains a critical period for first-generation students. A study identified socio-

emotional crossroads, cultural wealth, and financial stress as recurring themes shaping first-generation students' adjustment [2]. While the literature highlights persistent financial strain and limited familial guidance, it also documents strengths such as persistence, academic motivation, and sense of purpose. Importantly, this study emphasizes the responsibility of institutions to create structured academic support systems, foster belonging, and involve families in the transition process to mitigate systemic barriers.

A study examined institutional classism through an intersectional lens, revealing that the relationship between classism and social-emotional outcomes varies significantly by race, subjective social status, and first-generation status [3]. The findings link institutional structures to students' perceived value, access to resources, and compatibility between school and family life. Similarly, [4] demonstrated that first-generation students of color encounter distinct challenges and supports compared to their white counterparts, particularly in navigating racial discrimination and engaging with identity-based student organizations. Together, these studies highlight the need for nuanced, equity-driven institutional interventions.

Beyond access and perception, becoming a college student is an ongoing social process. This transition was conceptualized as a biographical and social practice shaped by class-specific habits, peer engagement, and pedagogical support [5]. Complementing this perspective, adaptive strategies employed by first-generation students during their first year, including capital conversion and strategic repositioning across majors or programs, were documented [6]. These strategies, often facilitated through peer networks and selective institutional engagement, demonstrate resilience while also revealing how higher education systems frequently undervalue the cultural capital first-generation students bring.

While peer influence is often assumed to significantly affect first-generation student performance, empirical evidence is mixed. A quasi-experimental study at the U.S. Military Academy found no statistically significant peer effects on first-generation students' early academic outcomes [7]. These results suggest that academic performance disparities may be more strongly linked to structural and institutional factors than to immediate peer academic characteristics.

Within engineering education, identity development emerges as a critical dimension for understanding first-generation student experiences. First-generation students in honors programs experience higher identity incompatibility and lower self-efficacy, despite reporting relatively strong senses of belonging [8]. Extending this work, [9] demonstrated that familial exposure to engineering significantly shapes engineering identity, confidence, and perceptions of success. First-generation engineering students, particularly those without engineers in their immediate family, exhibited lower identity scores and greater uncertainty, indicating the need for intentional mentoring and identity-supportive interventions.

The literature underlines that first-generation undergraduate students possess substantial motivation, resilience, and aspirational clarity, yet continue to face structural, cultural, and institutional barriers that influence their academic and professional trajectories. Differences within the first-generation population highlight the importance of multidimensional profiling approaches. These insights motivate the present study's focus on the Class of 2025, aiming to characterize first-generation students across multiple dimensions in order to inform targeted, evidence-based strategies that promote well-being, academic success, and professional preparation.

III. Method

Building on prior research that highlights the diversity, strengths, and structural challenges of first-generation undergraduate students, this study adopts a data-driven approach to profile the class of 2025. The methodology is designed to capture multiple academic, demographic, and experiential dimensions of first-generation students in order to generate an institutional snapshot that can inform targeted support initiatives. This study employs a quantitative, multidimensional analysis to examine the profile of first-generation undergraduate students graduating in the class of 2025 at Tecnologico de Monterrey. The analysis aims to characterize this group and compare it with the overall graduating cohort in order to identify distinguishing dimensions that can inform institutional strategies to support students' well-being, as well as their academic and professional success.

The total undergraduate population graduating in 2025 comprises 4316 students across six academic schools at the campus:

- School of Engineering and Sciences
- School of Business
- School of Architecture, Art and Design
- School of Social Sciences and Government
- School of Humanities and Education
- School of Medicine and Health Sciences

The study focuses on first-generation undergraduate students within this cohort (N = 243). Quantitative data were analyzed across multiple dimensions, including gender, place of origin (local, out-of-town, or international), academic school, degree program, access to financial aid, participation in international experiences (in-person or online), and cumulative Grade Point Average (GPA). Descriptive and comparative analyses were conducted to identify patterns and differences between first-generation students and the broader graduating population.

A. Data Analysis

Data analysis employed a multidimensional approach, integrating descriptive, distributional, and comparative techniques to examine differences between the overall graduating population and first-generation students.

Descriptive analyses compared the full graduating cohort with first-generation students across academic, demographic, and experiential variables. For categorical variables, frequency counts and percentages were calculated for both groups to describe group composition across dimensions such as gender, place of origin, academic school and degree program, access to financial aid, international experiences, and academic distinctions awarded at graduation.

Cumulative GPA was analyzed as a continuous variable to compare academic performance patterns between the overall population and first-generation undergraduate students. Measures of central tendency and dispersion were examined to assess similarities and differences in overall performance levels and variability, and distributional characteristics were evaluated to identify differences in the shape and spread of GPA outcomes.

Comparative analyses of categorical variables were conducted using chi-square tests of independence to compare the distribution of characteristics between first-generation and continuing-generation students. Prior to conducting each test, expected frequencies were reviewed to confirm that the assumptions of the chi-square test were satisfied. In cases where low expected counts were observed, categories were combined in a conceptually appropriate way to ensure the validity of the analysis. Statistical significance was assessed using an alpha level of .05, and Cramer's V was reported to evaluate the magnitude of observed associations.

Students with missing or unknown first-generation status were excluded from inferential analyses to maintain clearly defined comparison groups, while all remaining cases were included in descriptive summaries. All analyses were conducted using Microsoft Excel, and results were reviewed for internal consistency.

IV. Multidimensional Analysis

A. Descriptive Analysis

Considering the overall graduating population of the class of 2025 of 4316 students, 5.63% are first-generation students. Table I shows the descriptive characteristics of first-generation students of the class of 2025 compared with the overall graduating population. This descriptive comparison highlights meaningful similarities and differences between first-generation students and the overall graduating population. While first-generation students represent a relatively small proportion of the total cohort, their demographic composition, academic performance, and participation in institutional programs reveal both areas of equity and domains where structural differences remain evident. For example, the "Leaders of Tomorrow" program is an institutional social mobility initiative that provides full (100%) scholarships to high-achieving students. The program targets students with strong academic performance and demonstrated social impact potential who require a 100% scholarship to pursue their undergraduate studies at our university. Table I shows there is a higher participation rate in "Leaders of Tomorrow" program among first-generation students at 11%, compared to just 2% in the overall class. Regarding their origin, interestingly, first-generation students have a higher percentage of out-of-town residency at 70%, compared to 50% for the overall class.

The overall graduating population is distributed across six different academic Schools. Table II presents students enrollment by School. The data indicate that first-generation students show a slightly higher preference for Business-related degrees. In contrast, compared with the overall graduating class, first-generation students are underrepresented in Social Sciences and Government programs, as well as in Medicine.

TABLE I
Descriptive Characteristics of the Class of 2025 and its First-Generation Students

Indicator	Class of 2025	First-generation students
Total	4316	243
Female	44%	49%
Male	56%	51%
GPA Adobe 95	25%	26%
In-person international experience	53%	35%
Online international experience	30%	35%
Out-of-town	50%	70%
Local	43%	26%
Internacional	6%	4%
Financial aid	49%	52%
"Leaders of Tomorrow" program	2%	11%
With honors	5%	6%
With high Honors	5%	4%

TABLE II
Students Enrollment per School

School	Class of 2025	First-generation students	First-generation students (%)
Business	1238	87	7%
Humanities and Education	189	9	5%
Engineering and Sciences	1852	108	6%
Architecture, Art and Design	440	24	5%
Social Sciences and Government	291	13	4%
Medicine and Health Sciences	306	2	1%

Taking a closer look within the academic programs of the School of Engineering and Sciences, the enrollment of first-generation students also varies across disciplines (Table III).

TABLE III
STUDENTS ENROLLMENT PER PROGRAM WITHIN THE SCHOOL OF ENGINEERING AND SCIENCES

Acronym	Academic Program	Class of 2025	First-gen students	First-gen students (%)
IAL	Food Eng.	40	2	5%
IBT	Biotechnology Eng.	120	8	7%
IC	Civil Eng.	108	7	6%
IDM	Data Sciences and Math	104	8	8%
IDS	Sustainable Development	36	1	3%
IFI	Industrial Physics	78	5	6%
IID	Innovation and Development	57	3	5%
IIS	Industrial and Systems Eng.	229	10	4%
IM	Mechanical Eng.	158	8	5%
IMD	Biomedical Eng.	118	10	8%
IMT	Mechatronics Eng.	172	16	9%
INA	Nanotechnology Eng.	100	8	8%
IQ	Chemical Eng.	162	5	3%
IRS	Robotics and Digital Systems	40	2	5%
IE	Electronics Eng.	1	0	0%
ITC	Computer Science and Technology	253	12	5%
ITD	Business Digital Transformation	46	2	4%

Mechatronics Engineering is the academic program with the biggest representation of first-generation students, followed by Biomedical Engineering, Nanotechnology, and Data Sciences and Math. On the other hand, the programs with the smaller representation are Electronics Engineering, Sustainable Development, and Chemical Engineering.

B. GPA Analysis

The GPA frequency graph shown in Fig. 1 illustrates the distribution of cumulative GPA for the class of 2025 (the overall graduating population) and the distribution of cumulative GPA for the first-generation students. In general, the results indicate very similar academic performance.

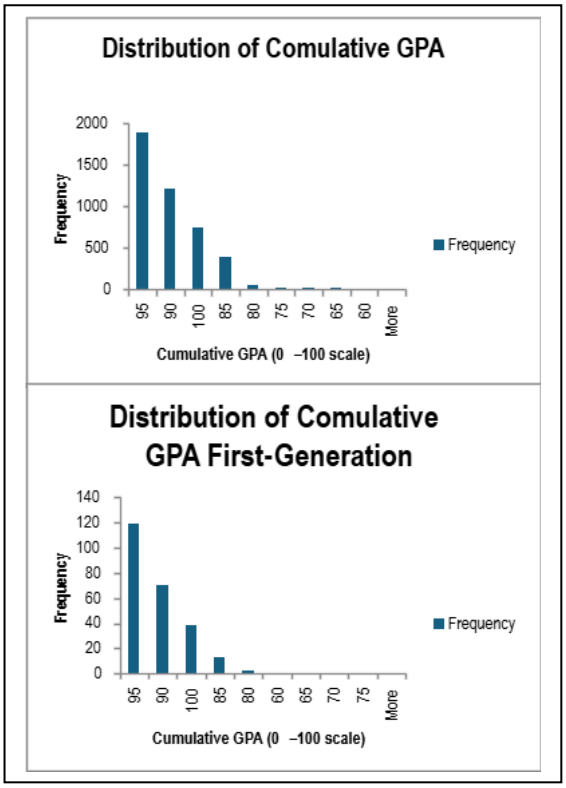

Fig. 1 Cumulative GPA for the class of 2025 and the first-generation population.

A deeper analysis of the data, included in Table IV, compares the distribution of cumulative GPA between first-generation and continuing-generation graduating students. Overall, the results indicate very similar academic performance profiles, with only small differences in central tendency and variability.

TABLE IV
GPA DESCRIPTIVE ANALYSIS

Distribution of Cumulative GPA		
Descriptive Statistics	Continuing-students	First-generation students
Mean	90.78365893	91.25867901
Standard Error	0.067762239	0.249867878
Median	91.35	91.69
Mode	93.43	95.12
Standard Deviation	4.448630964	3.895054735
Sample Variance	19.79031745	15.17145139
Kurtosis	0.918140026	1.247484964
Skewness	-0.766471509	-0.854084337
Range	36.796	24.06
Minimum	63.084	75.41
Maximum	99.88	99.47
Sum	391277.57	22175.859
Count	4310	243
Confidence Level (95.0%)	0.132848863	0.492193527

First-generation students exhibit a slightly higher mean cumulative GPA (M = 91.26) compared to continuing-generation students (M = 90.78). A similar pattern is observed for the median (91.69 vs. 91.35) and the mode (95.12 vs. 93.43). Although these differences are modest, they consistently suggest that first-generation students who reach graduation perform at least as well as their continuing-generation peers in terms of cumulative GPA.

The dispersion of GPA scores is slightly lower among first-generation students, as reflected in a smaller standard deviation (SD = 3.90) compared to continuing-generation students (SD = 4.45). This reduced variability suggests a more homogeneous academic performance among first-generation graduates, whereas continuing-generation students display a wider spread of GPA outcomes.

C. Chi Square Analysis

Finally, a chi-square analysis was conducted to determine if there is a significant difference between the observed frequencies in the categorical data. Table V shows the results.

TABLE V
ASSOCIATION BETWEEN FIRST-GENERATION STATUS AND CATEGORICAL VARIABLES

Categorical Variable	Categories (summary)	X^2	df	p	Cramer´s V
Gender	Female/Male	3.70	1	0.05	0.03
Financial aid	Yes/No	0.05	1	0.82	0.00
Place of origin	Local / Out-of-town / International	40.12	2	0.00	0.07
International experience	None / Online / In-person / Both	43.70	3	0.00	0.06
Academic distinctions awarded at graduation (Honors)	Yes / No	0.25	1	0.62	0.01

This study examined differences between first-generation and continuing-generation graduating students across multiple categorical dimensions, including gender, financial aid access, place of origin, international experience, and receipt of academic honors. Overall, the findings reveal a nuanced pattern, while several associations are statistically significant, most exhibit small effect sizes, suggesting that differences are generally modest in magnitude.

No statistically significant association was found between first-generation status and gender, nor between first-generation status and receipt of academic honors. In both cases, effect sizes were negligible, indicating virtually identical distributions between first-generation and continuing-generation students.

These results suggest that gender representation and academic recognition at graduation operate equitably across generational status. The absence of meaningful differences in honors attainment is particularly noteworthy, as it indicates that first-generation students who persist to graduation achieve academic distinctions at rates comparable to their peers. This finding aligns with a strengths-based perspective, emphasizing resilience and academic capability among first-generation students once they reach the completion stage.

In contrast, statistically significant associations were observed between first-generation status and both access to financial aid and place of origin, although effect sizes remained small. First-generation students were more likely to receive financial aid and were disproportionately represented among domestic non-local students, while being underrepresented among local students.

The strongest association identified in this study involved international experience, where first-generation students were significantly less likely to participate, especially in in-person experiences, and more likely to report no international experience at all. Although the overall effect size was still small, it was notably larger than those observed for other variables.

V. DISCUSSION AND CONCLUSION

This study provides a multidimensional picture of first-generation undergraduate students graduating in the class of 2025, highlighting both areas of convergence with and divergence from the overall graduating population. First-generation students represent 5.63% of the cohort, highlighting their presence as a minority group within the university while also emphasizing the importance of targeted analysis to avoid overgeneralization.

Across academic performance indicators, first-generation students demonstrate outcomes that are comparable to, and in some cases slightly higher than, those of continuing-generation students. Cumulative GPA distributions show similar central tendencies and dispersion patterns, with first-generation students exhibiting a marginally higher mean GPA and lower variability. The lack of significant differences in the attainment of academic honors reinforces the idea that first-generation students who reach graduation perform at levels equivalent to their peers. These findings align with the literature that challenges deficit-based narratives [1], [6], [7] and instead emphasizes resilience and academic capability among first-generation students.

The chi-square analysis shows statistically significant associations between first-generation status and variables including gender, place of origin, and international experience. However, effect sizes across all variables are small, which means that the observed differences are limited in magnitude. In particular, first-generation students are more likely to come from out-of-town locations (other cities and towns in the country) and are significantly less likely to participate in

international experiences, particularly in in-person programs. This behavior suggests that structural, financial, or informational barriers may affect access to high-impact educational experiences for first-generation students, even among those who complete their degrees.

In contrast, no meaningful association was found between first-generation status and financial aid receipt, which suggests that access to financial support is relatively equitable at the point of graduation. Similarly, the lack of differences in academic recognition (graduation with honors or with high honors) indicates that institutional evaluation mechanisms are applied consistently, regardless of the generation status.

Taken together, these findings point to important considerations for institutional practice. While first-generation students demonstrate strong academic performance and persistence, disparities in international experience exposure highlight areas where targeted interventions may yield meaningful impact. Universities may benefit from developing personal advising [5], funding mechanisms, language courses, and early outreach strategies to ensure that first-generation students can access and benefit from high-impact practices that support their personal and professional development.

Future research should extend this analysis to study pre-graduation trajectories and post-graduation outcomes, including employment, graduate education, income, and career progression. Qualitative approaches could complement the decision-making process and perceived barriers that limit first-generation students' participation in international experience programs. Out-of-town students' voices can also result in useful projects to support their student life and strengthen transition and belonging initiatives [8], especially during the early years of study. A longitudinal analysis, including cohorts of several years, could also complement this data to identify stable trends. By combining institutional data with students' voices, future work can strengthen equity-oriented strategies that support first-generation students throughout their academic journeys and beyond.

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