Attracting a More Diverse Student Population to the School of Engineering of the University of Puerto Rico at Mayagüez

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Abstract - **In the past years, the undergraduate enrollment population of the School of Engineering at the University of Puerto Rico in Mayagüez exhibits biases in geographic distribution, gender, type of school and family income, and the interactions among these elements. The data available provides for a comparison among the profiles of the admitted-registered, the admitted not registered and the not admitted groups in the School of Engineering. This comparison is based on demographic, high school academic performance, entrance examination test scores, and financial data of the students applying to our institution. In addition, a slight decrease of applications and admissions in the university as a whole has been observed. Using the elements previously listed, a representative profile of our potential applicants will be developed for our entering first year class to assist in improving diversity in our engineering student population. With the developed representative profile, the gaps with our real profile will be identified. The identification of the gaps between the representative and the real profile will contribute to the development of strategies to attract a more diverse student population in the School of Engineering.**

Index Terms – Admissions, diversity, geographic representation and profile of first year class.

PROFILE OF APPLICANTS TO ENGINEERING SCHOOL

Student admission data to the University of Puerto Rico at Mayagüez (UPRM) was obtained for academic years 2001-02 through 2004-05. The main interest is to study the profile of the engineering school candidates and identify gaps between the real profile, derived from the admission data, and a representative profile to be defined. In a previous study performed by the authors, a profile of the entering engineering classes of the College of Engineering of UPRM during the period of 1990-2003 was developed. The profile included variables such as: gender, school type (public or private), geographic location of high school, scores from five College Entrance Examination Board (CEEB) tests, high school grade point average (GPA), and the first university year GPA [3].

Of all the applicants to engineering (as their first, second or third choice) 35.8% were admitted and registered,

58.7% were not admitted, and 5.5% were admitted but declined registration at our programs. This information is portrayed in Figure 1 showing that in general terms around 4 of 10 applicants is admitted and registers in our engineering programs.

Stratifying these numbers based on type of high school (public or private) these applicants come from: 39.1% from private schools are admitted and register, but lower percentages, 30.1% from public schools do. As is shown in Figure 2, four out of ten students from private schools are accepted and register, while only 3 out of 10 students from public schools do.
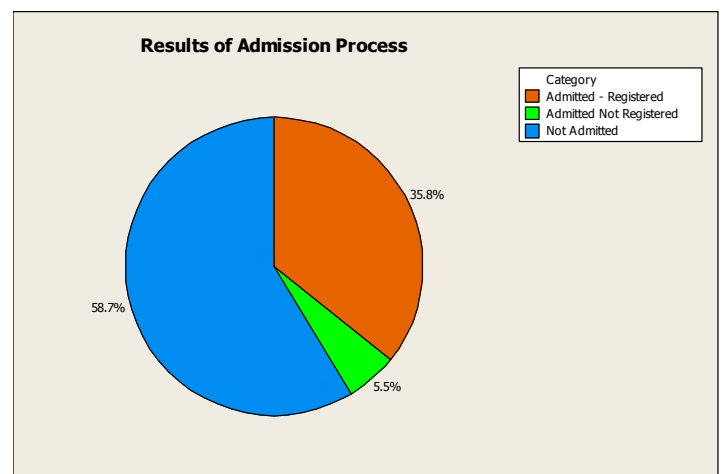

FIGURE 1
RESULT OF ADMISSION PROCESS.

Figure 3 shows the same distribution for the eight senatorial districts comprising Puerto Rico. These are: Bayamón, Carolina, Arecibo, Mayagüez, Ponce, San Juan, Humacao, and Guayama. Senatorial districts have approximately the same total population and each of them is composed of a number of municipalities, with the exception of San Juan that is composed only of one municipality. Notice that the rejection rate and the number of applicants are larger for the Mayagüez district, which is the western district where our campus is located.

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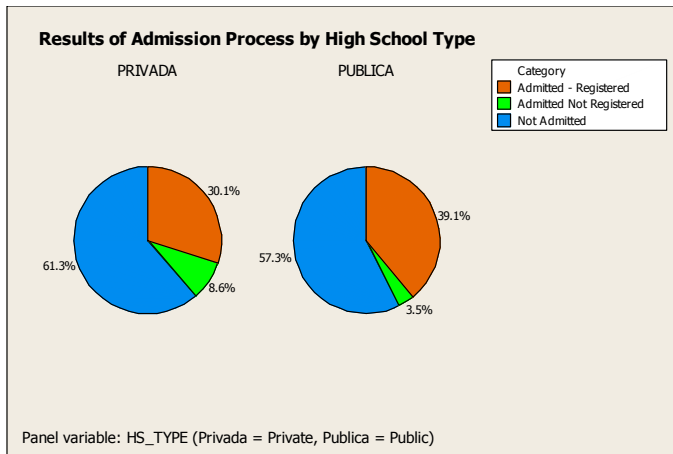**Results of Admission Process by High School Type**

FIGURE 2
RESULTS OF ADMISSION PROCESS BY TYPE OF SCHOOL.

San Juan is the capital city and the major urban center of Puerto Rico located on the northeastern coast of the Island. The University of Puerto Rico has 11 campuses. The campus of Mayagüez is the only one in the public university system where Bachelor of Science degrees in engineering are offered. A map of Puerto Rico is shown in Figure 4.

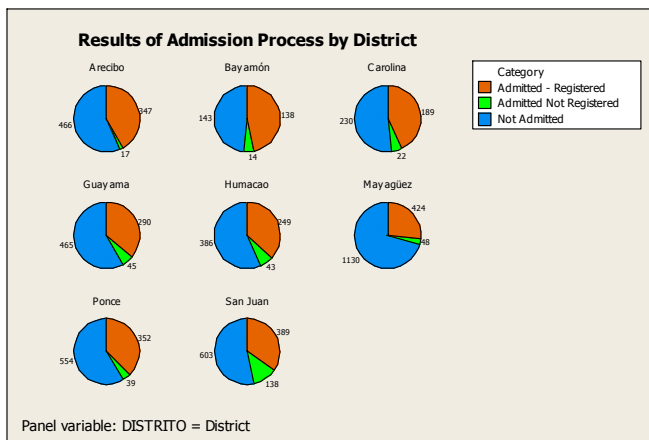**Results of Admission Process by District**

FIGURE 3
RESULT OF ADMISSION PROCESS BY DISTRICT.

FIGURE 4
MAP OF PUERTO RICO.

In 2004-2005, the College of Engineering of the University of Puerto Rico at Mayagüez had an undergraduate enrollment of 4,445 students. The Polytechnic University of Puerto Rico (PUPR) had an undergraduate engineering enrollment of 4,153 students. This university is private and it is located in the capital city of San Juan. Their engineering enrollment has been: 3,939 in 2001-2002, 4,021 in 2002-2003, and 4,099 in 2003-2004. PUPR has the only other comparable engineering school on the Island. [8]

Our engineering undergraduate enrollment places our college in the 14th position of United States of America Engineering Schools. Purdue University ranked number 1 with 6,049 students [9]. Our engineering college granted 622 bachelor's degrees in 2003-2004, ranking number 1 in the degrees granted to Hispanics and 23rd in the USA. The second position belonged to PUPR with 312 degrees, and the third place belonged to Florida International University with 136 bachelor's degrees awarded [10].

DESCRIPTION OF ADMISSION CRITERIA

The admission index, which is called the IGS, is composed of the high school grade point average, the verbal aptitude test score and the mathematics aptitude test score from the College Board Entrance Examination. The highest possible value of the IGS is 400. The weight of the GPA is 50%, while the weight for each of the two aptitude tests 25%. Figure 5 shows the IGS for each district based on gender. As can be noted all the admission index values are relatively high with females always leading and San Juan and Humacao showing better results. Figure 6 presents a box plot of the IGS for each district based on type of school. For all districts the median of the IGS are higher for students applying from private schools when compared with public school students.
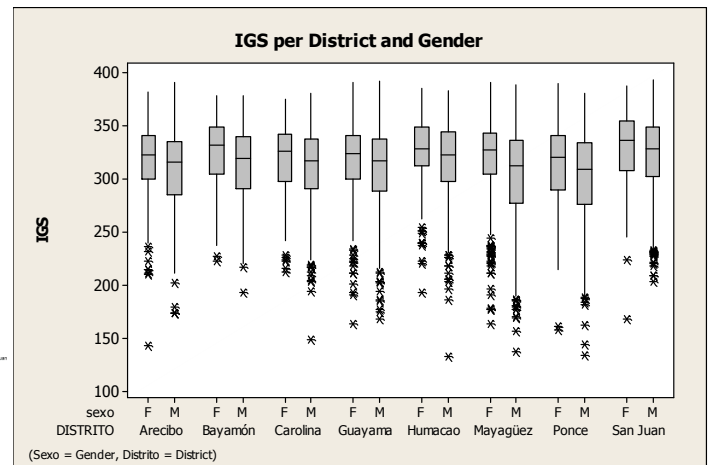
IGS per District and Gender

FIGURE 5
MEAN IGS PER DISTRICT AND GENDER.

Each academic department or program determines each year the minimum value of the IGS for the entering students. In general terms, no other measurement is used to admit a student in the first year of university studies. For the engineer class of 2004-2005, the minimum IGS fluctuated from to 313 for Surveying to 342 for Computer Engineering.
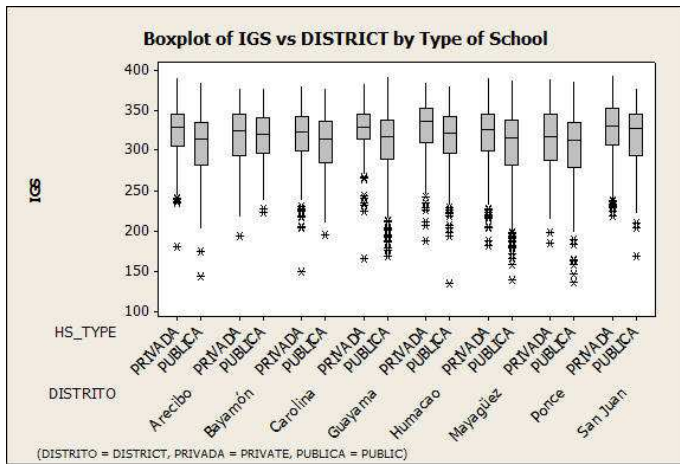
FIGURE 6
MEAN IGS PER DISTRICT AND HIGH SCHOOL TYPE.

ADMITTED STUDENTS TO ENGINEERING SCHOOL AND THE GAPS TO A MORE REPRESENTATIVE PROFILE

The number of students, stratified by gender, admitted to the Engineering School from 2001-02 through 2004-05 is shown in Figure 7. This represents approximately 65% and 35% percentages for males and females respectively. The general population of Puerto Rico shows almost a 50%-50% split between males and females (actually 51% females and 49% males)[11]. Taking this fact into consideration this is the first gap that can be identified towards a more representative profile of engineering students.
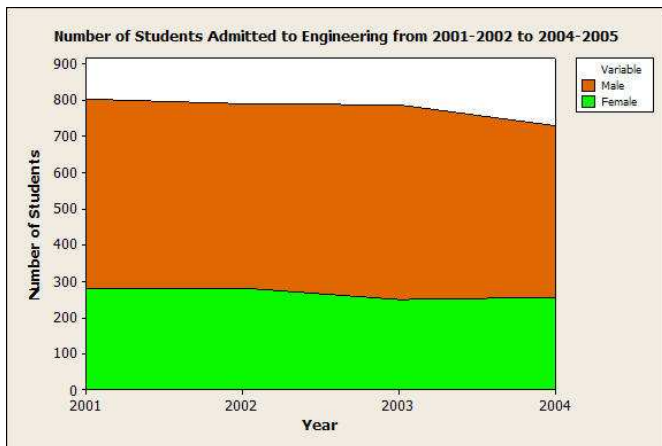

FIGURE 7
TREND CHART FOR NUMBER OF STUDENTS ADMITTED TO THE ENGINEERING SCHOOL PER GENDER.

The perception of a regional bias for the admitted students has been in the minds of several members of the UPRM academic community. Figure 8 shows the distribution of admitted students by district or region and by school type. These numbers range from 75 and 400 admissions approximately for the Bayamón and Mayagüez districts respectively. The general perception at the institution is that the students from the metropolitan area of San Juan, composed

by San Juan, Bayamón and Carolina districts, are not attracted to our institution. This thought is somewhat validated in Figure 8 mainly when public schools are considered. When this distribution is further analyzed by gender, in Figure 9, one can identify that UPRM has a challenge in attracting female applicants from public schools from the metropolitan area of San Juan. Thus, a couple of gaps are identified in figures 8 and 9. First, the composition of the admitted group of students is not representative of the general population of the island as presented by the variability in the number of students per district and second, the female students from public schools from the metropolitan area of San Juan are much underrepresented.
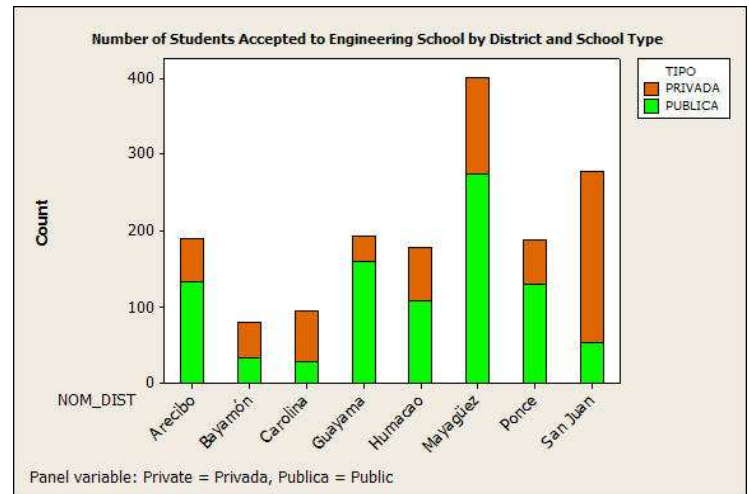

FIGURE 8
NUMBER OF STUDENTS ADMITTED TO ENGINEERING SCHOOL BY DISTRICT AND SCHOOL TYPE (2001-02 TO 2004-05).
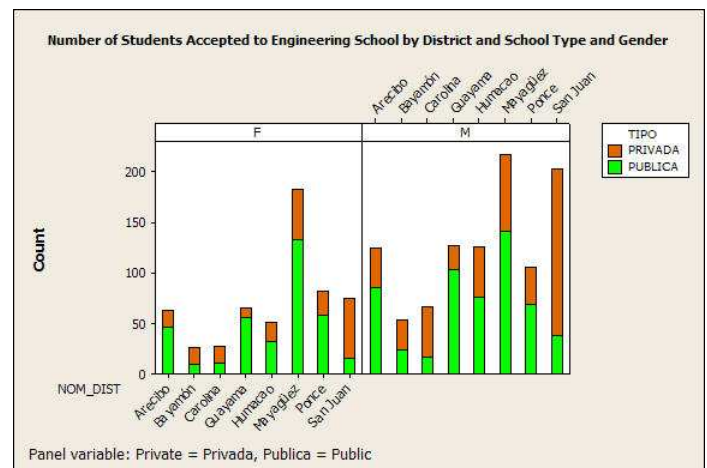

FIGURE 9
NUMBER OF STUDENTS ADMITTED TO THE ENGINEERING SCHOOL PER DISTRICT, TYPE OF SCHOOL AND GENDER (2001-02 TO 2004-05).

Differences in parents' income have been suggested a as a potential explanation for the low figures of applicants from public school of the metropolitan area of San Juan. Figure 10 shows the distribution of parents' income for the applicants to the engineering school at UPRM. The incomes are divided into ten categories. The percentage of parents for

students from private schools within the highest income category exceeds 33%, while for parents with students in public schools, less than 10% belongs to that same category. Moreover, around 25% of the parents for students from public schools report an income of $12,499 or less. For this same category, the percentage of the parents from private schools is less than 10%.
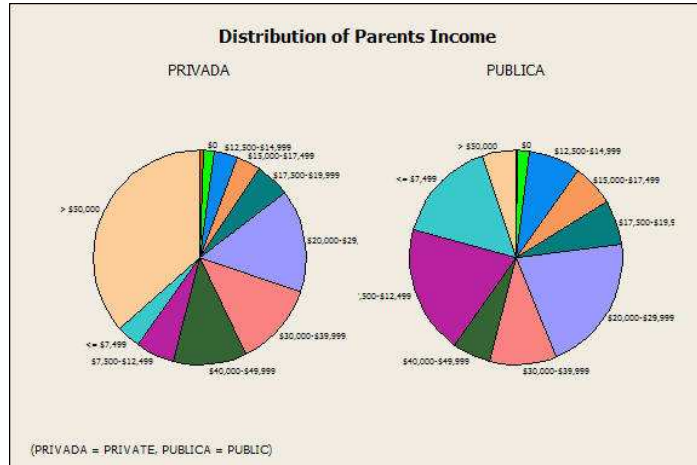

FIGURE 10
DISTRIBUTION OF PARENTS INCOME BY TYPE OF SCHOOL.

In Figure 8, San Juan is the district with the biggest difference for the number of admitted students when private and public schools are compared. In fact the ratio is greater than 5 to 1 in favor of students coming from private schools. Since the income for parents from private schools students are higher on average, as depicted in Figure 10, an income distribution for both type of schools for the district of San Juan is shown in Figure 11. Approximately 50% of the parents from private schools report an income in the highest category as compared to close to 12% for the parents of public schools students as shown in Figure 11. This graph supports the hypothesis that financial aspects may be a factor to consider in understanding the difference in the representation ratio for this district. This can be identified as another representative gap. Similar analysis should be performed for other underrepresented regional districts. Additionally, students from the San Juan district from the public schools showed lower IGS scores when compared to the ones from private schools. Still the IGS scores for students from public schools in San Juan are comparable to those of private schools in other districts.

The ratio of the number of admitted to the number of applicants for each geographic region can be called the success rate. This success rate can be used by the Admissions Office to evaluate its ability to attract a pool of students with the right characteristics to be admitted to our engineering programs is named the success rate.
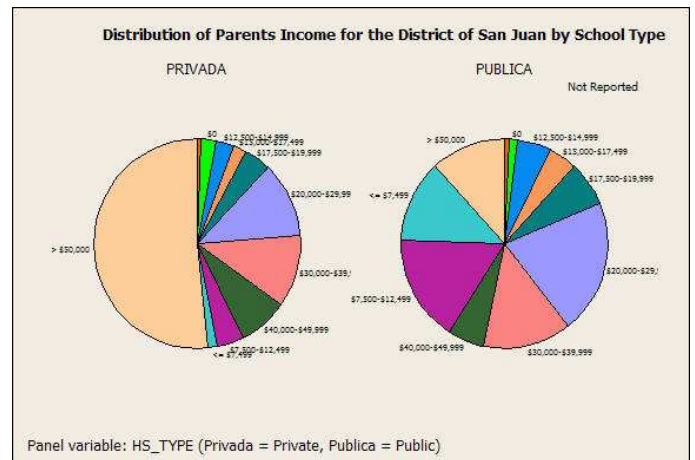

FIGURE 11
DISTRIBUTION OF PARENTS INCOME BY TYPE OF SCHOOL FOR THE DISTRICT OF SAN JUAN.

Figure 12 shows three success rates for each district. These are: overall success rate, success rate for private schools and success rate for public schools. This figure shows the district of Mayagüez as the one with the lowest success rates in each of the three ratios.
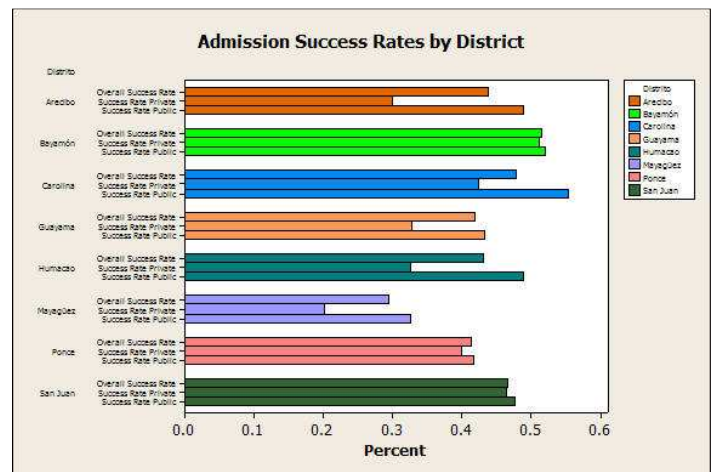

FIGURE 12
ADMISSION SUCCESS RATES PER DISTRICT (2001-02 TO 2004-05).

FINDINGS AND CONCLUSIONS

The data analyzed in this study suggests a number of gaps between an ideal representative profile and the real profile of entering class to the Engineering School. To increase the geographic, type of school and gender distributions in our entering first year engineering students:

- Since the representation from public schools in San Juan is very low, especially for female students, mechanism should be developed to make it possible for this underrepresented segment of our population to attend the College of Engineering of the University of Puerto Rico
- A survey should be developed to better understand why the underrepresented students by geographical

area and by type of school are not attending our college. The model presented by Anderson-Rowland of Arizona State University could be followed [1,2]

- Informing the students of the starting salaries for entry level engineers seems to be a strong motivator to study engineering as shown by Richard W. Heckel of Michigan Technological University [4,5,6]

- Sponsoring high schools in areas of low recruitment by developing programs where the students learn about engineering increases the pool of talented students applying. The article by Yates, et al. provides a model where a major corporation provided the financial support to pay special attention to underrepresented high schools [7]

- Implement the success rate performance criteria as a measurement of the Admissions Office ability to attract the right applicants to our school.

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