Book of Abstracts

October 4-5, 2018

Southeastern Institute for Operations Research and the Management Sciences

Welcome Message from the Program Chair

Welcome to the 2018 SE INFORMS conference in beautiful Myrtle Beach, South Carolina. This is the 54th annual meeting of the Southeastern Chapter of the Institute for Operations Research and Management Science. I hope the conference is both an enjoyable and informative experience for you. After the sessions are done for the day, please make sure to find time to enjoy the beaches, restaurants and attractions in Myrtle Beach.

Thank you to all the participants. You are the reason the conference exists and will continue to grow in the future. Please attend as many sessions as you can. There is so much that we can learn from each other. A total of 62 papers are being presented along with 6 workshops and panels. All of the submissions went through the peer review process. There is certainly something that will be of interest for everyone. Thank you for coming to the conference. You can access the conference program online through the URL: https://seinforms2018.exordo.com/programme

Please attend the business meeting on Thursday from 4:30-5:30pm in the Palisades C. At the meeting you can learn how SE INFORMS operates and can learn about ways to volunteer to help make the organization successful. Following the meeting is the President's reception at 6:00pm. This is a great opportunity to meet people and enjoy refreshments.

Thank you to everyone who reviewed papers and volunteered to act as session chairs. The track chairs did a great job coordinating the review process. All of your efforts make this conference successful. Also, thanks to the SE INFORMS officers, especially Donna Schaeffer, Jay Teets, Michelle Hagadorn and Cheryl Aasheim whose guidance was invaluable.

Thank you to my colleagues at Marymount University for their support of time and financial resources that has enabled me to perform my duties as program chair. I also want to thank all the reviewers who contributed their time and expertise reviewing the submissions and providing valuable feedback to the authors.

I found the people in the SE INFORMS to be very supportive and welcoming. Please make sure to say hello to someone that you don't know while you are saying hi to those you know. If I haven't met you before, please introduce yourself so I can meet new friends and potential research collaborators.

I hope you have a great conference. If you have any problems, please see me so that the problem can be resolved.

Michelle(Xiang) Liu, PhD, CCII, ERM^{P}
School of Business & Technology, Marymount University
2018 SEINFORMS Program Chair

Table of Contents

A COMPARISON OF PRE-COLLEGE ENRICHMENT PROGRAM PARTICIPANTS AND NON-PARTICIPANTS: COLLEGE ACADEMIC PERFORMANCE MEASURES

Sherron McKendall, Health Sciences & Technology Academy, West Virginia University
Alan McKendall, Industrial and Management Systems Engineering, West Virginia University
Ann Chester, Health Sciences & Technology Academy, West Virginia University

ABSTRACT

This paper analyzes College Grade Point Averages (CGPAs), American College Testing Composite (ACTC) scores and Scholastic Assessment Test Total (SATT) scores of over 1,300 undergraduates at West Virginia University (WVU) who participated in the Health Sciences and Technology Academy (HSTA) to those students who did not (Non-HSTA). Traditionally, pre-college enrichment programs provide academic enrichment to underrepresented youth with the intent of increasing their chances for post-secondary entry and success. Factorial design determined if HSTA participants were better prepared to pursue post-secondary study. Overall, the results reveal that HSTA students outperformed their Non-HSTA counterparts in that there were significant differences in the overall CGPA, ACTC and SATT scores.

INTRODUCTION

Academic measurements such as standardized test scores, specifically the SATT and the ACTC are utilized to measure mental aptitude/abilities and are a determinant of college admission in the United States. However, underrepresented (i.e., African-American, financially disadvantaged, first generation college, and rural) students may not perform well on these entrance exams, which may serve as obstacles to post-secondary pursuit. An important question for educators and policy makers to consider is "Can pre-college/science, technology, engineering, and mathematics (STEM) enrichment programs increase academic achievement outcomes, namely standardized test scores and CGPAs for underrepresented students?" The West Virginia Health Sciences and Technology Academy (HSTA) is a science and math intervention academic enrichment program with a primary goal of addressing the problem of underrepresentation in college enrollment, for certain populations of students, in West Virginia. It aims at promoting the pursuance of careers by African American, financially disadvantaged, first generation and extremely rural students in health sciences as well as STEM fields, mainly through facilitating preparation and enthusiasm prior to their graduation from high school. The HSTA student population is comprised of 37% African-American, 47% low socio-economic, 68% first generation college goers, 75% rural, and 69% female.

This paper seeks to determine if HSTA participants have higher overall CGPAs, ACTC and SATT scores than Non-HSTA participants by considering the following questions:

- What effects do Status (i.e., HSTA and Non-HSTA) and Race (i.e., African American/Black and White/Caucasian) have on the academic performance of the populations?
- Is there any interaction between the aforementioned factors (i.e., Status and Race)?

There is minimal research that examines whether participants/graduates of pre-college enrichment programs have been better prepared to pursue 4-year degrees compared to those who have not. The purpose of this study is to exemplify that African American and Caucasian students who receive the HSTA intervention are more likely to attain higher standardized test scores and CGPAs because they receive

services that are equivalent to a gifted program providing them with a competitive edge to do well on these tests. Essentially, HSTA makes a difference in the lives of students in both the development of their skills and knowledge as well as their access to higher education [14].

LITERATURE REVIEW

A review of the literature found that only a limited number of out-of-school-time (OST) programs have performed empirical studies of their offerings [4] [11] [15] [19]. Even fewer have established experimental-control designs analyzing standardized test scores targeting graduates of academic enrichment programs [16] [25]. Watt, Huerta & Lazano [26] conducted a control-experimental study of GEAR UP and AVID students' educational aspirations, among other factors. The study examined mathematics achievement scores. The control group scored slightly higher than the GEAR UP, AVID, and combined GEAR UP/AVID groups, but the results were not statistically significant. Another study on GEAR UP students' college readiness performed by Bausmith and France [2] utilizing standardized test measurements showed promising results for students in low-income schools. Fashola and Slavin [8] examined several programs for students at risk that have employed empirical studies revealing positive outcomes for elementary and middle school students. In the realm of pre-college enrichment programming, it is rare to find studies comparing standardized test scores of program participants to those of non-program participants at the college level [2]. The current study addresses this gap in evidence by comparing the scores of students who attended HSTA to a matched cohort of non-HSTA students' ACTC, SATT, and CGPA.

METHODOLOGY

The researchers obtained internal data from the WVU registrar's office for students enrolled during the 1997 through 2011 academic calendar years. The data set includes demographics (i.e., race), ACTC and SATT scores, enrollment status, and cumulative CGPAs for all undergraduate students in this time frame. After data was received, a one (HSTA) to three (Non-HSTA) match was performed based on race, gender and enrollment status for the undergraduate student populations. We used the statistical software SAS 9.4 for Windows during the data analysis process. The final data set comprised 327 HSTA and 981 Non-HSTA students totaling 1,308 participants. The participants' demographics are 384 Blacks and 924 Whites students.

Factorial Experiment Design

The Encyclopedia of Survey Research Methods describes factorial designs or fully crossed designs as a "form of true experiment" because the researcher can manipulate or vary multiple factors/independent variables in the research design. This is advantageous because the researcher can examine the main effects of two or more independent variables simultaneously as well as interactions between the variables. An interaction occurs "when the effects of one variable vary according to the levels of another variable" and is only "detected when the variables are examined in combination" [12, pp. 261-262]. In general, factorial designs are most efficient for this type of experiment given that an examination of each complete trial/replication of the experiment and all possible combinations of the levels of the factors takes place. In order to examine the effects of race on the academic performance of HSTA and Non-HSTA students, there are two different factors, which considers membership in HSTA as the first level of the design and lack of membership as the second level, as presented in Table 1 below.

		Treatment Combinations	
Race	**Factor Name**	**HSTA**	**NON-HSTA**
African American/Black	A	1	-1
White/Caucasian	B	1	-1

Note: Using "+" and "-" notation represents whether the students belong to HSTA group or not.
Table 1. Factor Definition

For the treatment combinations, the contrast coding of 1 and -1 reflects the comparisons made between HSTA and Non-HSTA students. Since the sample size for the treatment combinations are unequal, we have an unbalanced experimental design. Additionally, all of the factors in the experiment are fixed. In this study, we took advantage of 2^k factorial design. This is the special case of the factorial design with k factors occurring only at two levels to investigate the effect of Status and Race on the academic performance of students (See Figure1):

- Status at two levels: HSTA, Non-HSTA
- Race at two levels: African American/Black, White/Caucasian

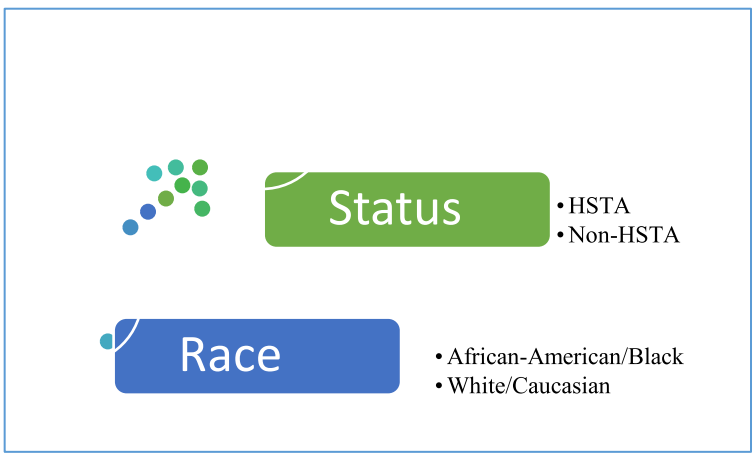

Figure 1. Design of Experiment

The following SAS code depicts an example of the combinations and interactions for the dependent variable ACTC score.

```
DATA HSTA;
INPUT STATUS RACE ACTC;
DATALINES;
1       1       20
-1      1       15
-1      1       .
-1      1       .
1       2       .
-1      2       24
-1      2       19
-1      2       28
```

```
1        1        26
-1       1        21
-1       1        17
-1       1        .
1        1        18
-1       1        26
-1       1        20
-1       1        18
;
proc glm plot=meanplot(cl);
  class STATUS RACE;
  model ACTC=STATUS RACE STATUS*RACE;
  lsmeans STATUS RACE STATUS*RACE   / cl pdiff=all adjust=tukey;
run;
ods graphics off;
```

Note that the (.) represent missing data and that all the DATALINES that appear in the final SAS code are not in the above code. As previously mentioned, the Status happens at two levels of HSTA (1) and Non-HSTA (-1) and the race at two levels of Black (1) and White (2). The response variables examined were the overall CGPA, ACTC, and SATT scores.

To conduct the experiment, we used the SAS procedure, PROC GLM (General Linear Model) instead of PROC ANOVA (One-way analysis of variance). PROC GLM is similar to PROC ANOVA and uses many of the same options and statements. However, PROC GLM can compute contrasts and analyze unbalanced designs. In addition, the least squares means (LS-means) statement is used for unbalanced and fixed effects procedures in SAS. It is also important to note that the statement contains only classification variables. An LS-means "estimate the averages you would have seen if your data had been balanced; they indicate how a given factor affects the response, all other things being equal;" thereby, providing "an estimate for certain linear combinations of population parameters. The particular linear functions are defined by population marginal means of the corresponding means for balanced data" [3, pp. 1-2]. Determining LS-means as opposed to arithmetic means in an unbalanced experiment considers that the sample sizes in all groups are different and assumes an even distribution of Status and Race in the underlying population. Thus, an LS-mean is equivalent to the mean for unbalanced experimental designs [3]. The class statement tells SAS that we have a categorical variable in our data set. The most common usage of the class statement will most likely be in the univariate, means, and GLM procedures. It is required for the GLM procedure only if we have a categorical variable such as race. The model statement specifies which model to analyze for the data. The dependent or response variable is always positioned on the left side of the equal sign while the independent variable(s) come after the equal sign. In the above code, we consider ACTC as the dependent variable; however, the model is repeated for all considered dependent variables. Additionally, the (*) is used in the model and lsmeans statement to tell SAS to consider all the possible interactions between the factors.

The GLM procedure produces the Type I (sequential) and Type III (partial), Marginal Sums of Squares for each model. Both provide the results on the significance level for each of the fixed effects in the model statement. However, the marginal (Type III) Sums of Squares are preferable in most cases since they correspond to the variation attributable to an effect after correcting for any other effects in the model. Type III Sums of Squares also provide estimates, which are not a function of the frequency of observations in any group, (i.e., for unbalanced data structures), where we have unequal numbers of observations in each group. As such, the group(s) with more observations does not per se have more importance than group(s) with fewer observations. Thus, this test is unaffected by the frequency of observations.

RESULTS

We conducted analyses on each of the dependent variables (i.e., ACTC, SATT, and CGPA) and the two main factors (Status and Race) to determine model validity (Table 2 below).

Model	CT	$\bar{X}$	df	SSE	SS	MSE	COV	R^2	F Value	Pr > F
ACTC	1115	22.07	3	14589.56	1343.26	447.75	16.41	0.084	34.13	***
SATT	397	1003.19	3	9933131.29	1608516.20	536172.07	15.82	0.14	21.27	***
CGPA	1271	2.75	3	936.41	38.59	12.86	31.20	0.04	17.42	***

Note: *CT* = Corrected Total; *SSE* = Sum of Squares Error; *SS* = Sum of Squares; *MSE* = Mean Squares Error; *COV* = Coefficient of Variation; R^2 = R-Square; *significance level* = *** $p < 0.0001$

Table 2. Predictive models by Dependent Variables for Status and Race (All Participants)

In table 2, we can see that there is a significant difference for each model at the <.0001 level; however, the R^2 for the ACTC and the CGPA models are extremely low and for the SATT only 14% of the variation is accounted for by the model. Although this may seem problematic given that R-square estimates determine strength of relationship between the model and the response variable, we might attribute a low R-square to the wide range in the test scores and CGPAs. Academic performance measures might be lower, in particular for some Black students, due to outlying factors such as stereotype threat [23] [24]. Stereotype threat is a phenomenon in which "individuals from stereotyped groups display impaired performance by virtue of a predisposition of conforming to or fear of reinforcing the negative stereotype of the group. Thus, culturally tolerated stereotypes (e.g., African Americans are intellectually inferior to Whites, males are better at math than females) can hinder an individual's academic performance if the individual identifies with the group" [22]. Several empirical studies have validated that the stereotype threat phenomena results in lower academic performance among certain underrepresented groups [1] [10] [17] [18]. Despite this, we see that the models are highly significant. The coefficient of variation shows that there are higher variance in the CGPA compared to the ACTC and SATT, with SATT showing the lowest degree of variation in the distributions.

Tables 3 through 5 provide the models displaying significance levels of the main effects and their interaction. The results indicate significance for the main effects; however, the interaction between Status and Race is not significant for each of the dependent variables. The generalized linear models for the Type III SS showed statistically significant differences in the mean scores at the $p < 0.001$ or lower for ACTC, SATT and CGPA.

Source ACTC	DF	Type III SS	F Value	Pr > F
STATUS	1	158.690523	12.10	0.0005
RACE	1	1055.738498	80.47	< 0.0001
STATUS*RACE	1	43.471740	3.31	0.0690

Table 3. GLM Procedure for ACTC Score

Source SATT	DF	Type III SS	F Value	Pr > F
STATUS	1	395514.6940	15.69	< 0.0001
RACE	1	811862.7562	32.20	< 0.0001
STATUS*RACE	1	6433.9338	0.26	0.6137

Table 4. GLM Procedure for SATT Score

Source GPA C	DF	Type III SS	F Value	Pr > F
STATUS	1	10.08452170	13.66	0.0002
RACE	1	20.44710571	27.69	< 0.0001
STATUS*RACE	1	0.00761846	0.01	0.9191

Table 5. GLM Procedure for CGPA

Tukey's Honestly Significant Difference (HSD) adjustment for multiple comparisons revealed that the difference in the mean scores between HSTA and Non-HSTA students on the ACTC, SATT and CGPA is -0.93, -77.89, and -0.22, respectively. Analyses of the variable Race also produced statistically significant differences in the mean scores between Black and White students at the $p < 0.0001$ for ACTC, SATT and CGPA. In Tables 6 and 7 below, the HSD adjustment for Confidence Limits (CL) also revealed that the greatest mean difference appeared in the SATT scores (-111.60). The differences were not as prominent for the ACTC and CGPA variables.

	$\bar{X}$	95% CL		Difference Between Means	Simultaneous 95% CL LSMean(i)-LSMean(j)	
		Lower	Upper			
ACTC						
HSTA	22.22	21.78	22.66	-0.93	-1.45	-0.41
NHSTA	21.29	21.29	20.99			
SATT						
HSTA	1045.83	1012.01	1079.65	-77.89	-116.55	-39.23
NHSTA	967.94	949.20	986.67			
CGPA						
HSTA	2.86	2.75	2.96	-0.22	-0.34	-0.10
NHSTA	2.63	2.57	2.69			

Table 6. LS-Means for Dependent Variables by Status Adjustment for Multiple Comparisons: HSD

	$\bar{X}$	95% CL		Difference Between Means	Simultaneous 95% CL LSMean(i)-LSMean(j)	
		Lower	Upper			
ACTC						
Black	20.55	20.11	21.00	-2.40	-2.92	-1.87
White	22.95	22.68	23.23			
SATT						
Black	951.08	920.32	981.58	-111.60	-150.26	72.94
White	1062.96	1039.26	1086.11			
CGPA						
Black	2.58	2.48	2.68	-0.32	-0.44	-0.20
White	2.90	2.83	2.96			

Table 7. LS-Means for Dependent Variables by Race Adjustment for Multiple Comparisons: HSD

The Tables 6 and 7 also provides the 95% confidence limits for the test scores and CGPA lsmeans as well as the 95% simultaneous CLs for the mean difference of the variables indicating that we can be 95% confident that all the confidence intervals contain the true differences. In addition, Figures 2 through 4 illustrate the 95% confidence limits for the interaction between Status and Race for ACTC and SATT.

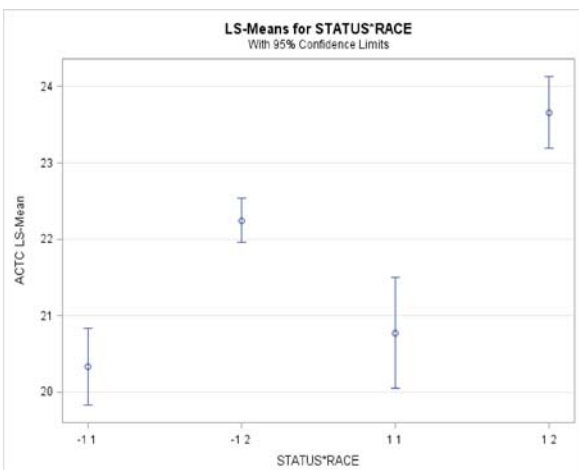

Figure 2. Graph depicting 95% CL for ACTC for Status by Race

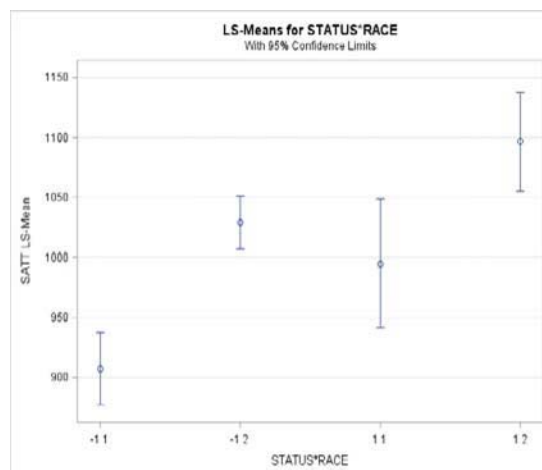

Figure 3. Graph depicting 95% CL for SATT for Status by Race

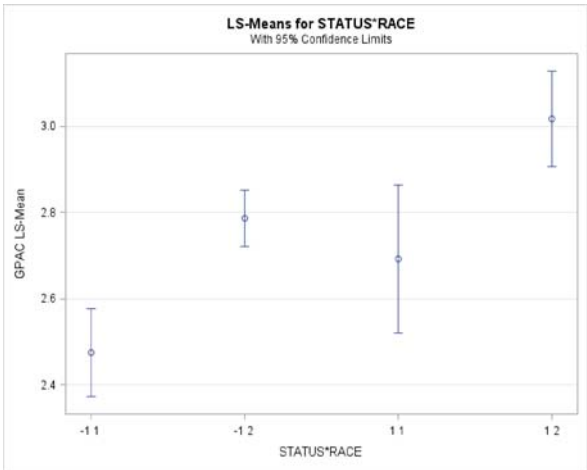

Figure 4. Graph depicting 95% CL for CGPA for Status by Race

Although the GLM models did not show significant difference in the interaction between Status and Race (recall Tables 3 through 5); however, the HSD analyses revealed significant differences in the test scores and CGPA when comparing across groups by Status and Race (See Tables 8 through 10). The ACTC lsmeans showed significant difference in test scores between HSTA White participants and the other groups including HSTA Blacks. ACTC lsmeans for each group is 20.78, 23.66, 20.33, and 22.25 for HSTA Black, HSTA White, Non-HSTA Black and Non-HSTA White populations, respectively. The mean difference between HSTA White and the other groups ranged from 1.41 to 3.33. The mean difference between the HSTA and Non-HSTA Black population scores was 0.45.

i/j	N-HSTA Black	N-HSTA White	HSTA Black	HSTA White
N-HSTA Black	--	***	ns	***
N-HSTA White	***	--	*	***
HSTA Black	ns	*	--	***
HSTA White	***	***	***	--

* $p < 0.05$, ** $p < 0.001$, *** $p < 0.0001$, ns = not significant

Table 8. LS-Means for Dependent Variable ACTC by Status and Race Adjustment for Multiple Comparisons: HSD Pr > |t| for H0: LS-Mean(i)=LS-Mean(j)

SATT lsmeans scores for interaction between the main effects showed that HSTA African American students' scores were significantly different from their Non-HSTA counterparts (995.00 vs. 907.17, p = 0.0269). The results also revealed that HSTA Black students SATT scores were not significantly different from the Non-HSTA White population (p = 0.6620). Comparably, HSTA White students also performed better on the SATT score than their Non-HSTA counterparts (1096.67 vs. 1028.71, p = 0.0236). Significance levels for Status by Race are presented below in Table 9.

i/j	N-HSTA Black	N-HSTA White	HSTA Black	HSTA White
N-HSTA Black	--	***	*	***
N-HSTA White	***	--	ns	*
HSTA Black	*	ns	--	*
HSTA White	***	*	*	--

* p < .05, **, p<.001, ***p < .0001, ns=not significant

Table 9. LS-Means for Dependent Variable SATT by Status and Race Adjustment for Multiple Comparisons: HSD Pr > |t| for H0: LS-Mean(i)=LS-Mean(j)

The CGPA scores revealed that the HSTA African American students' CGPA was not significantly different from their Non-HSTA counterparts (2.69 vs. 2.47; p = 0.1416). However, it was also not significantly different from Non-HSTA White students (2.69 vs 2.79; p = 0.7424) which is only a 0.10 difference in range. Conversely, Non-HSTA Black students' CGPA was significantly different from Non-HSTA White and HSTA White students (3.02). Table 10 below presents significance levels across groups.

i/j	N-HSTA Black	N-HSTA White	HSTA Black	HSTA White
N-HSTA Black	--	***	ns	***
N-HSTA White	***	--	ns	*
HSTA Black	ns	ns	--	*
HSTA White	***	*	*	--

* $p < 0.05$, ** $p < 0.001$, *** $p < 0.0001$, ns = not significant

Table 10. LS-Means for Dependent Variable CGPA by Status and Race Adjustment for Multiple Comparisons: HSD Pr > |t| for H0: LS-Mean(i)=LS-Mean(j)

The mean SATT and CGPA differences between HSTA White students and the other groups ranged from 189.5 to 101.67 and 0.55 to 0.33, respectively. HSTA Black students outperformed their Non-HSTA counterparts on the SATT test (mean difference = 87.83); however, there were no significant differences between the groups on the CGPA (mean difference = 0.22). Although significant differences were found between the Non-HSTA Black and White students on the SATT and CGPAs, findings showed that the mean differences in SATT (33.71) and the CGPAs (.10) for HSTA Blacks and Non-HSTA Whites were not significantly different. The simultaneous 95% confidence limits for the difference between the means for SATT and CGPA of HSTA Blacks and Non-HSTA Whites is -42.25 to 109.67 and -0.14 to 0.34, respectively. Recall the SAS code for HSTA (1) and Non-HSTA (-1) status as well as the codes for the Black (1) and White (2) categories. The Status and Race categories are represented by these codes in Figures 5 through 7, which provide a graphic of the HSD significance levels. The graphics indicate no significant difference in the SATT and CGPA between HSTA Blacks and Non-HSTA White students.

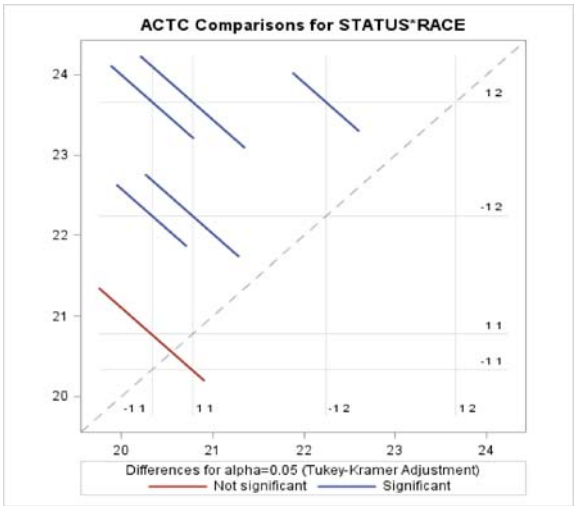

Figure 5. Graph depicting significance level for for ACTC for Status by Race

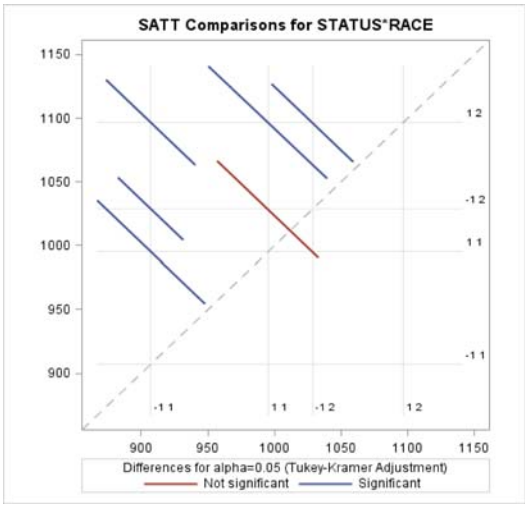

Figure 6. Graph depicting significance level for SATT for Status by Race

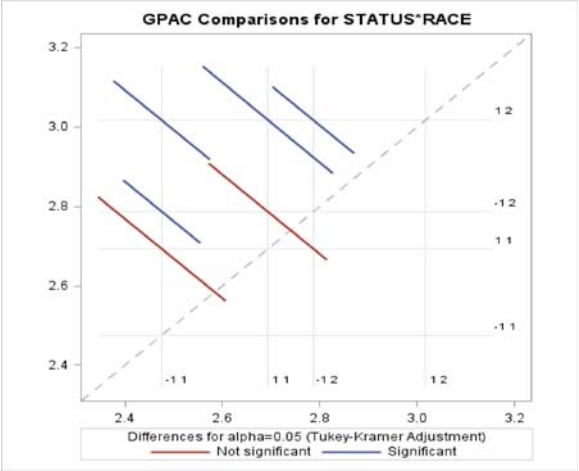

Figure 7. Graph depicting significance level for CGPA for Status by Race

CONCLUSION

The purpose of this study was to analyze the academic performance of HSTA (a pre-college/STEM enrichment program) participants relative to their Non-HSTA counterparts. As an academic and science intervention program, HSTA has become an important element to enhancing the academic performance of underrepresented students in West Virginia. Although there is research showing that such programs can have a tremendous impact on increasing pursuit of higher degrees in math and science, including Master's, PhDs, and MDs [5] [14] [21], there is still the need for more empirically based studies [7] [20]. Such studies could reveal the mechanisms through which these impacts occur. This study offers some evidence that HSTA may aid in increasing standardized test scores, an integral component of college acceptance and a probable tool to measure college success. There are few studies comparing standardized test scores of high school academic enrichment/STEM program and non-program participants who have gone to college [2]. More specifically, a comparison of CGPAs for academic enrichment program and non-program participants is warranted, and this study is the beginning of such endeavors. We recognize that a possible limitation to this study is the selection bias into the program for HSTA participants. HSTA participants are required to have a 2.5 high school GPA to enter the program and must successfully graduate with a 3.0 high school GPA, which may bring into question the validity of this study [22]. However, it can be argued that the

impetus for programs such as HSTA is to provide the necessary academic enrichment; thereby, germinating the seeds for growth and maturity in academia and beyond. As a pre-college/STEM enrichment program, HSTA participants receive the essential tools to improve upon the gatekeeper qualifications for students who historically exhibit lower standardized test scores. One of HSTA's primary goals is to prepare students to pursue post-secondary study and ultimately a career in Health Sciences/STEM related areas by creating community/academic partnerships, fostering parental/family involvement, and implementing core program components. Thus, HSTA diligently seeks to create positive educational environments and outcomes while attempting to dismantle the phenomena of stereotype threat performance for its participants [24].

The results of this study indicate that HSTA White participants show enhanced academic performance on standardized tests [14]. HSTA White students are surpassing their HSTA and non-HSTA counterparts on all of the academic measurements. The HSTA Black participant population showed significant differences in their SATT scores from the Non-HSTA Black students, and they are doing slightly better in other areas. Furthermore, significant findings indicate that on some of the academic measurements (SATT and CGPA), HSTA Black students are not performing under par in comparison to Non-HSTA Whites. Essentially, these findings suggest that there is a relationship between program participation and higher standardized test scores; however, further research is needed in order to substantiate that successful STEM enrichment programs may have the potential to affect this type of evaluation – an important indicator of acceptance into post-secondary institutions.

REFERENCES

[1] Adams, G., Garcia, D., Purdie-Vaughns, V., & Steele, C. "The detrimental effects of a suggestion of sexism in an instruction situation." *Journal of Experimental Social Psychology*, 2006, 42(5), 602-615.

[2] Bausmith, J. M., & France, M. (2012). "The Impact of GEAR UP on College Readiness for Students in Low-Income Schools." *Journal of Education for Students Placed at Risk (JESPAR)*, 2012, 17(4), 234-246.

[3] Cai, W. "Making Comparisons Fair: How LS-Means Unify the Analysis of Linear Models." Retreived July 26, 2018, 2014, from https://support.sas.com/resources/papers/proceedings14/SAS060-2014.pdf.

[4] Can, I., Koydemir, S., Durhan, S., Ogan, S., Gozukara, C., & Cokluk, G. "Changing high school students'attitudes towards mathematics in a summer camp: Happiness matters." *Educational Sciences: Theory & Practice*, 2017, 17(5), 1625–1648.

[5] Carter, F. D., Mandell, M., & Maton, K. I. "The Influence of On-Campus, Academic Year Undergraduate Research on STEM Ph.D. Outcomes: Evidence From the Meyerhoff Scholarship Program." Educational Evaluation and Policy Analysis, 2009, 31(4), 441-462.

[6] "CODING SYSTEMS FOR CATEGORICAL VARIABLES IN REGRESSION ANALYSIS." Retrieved July 26, 2018, from https://stats.idre.ucla.edu/spss/faq/coding-systems-for-categorical-variables-in-regression-analysis-2/.

[7] Cooper, M. M. "Evidence-based reform of teaching and learning." *Analytical and Bioanalytical Chemistry*, 2013, 406(1), 1-4. doi:10.1007/s00216-013-7438-4

[8] Fashola, O. S., & Slavin, R. E. "Promising Programs for Elementary and Middle Schools: Evidence of Effectiveness and Replicability." *Journal of Education for Students Placed at Risk (JESPAR)*, 1997, 2(3), 251-307.

[9] Huerta, J., & Watt, K. M. "Examining the College Preparation and Intermediate Outcomes of College Success of AVID Graduates Enrolled in Universities and Community Colleges." *American Secondary Education*, 2015, 43(3), 20-35.

[10] Kellow, J. T., & Jones, B. D. "The Effects of Stereotypes on the Achievement Gap: Reexamining the Academic Performance of African American High School Students." *Journal of Black Psychology*, 2008, 34(1), 94-120.

[11] Lauer, P., Akiba, M., Wilkerson, S., Apthorp, H., Snow, D., & Martin-Glenn, M. L. "Out-of-School-Time Programs: A Meta-Analysis of Effects for At-Risk Students." *Review of Educational Research*, 2006, 76(2), 275-313.

[12] Lavrakas, P. (Ed.). *Encyclopedia of survey research methods (SAGE research methods online)*. Thousand Oaks, Calif.: SAGE Publications, 2008.

[13] "Means vs. LSMeans and Type I vs. Type III Sums of Squares." Retrieved July 27, 2018, from http://www.public.iastate.edu/~dnett/S402/wlsmeans.pdf.

[14] McKendall, S. B., Kasten, K., Hanks, S., & Chester, A. "The Health Sciences and Technology Academy: An Educational Pipeline to Address Health Care Disparities in West Virginia." Academic Medicine : Journal of the Association of American Medical Colleges, 2014, 89(1), 37–42.

[15] Meyer, R. L., Bronwyn, B., & Garza, P. "Museums Afterschool: Principles, Data, and Design. University of Minnesota Extension." Retrieved March 8, 2018 from, 2010, https://conservancy.umn.edu/bitstream/handle/11299/113561/MAPDD%20MN%20Extension%202010%20Final.pdf;sequence=1.

[16] Modarresi, S., Wolanin, N., Cooper-Martin, E., & Montgomery County Public Schools (MCPS), O. A. "Comparative Evaluation: Participants versus Nonparticipants in the Achieving Collegiate Excellence and Success (ACES) Program at Montgomery County Public Schools in Year One and Year Two," 2016.

[17] Murphy, M., Steele, C., & Gross, J. "Signaling threat: How situational cues affect women in math, science, and engineering settings." *Psychological Science*, 2007, 18(10), 879-885.

[18] Ryan, K. E., & Ryan, A. M. "Psychological Processes Underlying Stereotype Threat and Standardized Math Test Performance." *Educational Psychologist*, 2005, 40(1), 53-63.

[19] Shernoff, D. J. "Engagement in After-School Programs as a Predictor of Social Competence and Academic Performance." *American Journal of Community Psychology*, 2010, 45(3-4), 325-337.

[20] Slavin, R. E. "Evidence-Based Reform: Advancing the Education of Students at Risk." Retrieved August 1, 2018, 2005, from https://www.americanprogress.org/wp-content/uploads/kf/Slavin%203%2017% 20FINAL.pdf.

[21] Slovacek, S., Whittinghill, J., Flenoury, L., & Wiseman, D. "Promoting minority success in the sciences: The minority opportunities in research programs at CSULA." *Journal of Research in Science Teaching*, 2011, 49(2), 199-217.

[22] Smith, F., McKendall, S., Chester, A., Hornbeck, B., & McKendall, A. "Demonstrating the Efficacy of the Health Sciences and Technology Academy: Using Archival Standardized Test Scores to Analyze an

OST College-Preparatory Program for Underserved Youth, *Journal of STEM Outreach*, 2018, 1, 1-11. [Forthcoming].

[23] Spencer, S., Steele, C., & Quinn, D. "Stereotype threat and women's math performance." *Journal of Experimental Social Psychology*, 1999, 35(1), 4-28.

[24] Steele, C. M., Spencer, S. J., & Aronson, J. "Contending with group image: The Psychology of stereotype and social identity threat." *Advances in Experimental Social Psychology*, 2002, 34, 379-440.

[25] Walpole, M., Simmerman, H., Mack, C., Mills, J. T., Scales, M., & Albano, D. "Bridge to Success: Insight into Summer Bridge Program Students' College Transition." *Journal Of The First-Year Experience & Students In Transition*, 2008, 20(1), 11-30.

[26] Watt, K. M., Huerta, J., & Lozano, A. "A Comparison Study of AVID and GEAR UP 10th-Grade Students in Two High Schools in the Rio Grande Valley of Texas." *Journal of Education for Students Placed at Risk (JESPAR)*, 2001, 12(2), 185-212.

[27] Zwick, R. & Sklar, J.C. "Predicting College Grades and Degree Completion Using High School Grades and SAT Scores: The Role of Student Ethnicity and First Language." *American Educational Research Journal*, 2005, 42(3), 439-464.