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A DESCRIPTION OF THE STATISTICS BEHIND ANALYZING PERFORMANCE DATA: A Five-Year Study of an Summer Bridge Program for Incoming URM Freshman

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A DESCRIPTION OF THE STATISTICS BEHIND ANALYZING PERFORMANCE DATA: A Five-Year Study of a Summer Bridge Program for Incoming URM Freshman

The Purdue University Minority Engineering Program initiated the Engineering Academic Boot Camp (ABC), a summer bridge program, in 2005 to address a nine percentage point difference between the 2004 underrepresented minority (URM) first year retention rates and the overall cohort's retention rate (67% vs. 76%). This program was designed to address transition issues experienced by URM students entering a majority institution through a rigorous simulation of the first semester engineering experience, in part by providing these students with a core of support from their peers to prevent the social isolation that often hinders URM success. A five-year analysis was performed on the incoming F'08 – F'12 cohorts of the program to determine its value to incoming students (n=90). The paramount success metric of this program was the improvement of the first year retention rate of the URM population, thus removing the previously observed disparity. A potential secondary benefit would be increased academic performance in the gateway courses presented in the camps, thus improving their first term GPA.

This paper will explain the two methods of statistical analysis that were used to compare first year retention rates and first term GPAs of the three populations: URM students who took the ABC, non-attending URM students, and majority students who did not take the ABC. The Independent Population Method took all students from each population to determine statistical differences between the retention and GPAs. These determiners of student success were also compared using a Matched Pair Method, where each ABC student was matched with one student in the other two populations. This allowed comparisons of similar students with regard to demographics; incoming metrics from Core GPA and test scores; and first semester courses.

The Independent Population Method was able to show some significance when comparing the Academic Boot Camp against the other populations. The Matched Pair Method removed differences generated by comparing populations of greatly differing sizes. This method resulted in an improved comparison between the ABC and URM populations for retention comparisons and removed the significance of the majority and ABC first-term GPA comparison. The authors hope to aid program administrators in conducting similar analyses of their programs by providing a detailed walk-through of how results were reached.

Introduction

Program evaluation and knowledge sharing are key elements in programs targeting ethnic diversity in STEM.[1] Yet time and responsibility constraints in addition to a lack of familiarity with evaluation methods and statistical techniques has been observed in the authors' interaction with staff from programs that support underrepresented minority (URM) students. For the purpose of this paper and in alignment with the National Science Foundation (NSF), the URM designation is defined by the following race/ethnicities: American Indian or Alaska Native, Black or African American, Hispanic/Latino, Native Hawaiian or Other Pacific Islander, or 2 or more Races which includes a URM ethnicity. This designation is given since as a group they are a minority because they make up only 31.4% of the population.[2] The URM designation comes from the fact that these students only make up 16.1% of engineering students in the US.[3]Asian Americans are also a minority, but not underrepresented in engineering. Majority students are then those students who select: Asian, 2 or more Races who are Asian/White, International, Unknown, and White.

There is a lack of formally published evaluations and research insights for programs that support URM students.[1,4,5] In one national level study by The College Board, a primary goal was to identify and "describe the efforts that are underway in colleges and universities to promote the high achievement of underrepresented minority students and to assess the extent to which these programs were achieving their goals."[4] This challenge led to some programs being dropped from consideration due to a lack of documentation and evaluation data.[4] In addition, minority retention issues in STEM are complex phenomena, compounding the research and evaluation challenge.[6] While the need for more qualitative studies to understand these complex nuances is evident, there is also a need for more rigorous quantitative work. For example, in a review of 28 Louis Stokes Alliances for Minority Participation (LSAMP) projects, although studies were primarily quantitative or mixed methods designs, the focus was on participation numbers and graduation rates of URMs in STEM with no experimental designs.[6]

Tinto[7] argues for improved assessment and evaluation efforts so that program staff can translate retention impact data to other audiences for broader program growth and institutional support. Staff being unable to produce empirical evidence and experimental designs supporting the fact that investment in their programs leads to achievement of long-term institutional outcomes "undermines their ability to generate the sorts of long-term funding that is essential to program institutionalization" (p. 10) However, for the general staff member or practitioner with budget and time restrictions, producing internal reports or publishable studies of the relevant and needed work they are doing can prove to be a daunting task.

While many practitioner papers outline both qualitative and quantitative descriptive data, program staff can also add an additional level of rigor in data analysis using general statistical techniques. One basic approach to determine a program's impact on student retention and academic standing is to compare outcomes of participants and non-participants.[8,9] This comparison can be between categorical data (with the use of Chi-square test) or continuous data (with the use of a t-test). In cases where the budget does not allow for an external or dedicated evaluator or researcher, program staff can carry out basic research and analysis methods to data they are already collecting with guidance. This paper explores such analyses in the Engineering

Academic Boot Camp (ABC) at Purdue University with a particular focus on using the Chi-Square and T-test statistical methods for retention and GPA comparisons respectively. As MEPs typically target small groups, the authors also explore the use of matched groups to draw additional conclusions about the relative success of program activities in meeting desired MEP objectives.

Background

A. Program Overview

Retention studies may have different or combined foci including academic and social integration, persistence and attrition, student support (peers, faculty, family, institutional), demographic influences, economic factors, cultural factors, and psychological factors.[6,10–12] The influence of different characteristics on URM student success is of interest to institutions and programs that support the increased recruitment and retention of minority engineers.[6,13–15] Within retention studies, summer bridge programs are a popular focus for their potential to positively influence persistence and degree completion goals. Published evaluation efforts of bridge programs provide useful descriptive information,[16–19] and more research-oriented studies introduce experimental designs[9,20,21] to explore the impact of these initiatives. Despite the evidence of positive steps in this direction, more prevalence of rigorous studies in this area could garner greater institutional support and highlight important nuances for further exploration.

The program that will be analyzed for this statistical study is the Academic Boot Camp (ABC) which was initiated by the Purdue University Minority Engineering Program. It was created to address a nine percentage point difference between the 2004 underrepresented minority (URM) first year retention rates and the overall cohort's retention (67% vs 76%). The program was offered for the first time in summer 2005. This program was designed to address transition issues experienced by URM students entering a majority institution through a rigorous simulation of the first semester engineering experience. Embracing the best practices of learning communities, engineering students are required to live, study, and attend classes together in preparation for global competition. Through these methods, the Academic Boot Camp aims to develop a cohesive group of peer and staff support so that participants develop a sense of belonging with the Purdue Engineering community and are successfully retained in the first year. The five-week program is self-selected by the incoming students and their parents and has a cost associated with it. The program is promoted to all incoming URM students, though it is open to any engineering student who wishes to attend. The program includes accelerated, non-credit bearing gateway courses, a time management/study skills seminar, a team engineering design project, and an introduction to different aspects of the campus and support services that are available to the student body. A more complete discussion of the program structure is included in Dickerson, et al.[18] The two statistical tests explored in this paper are the Chi-square test and the t-test to analyze retention rates and students' GPA respectively.

B. Statistical Overview

The Chi-square test is used to compare frequency of occurrence for those results that come from categorical (discrete) data, such as retention rates. A specific version of this test is the Pearson's Chi-square test that compares the expected value of an occurrence to the actual occurrence rate.

Retention rate data is discrete because a person can only be in a state of 'Yes' (the person was retained) or 'No' (the person was not retained). Alternatively term or cumulative GPA data can have a wide range of values; therefore, the GPA analysis uses the t-Test. [22]

The Chi-square distribution is continuous, unimodal, and right-skewed. The degrees of freedom are found using:

$(p\text{-}1)(c\text{-}1)$

where p is the number of populations compared and c is the number of conditions.

In the analyses used in this paper, the degrees of freedom will always be one, since two populations will be compared using two conditions (retained or not retained). Due to the exploratory nature of this study, a p level of 0.10 was used to determine statistical significance.[8] The critical comparison value becomes $\chi 2(1)=2.71$, $(p=0.10)$.[22] The Chi-square test requires that each data set contains unique individuals (thus it cannot be used for a repeated-measure design such that a person could be in two populations) and the expected frequency of an occurrence (URM/Retained, Other/Not retained, etc.) must be larger than five.

Most universities use a 0-4.0 scale for GPA and a student's GPA can fall anywhere in that range. Therefore, the GPA analysis will be tested using a t-test. The t-test can be used to compare means between two normal populations. The difference of the means should be normal; however this requirement does not necessarily extend to the scores themselves.[22] The hypothesis tested can be whether the means are different using a two-tailed test, or whether one mean is greater than the other using a one-tailed test. This study will test whether the performance metrics for the program students were greater than the other groups; thus, the one-tailed test was used. The t-test can be used for both independent and dependent populations that are rated on a scaled measure. SPSS has separate analyses for both. The analysis is to compare means and not individual data. Therefore, while it might be concluded that the two populations have significantly different means, it doesn't allow any statement to be made about a certain person's GPA in either population. In the Independent Population test in SPSS, a Levene's Test for Equality of Variances is used to determine whether the significance is determined using the line where Equal variances is assumed or not assumed.

Methods

The paramount success metric of the Engineering Academic Boot Camp is to improve the first year retention of the underrepresented minority population and thus close the retention and achievement gap between the URM and majority populations. Additionally, if students were properly transitioned to the university environment, then a potential secondary benefit would be an increased academic performance in the gateway courses presented in the camps, thus improving their first term GPA. Graduation rates were not considered since there are many other influences that can affect the student in the following three to five years.

This paper will consider three primary groups:

- ABC Group: those underrepresented students who attended the program;
- URM Group: those underrepresented students who did not attended the program;
- MAJ Group: those students of Asian, White, Unknown, or International ethnicity who did not attended the program.

A fourth group consisting of majority students that did attend the program, denoted by ABC(MAJ), was not included in this analysis as the number is very small (n=7) and the focus of the study is to determine the program's effect on URM students who attended the program. Table 1 provides each year's incoming cohort for the College of Engineering. Not all attendees of the 2008 – 2012 Engineering Academic Boot Camps are included in this analysis. Some students came in who were accepted into other schools or regional campuses and desired to move into engineering at the main campus in the future. All reasons for a student not being included in the analysis are shown in Table 2, which resulted in study group of 90 students.

Table 1 - Retention Cohort Numbers for F'08 to F'12.

Cohort Year	ABC	URM	Percentage ABC:URM	MAJ	Percentage ABC:MAJ
F'08	20	54	37%	1,619	1.2%
F'09	21	72	29%	1,556	1.3%
F'10	21	106	19%	1,604	1.3%
F'11	12	111	11%	1,648	0.7%
F'12	16	89	18%	1,656	0.9%
Average	18	90	20%	1,616	1.1%

Table 2 - Registration Breakdown of ABC Attendees

	# of Attendees
ABC Group used in study	90
ABC(MAJ) Group	7
Regional students	5
Didn't attend University or not full time status	2
Enrolled in the Colleges of Science or Technology	3
Registered in Other nonSTEM College	12
Didn't finish ABC	1
Total Attending 2008-2012 Programs	120

Two comparison methods of analyzing the effectiveness of the ABC were performed for both retention and academic performance data. The first method, Independent Populations, compared the students who attended the ABC in engineering against:

1) the URM students (URM) who did not take the camp, and
2) the non-URM, non-attending (MAJ) engineering students.

The second method, Matched Pair, matched an ABC student with both a URM and White student from the same cohort who had similar incoming high school core GPA, test scores, residency, gender, and first semester classes. The Matched Pair analysis allows each comparison population to be the same size and consists of similar students as far as the admissions process is concerned. A wide variety of students self-select to come to the program; however, more students who are not as confident about their academic competitiveness at the university tend to self-select through committing to the five week program before coming to college. To determine the effectiveness of the program, a five year study was performed using the summers of 2008-2012.

The standard retention status of a first-time, full-time student after the first semester when they remain registered at the college would be either: a) Retained in Cohort (within the College of Engineering) or b) Retained in non-Cohort (within Purdue University but not in the College of Engineering). For this study, the latter group was further subdivided into two sub-groups to create a total of three categories. If a student remained at the university, but changed to the Colleges of Science or Technology, then the student was listed as "Retained in STEM." This distinction was created, since the program highly encourages STEM major participation. If a student moved into a non-STEM college at the university, then they were listed as "Retained at University." This discrete categorization requires the use of Chi-squared tests for the analysis.

Data and Analysis

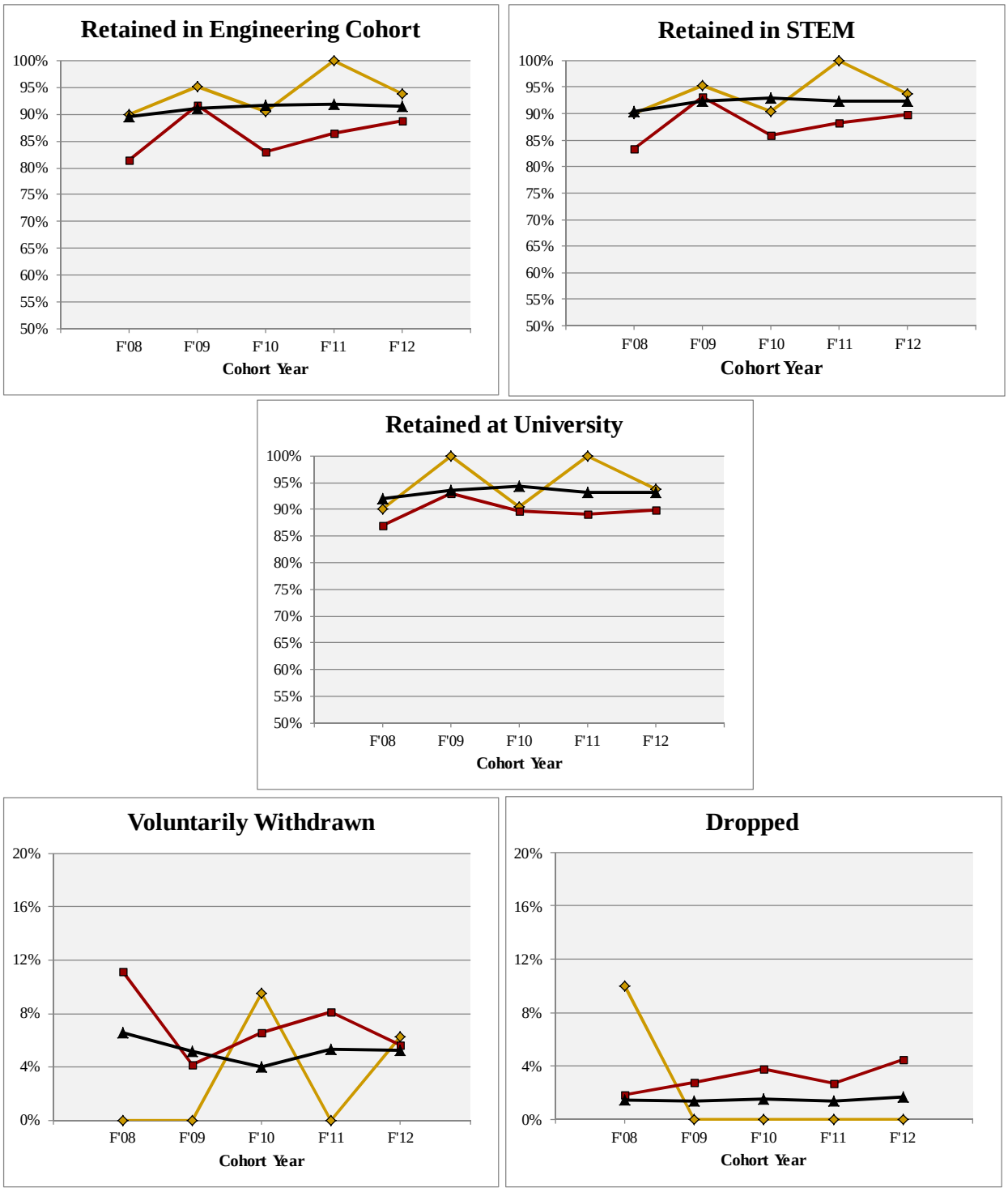
A. First Year Retention

1. Independent Populations

Table 3 presents the five-year average of each retention status obtained between the three groups (*ABC*, *URM*, and *MAJ*) that were analyzed, and Figure 1 presents charts showing each year's average retention rates. When comparing the two underrepresented populations in Figure 1, the students who attended the program attained better first year retentions for five of the five years for remaining in the cohort, STEM, and any college at the university. The attendees also had lower voluntarily withdrawal rates for three of the five years and lower drop rates for four of the five years when compared against the non-attending URM population.

Table 3 - Five year average retention rates for those students remaining enrolled at the university; Independent Populations analysis.

	Ret-Cohort	**Ret-STEM**	**Ret-Univ.**
ABC (n=90)	93%	93%	94%
URM (n=432)	86%	88%	90%
MAJ (n=8,082)	91%	92%	93%



Cohort Size	F'08	F'09	F'10	F'11	F'12	LEGEND
ABC	20	21	21	12	16	
URM	54	72	106	111	89	
MAJ	1,619	1,556	1,604	1,648	1,656	

Figure 1 - Comparison of the Engineering Program's Influence on First Year Retention - All students.

While the results are not as consistent when comparing the ABC group to the MAJ group, each retention rate (cohort, STEM, or the university) has two or three years that the program cohorts have higher rates over the majority cohort. In the ABC cohort, there were no students who voluntarily withdrew for three of the five years and no students who were dropped for four of the five years. Neither of the other cohorts had any years where zero students within the group were voluntarily withdrawn nor dropped.

SPSS Statistics 21 was used to determine statistical significance of the first year retention data. A good reference for learning SPSS is from Andy Field.[22] A Chi-squared test was used to test retention differences between groups. A column was generated for Retention(Cohort), Retention(STEM), and Retention(PU). Each person either had a 'YES' for being retained in the status in question or a 'NO' for not being retained. A crosstab was generated for each group (ABC, URM, MAJ) comparison for each of the three retention types(Cohort, STEM, University). The Chi-squared test is used, since retention rates are a nominal variable (yes/no).

As mentioned in the Introduction, the $\chi 2(1)$, $p=0.10$ which will be used in testing is 2.71. This value does not need to be known, since SPSS generates the significance in its output. The ABC students are retained within the College of Engineering at a statistical significant ($\chi 2(1)=3.339$, $p=0.068$) higher rate than the non-attending URM students who started in the College of Engineering. The ABC group resulted in a 93% retained in the cohort compared to 86% for the URM group. There was a significant association between taking the academic boot camp as to whether an underrepresented minority student will be retained in engineering at the university. The comparison between the ABC and the MAJ groups does not show any statistical differences ($\chi 2(1)=0.540$, $p=0.462$) between the retention rates of the students attending the academic boot camp (93%) and the majority population with 91% retained in engineering. Table 4 presents the results of the Chi-square test comparison between each group and which group showed a higher retention if statistically significant and the significance value obtained.

Table 4 - Results of Chi-square tests on retention using Independent Populations.

	COHORT		STEM		UNIVERSITY	
	Results	**Asymp. Sig.**	**Results**	**Asymp. Sig.**	**Results**	**Asymp. Sig.**
Retention (ABC,URM)	R-C(ABC) > R-C(URM)	0.068	Not Significant	0.155	Not Significant	0.171
Retention (ABC,MAJ)	Not Significant	0.462	Not Significant	0.657	Not Significant	0.646
Retention (URM,MAJ)	R-C(MAJ) > R-C(URM)	0.001	R-S(MAJ) > R-S(URM)	0.004	R-U(MAJ) > R-U(URM)	0.007

The Chi-squared test can be used against groups of different population sizes, though the extreme difference between the ABC and the MAJ groups could tend to generate significance in part by the large size of the majority population.[7] Tables 1 and 5 illustrates what a small subgroup the boot camp attendees are when compared against the non-attending URM student and becomes miniscule against the majority cohort. This prompted the desire to provide a comparison between the three groups with equal sample size and paired against each ABC attendee. The previously discussed comparison tests were then rerun using the matched group

data to determine how similar groups would affect the difference in 1st Year Retention Rates. This matching process will be discussed more in the next section.

Table 5 - Percent of ABC attendees when compared against the majority population.

	F'08	**F'09**	**F'10**	**F'11**	**F'12**	**Average**
ABC:URM	37%	29%	19%	11%	18%	21%
ABC:MAJ	1.2%	1.3%	1.3%	0.7%	1.0%	1.1%

2. Matched Pair

This matched cohort technique is a methodology used by State Departments of Education when comparing the performance of groups with similar characteristics, but widely differing sizes.[9] There are many facets of an incoming student which could predict the success of that student as they enter and progress with their education at the university. Ethnicity, gender, residency, and incoming metrics are all considered in the holistic process of admitting students into the various colleges at the university. These same factors were used to match similar students for the matched pair analysis. Since matriculating out of the First Year Engineering program is an indicator of success in engineering, the observer was blinded to profile school in engineering to remove that potential source of bias when choosing the matched pair. Each ABC student was given an identifying number. These boot camp attendees were then placed in a matrix that provided:

- Ethnicity
- Gender
- Residency
- Core GPA
- SAT(Math), SAT(Critical Reading), SAT(M+CR), or the SAT equivalent of these ACT scores
- Number of types of involvement in the minority sponsored programs
- First semester courses

Each ABC attendee in a given cohort was then matched with a URM student and a Majority student that was as comparable as possible. Students identifying as White were used as frequently as possible for the Majority match. Each cohort was matched separately. Students were grouped into incoming math and chemistry classes. There is one math/chemistry track for calculus-ready students and a second for those students who need to begin with pre-calculus. Since these classes were covered in the program, this was considered the best first match. The boot camp students were highlighted and similar gendered and residency students were compared to find a match. Ethnicity was matched as closely as possible. However, in some cases, particularly for Black or African American students, there was a lack of similar students to match. Therefore, some variance in the number of each type of race/ethnicity and gender/ residency resulted as shown in Tables 6 and 7. In general, similar SAT(Math) was used first for comparing incoming metrics between the two URM students, and Core GPA was the original

match point for ABC and MAJ students. When a URM student was being matched with an ABC student, the desire was to choose a student who attended the least number of other minority program offerings. Financial need was not taken into consideration when matching students which may have affected the results of the analysis.

Table 6 - Total of each race/ethnicity in the two URM matched groups.

ABC Cohort				**URM Cohort**			
American Indian or Alaska Native	Black or African American	Hispanic/ Latino	2 or more Race (URM inclusive)	American Indian or Alaska Native	Black or African American	Hispanic/ Latino	2 or more Race (URM inclusive)
2	56	30	2	3	42	39	6

Table 7 - Total of Gender/Residency of each matched group.

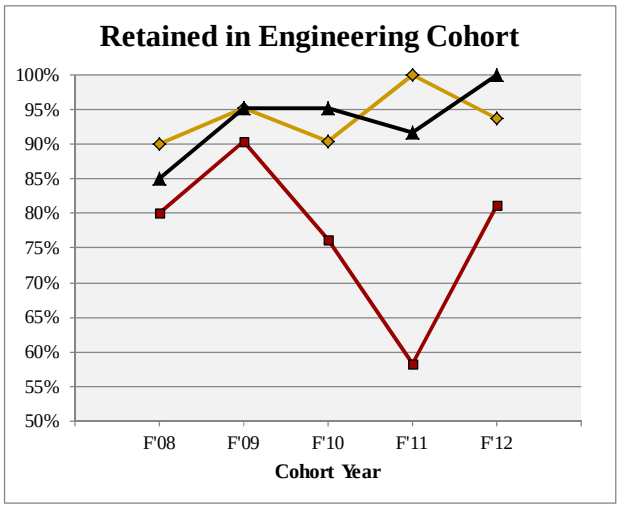
ABC				**URM**				**MAJ**			
Female Nonres	Female Resident	Male Nonres	Male Resident	Female Nonres	Female Resident	Male Nonres	Male Resident	Female Nonres	Female Resident	Male Nonres	Male Resident
16	11	38	25	17	10	37	26	16	11	37	26

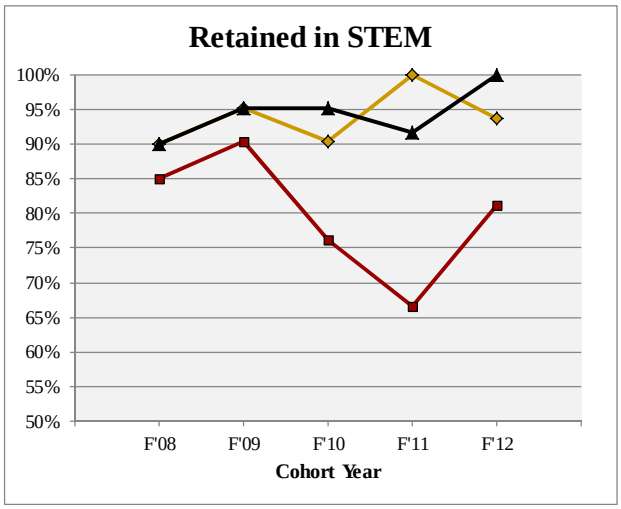
The matched pair results show the five-year average data in Table 8 and each year's cohort averages in Figure 2. Figure 2 presents a good illustration of the variances in the results of small populations. The URM and MAJ yearly retention, voluntarily withdrawn, and dropped rates each year fluctuate far more than the values seen in the Method 1 analysis. However, the five year average for each remains close to the whole cohort averages. The URM population loses eight percentage points in the average for the retained in cohort or retained in STEM at the university when compared to Method 1. The results for the boot camp students are still better than the other URM students. The MAJ population actually saw a two percentage point improvement in the three retention rate averages when compared against Method 1.

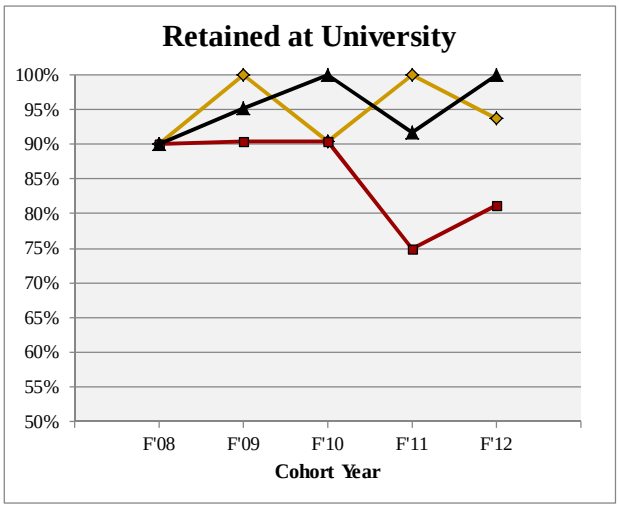
Table 8 - Five year average retention rates for those students remaining enrolled at the university; Matched Pair analysis.

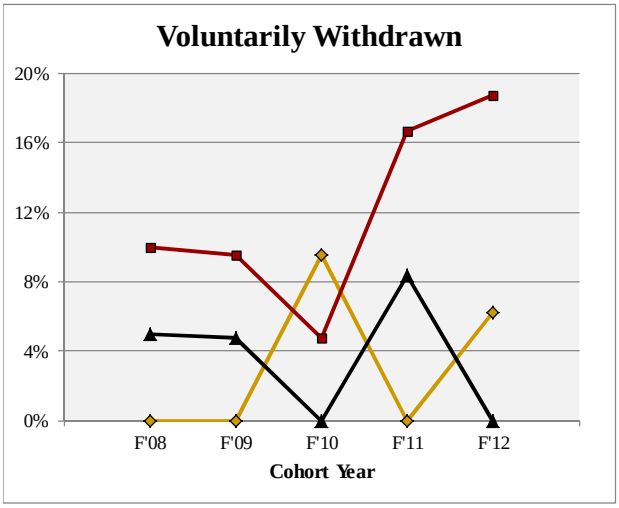
	Ret-Cohort	**Ret-STEM**	**Ret-Univ.**
ABC (n=90)	93%	93%	94%
URM (n=90)	79%	81%	87%
MAJ (n=90)	93%	94%	96%

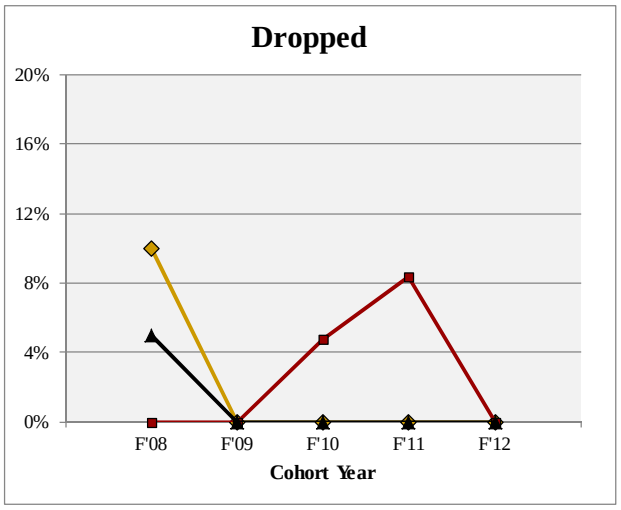
The Engineering Academic Boot Camp attendee's five-year average for 1st Year Retention in the Cohort (93%) is statistically better than ($\chi 2(1)=7.850$, $p<0.01$) the URM matched group (79%). Similar results were seen as in the whole cohort analysis when comparing the URM student group to the MAJ student group. These results are summarized in Table 9 for the matched pair











Cohort Size	F'08	F'09	F'10	F'11	F'12	LEGEND
ABC	20	21	21	12	16	
URM	20	21	21	12	16	
MAJ	20	21	21	12	16	

Figure 2 - Comparison of Engineering Program's Influence on First Year Retention - Matched Pairs.

analysis. The ABC students' retention within STEM and the University became statistically better than the non-attending URM populations.

Table 9 – Results of Chi-square test on retention using Matched Pairs.

	COHORT		**STEM**		**UNIVERSITY**	
	Results	Asymp. Sig.	Results	Asymp. Sig.	Results	Asymp. Sig.
Retention (ABC,URM)	R-C(ABC) > R-C(URM)	0.005	R-S(ABC) > R-S(URM)	0.014	R-U(ABC) > R-U(URM)	0.074
Retention (ABC,MAJ)	Not Significant	1.000	Not Significant	0.756	Not Significant	0.732
Retention (URM,MAJ)	R-C(MAJ) > R-C(URM)	0.005	R-S(MAJ) > R-S(URM)	0.006	R-U(MAJ) > R-U(URM)	0.036

B. First Term Grade Point Average

1. Independent Populations

As discussed above, a possible secondary benefit to the acclimation generated by the Academic Boot Camp was that the attendees might perform better in classes than their peers who did not attend the program. The average first term GPA for all students in the F'08 to F'12 cohorts is presented in Table 10 and is charted in Figure 3. A summary of the results of the independent sample t-test is shown in Table 11. In engineering, the ABC students had a statistically higher 1st term GPA than the URM students. In both programs, the Majority students' 1st term GPA average was statistically higher than both the ABC and URM groups.

Table 10 - First Term GPA yearly averages and five-year average for the Independent Populations analysis.

	F'08	**F'09**	**F'10**	**F'11**	**F'12**	**Avg.**
ABC (n=90)	2.63	3.18	3.16	2.71	2.73	2.88
URM (n=432)	2.65	2.74	2.74	2.70	2.80	2.73
MAJ (n=8,082)	2.98	2.97	3.14	3.15	3.15	3.08

Table 11 - Results of t-Tests on 1st Term GPA using Independent Populations.

	Results	**Sig. (1 tailed)**
GPA (ABC,URM)	GPA(ABC) > GPA(URM)	0.034
GPA (ABC,MAJ)	GPA(MAJ) > GPA(ABC)	0.027
GPA (URM,MAJ)	GPA(MAJ) > GPA(URM)	0.000

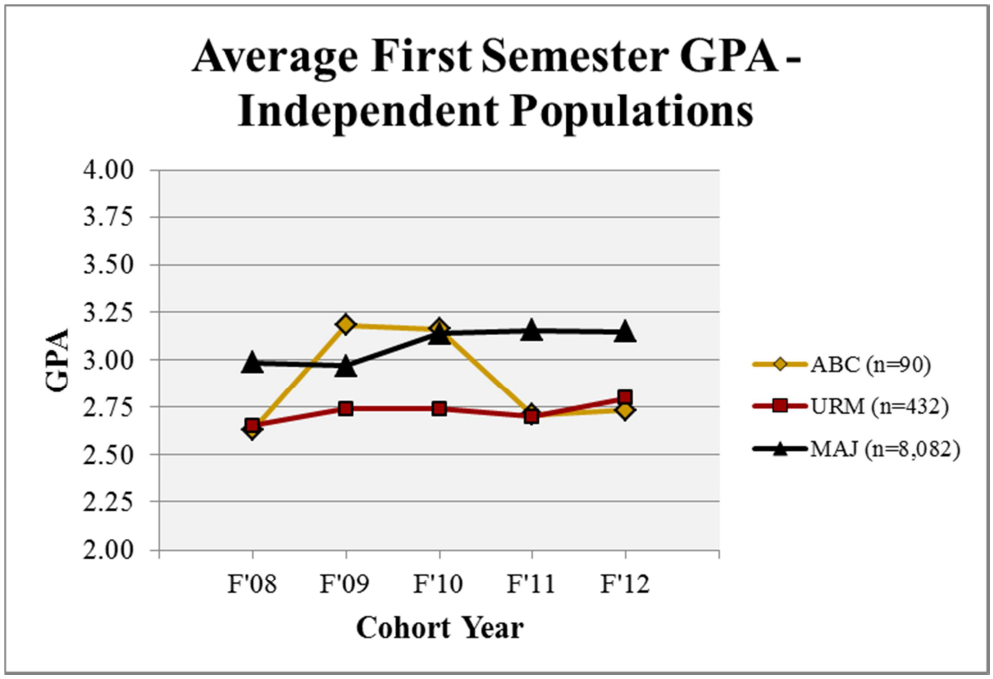


Figure 3 - First semester GPA of each cohort using Independent Population analysis.

The same matched groups from the first year retention analysis were used for the paired sample t-test analysis of the first term GPA comparison. The five year average of first term GPA's are shown in Table 12 and is charted in Figure 4. The paired sample t-test results are summarized for first term GPA's in Table 13. The GPA's of the ABC and Majority group are statistically better than the URM group. The difference between the ABC and MAJ 1st Term GPA became insignificant in the matched pair analysis.

Table 12 - First Term GPA yearly averages and five-year average for the Matched Pair analysis.

	F'08 n=20	**F'09 n=21**	**F'10 n=21**	**F'11 n=12**	**F'12 n=16**	**Avg.**
ABC (n=90)	2.63	3.18	3.16	2.71	2.73	2.88
URM (n=90)	2.43	2.86	2.60	2.11	2.59	2.52
MAJ (n=90)	2.72	2.79	3.01	2.86	2.99	2.87

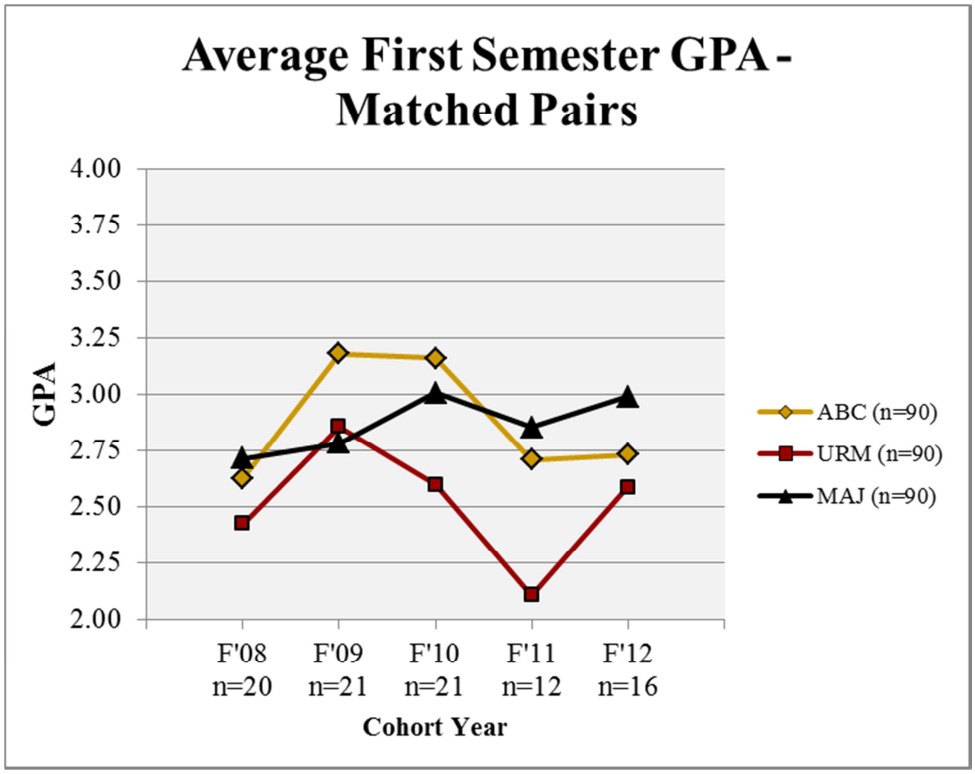


Figure 4 – First semester GPA for each year's sub-cohort using Matched Pair analysis.

Table 13 - Results of t-Tests on 1st Term GPA using Matched Pairs.

	Results	**Sig. (1 tailed)**
GPA (ABC,URM)	GPA(ABC) > GPA(URM)	0.001
GPA (ABC,MAJ)	Not Significant	0.333
GPA (URM,MAJ)	GPA(MAJ) > GPA(URM)	0.002

Conclusions and Discussion

Through the utilization of statistical methods of Independent Populations, program staff have been able to demonstrate the effectiveness of the Engineering Academic Boot Camp in improving first year retention and first semester academic performance for program participants compared to their underrepresented minority peers. This confirms the primary and secondary metrics that were designated as success indicators (retention and GPA) for the Academic Boot Camp have been met for the previous five years beyond the descriptive statistics (for e.g. GPA averages) typically reported for program evaluation purposes.

The performance of the matched pair analysis shows that there can be legitimate differences between the program performance using this one-to-one analysis instead of using the entire majority cohort. The Independent Population analysis comparing the retention between the ABC and URM populations generated only statistical significance in the Retained in Cohort comparison. The Matched Pair analysis generated statistical significance across all levels of enrollment at the university (Cohort, STEM, and University.) However, no differences were seen between the two methods when comparing the retention of the ABC students to the majority student. There remained no statistical significance between the two populations. When comparing first semester GPAs, the Matched Pair analysis resulted in a loss of significance between the ABC and MAJ populations. It should be remembered that the program was designed to "close the achievement gap", which the Paired Match analysis does demonstrate. This is a strong statement that the program provided an avenue to remove the transition issues that have historically acted as barrier to URM success.

The Purdue University Minority Engineering Program continues to look for ways to broaden the impact of this type of programming for a greater percentage of the incoming URM population. Further study that would be beneficial in the design of future camps would be to determine what parts of the camp most affect the retention and grade improvements. This could lead to improvements that might make the camp more effective and allow prioritization of the types of activities included in the curriculum.

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