Contextual Factors that Influence STEM Majors & Standardized Test Scores High School Students

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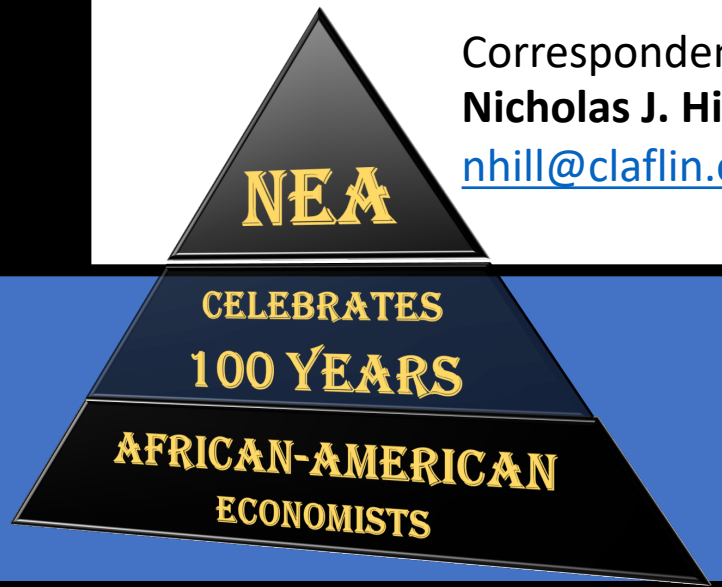

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Major Research Question of the Grant

What are the effects of attending an HBCU on graduation?

What are the effects of attending an HBCU on graduating in a STEM discipline?

What are the effects of attending an HBCU on attending graduate school?

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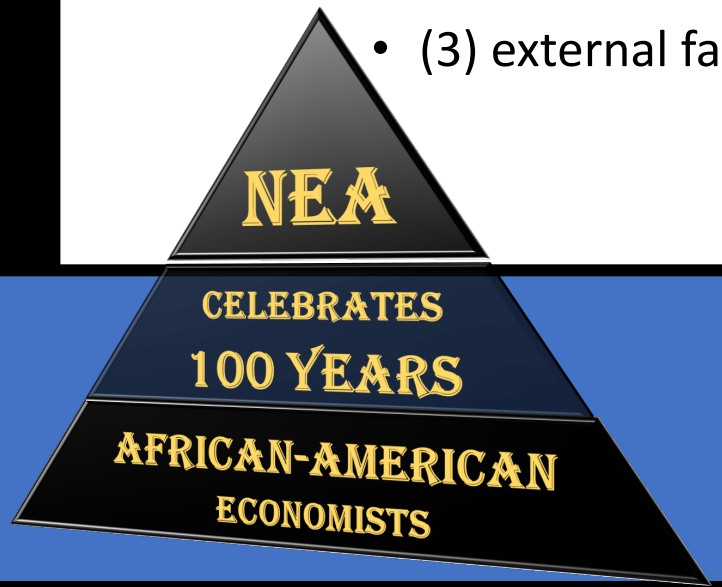
Primary Research Focus for Research STEM and SAT takers

Research Question Two: What are the effects of attending an HBCU on graduating in a STEM discipline?

- What are the factors that influence interest in majoring in a STEM discipline for high school students?
- What individual, family and school level contextual factors impact the likelihood of student's performance on standardized tests, specifically the (SAT).
  - (1) internal (Individual);
  - (2) external to the individual with majority of factors at the family level and;
  - (3) external family, majority of school level activities but within the school environment.



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Literature: HBCU and STEM - Investigating the efficiency of the role for HBCUs to produce graduates

- From 2011-2014, four (4) HBCUs were among the Thirteen (13) largest producers of Black baccalaureates in STEM disciplines.
  - Howard - 5th, North Carolina A&T - 7th, Florida A&M - 9th and Spelman - 13th
- From 2011-2014, three (3) HBCUs were leading producers of Black applicants to medical schools.
  - Howard - 1st, Xavier - 2nd and Spelman - 6th

Literature: College SAT Test Takers

- Correlation between SAT scores, and parental income and education, and race.
  - 1 Espenshade and Chung, 2010
  - 2 Geiser and Stantelices, 2007
  - Hannon, 2015
- First Generational College Students & Students in Lower socioeconomic status
  - 1 Geiser and Studley , 2002
  - 2 Bridgeman and Wendler, 2005
  - 3 Choy, 2001

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Students' Interest and Motivations for STEM

- Race
  - Although White and Asian males are traditionally well-represented in the STEM fields, White students have the lowest levels of interest in science, in comparison to other racial and ethnic groups, while Asian students have the highest levels of interest (Elliott, Strenta, Adair, Matier, & Scott, 1996).
  - Despite Latino and African American students exhibiting similar and sometimes higher levels of interest in STEM fields than White students, fewer enter into and persist in STEM majors in college (Hurtado, Pryor, Tran, Blake, DeAngelo, & Aragon, 2010)
- Gender
  - Female (White) have lower rates of interest in science than Male (White) (Seymour & Hewitt, 1997)

Article Comparison (Lichtenberger & George-Jackson, 2013)

- *Male high school students were significantly more likely to have an early interest in STEM relative to their female peers,*
- *African American high school students had higher interest compared with White students.*
- *Low-income students were significantly more likely to be interested in STEM majors than higher income students,*
- *Teacher academic qualifications had a negative but significant relationship with an early interest in STEM, teacher experience had a small but significant positive relationship.*
- *High school course taking in science and performance on science and math standardized tests were significantly and positively related to an increased interest in STEM.*

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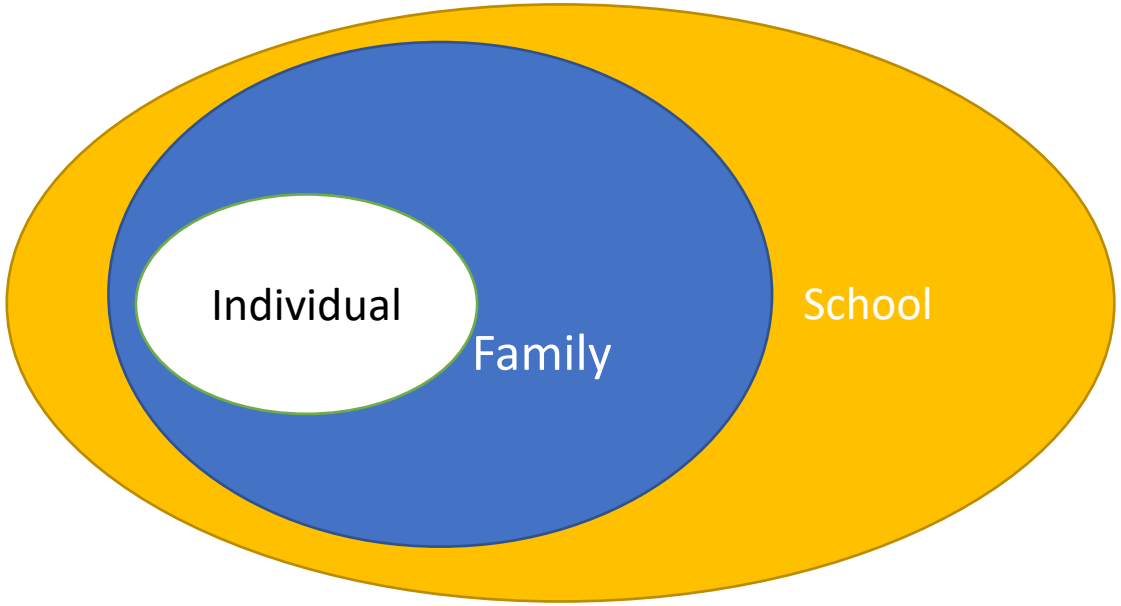
Contextual Factors that Influence STEM and SAT Scores



- Internal – Environmental – External

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College Board Data Set

College Bound Seniors years 2004 to 2007, African-American students only, with the following information:

- SAT scores. Each score
- Student Questionnaire responses, especially those on parental education, parental income, self-reported HSGPA, and intended major;

Data Description

Individual Level Data

Variable		Type	Variable Description
STEM		Dichotomous	A dichotomous variable of whether a student is a STEM major. Is based on the list of majors that the participant selected as their major.
Sex		Dichotomous	Whether participant identifies as Male (1) or Female (0)
Verbal SAT		Scale	Continuous variables of the scores on Verbal SAT
Math SAT		Scale	Continuous variables of the scores on Math SAT
Writing SAT		Scale	Continuous variables of the scores on Writing SAT
Total SAT		Scale	Combined Verbal, Math, and Writing SAT scores
GPA		Ordinal	Participant's Cumulative Grade Point Average: 1 (F, 0.00), 2 (D, 1.33) 3 (D+, 1.33), 4 (C-, 1.67), 5 (C, 2.00), 6 (C+, 2.33), 7 (B-, 2.67), 8 (B, 3.00), 9 (B+, 3.33), 10 (A-, 3.67), (A, 4.00), or (A+, 4.33)

Data Description (cont') Individual Level Data

Years in English		**Scale**	**Continuous variable of number of years taken the subject**
Years in Math		Scale	Continuous variable of number of years taken the subject
Years in Science		Scale	Continuous variable of number of years taken the subject
Honors Course		Dichotomous	Whether participant took a STEM subject honors course
Student Help		Dichotomous	Whether participant needs help with study skills
Degree Goal		Nominal	What are the degree goals for the student 1 (Certificate) to 5 (Doctoral)
4yr College		Dichotomous	Whether participant wants to attend a 4-year college
2yr College		Dichotomous	Whether participant wants to attend a 2-year college
***College Years Preference**		Dichotomous	Whether participant states a 2-year or 4-year preference
Certain about Major		Nominal	Whether participant is certain about their major 1 (Not Certain), 2 (Fairly Certain), or 3 (Very Certain)

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Data Description

Family Level Data

Variable		Type	Variable Description
Family Income		Ordinal	Combined family income: 1 (<10K), 2 (10K-15K), 3 (15K-20K), 4 (20K-25K), 5 (25K-30K), 6 (30K-35K), 7 (35K-40K), 8 (40K-50K), 9 (50K-60K), 10 (60K-70K), 11 (70K-80K), 12 (80K-100K), or 13 (>100K)
Financial Aid		Nominal	Whether participant intends to receive financial aid: 1 (Do not know), 2 (No), or 3 (Yes)
Work a Job in College		Nominal	Whether participant intends to work in college: 1 (Do not know), 2 (No) or 3 (Yes)
Parents Education		Nominal	Highest level of parents' education: 1 (Grade School), 2 (Some High School), 3 (High School Diploma), 4 (Business School), 5 (Some College), 6 (Associate Degree), 7 (Bachelors Degree), 8 (Some Graduate), or 9 (Graduate School)

Data Description
School Level Data

Variable		Type	Variable Description
Sports Participation		Dichotomous	Whether participant was involved in a sport (36 options) during high school
Arts/Music Participation		Dichotomous	Whether participant was involved in arts, music instrument or vocal during high school

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Descriptive Statistics of Sample

	Full sample	STEM	Non-STEM
STEM	0.27		
SEX	0.42	0.35	0.44
SAT Reading	432.8	429.9	434.4
SAT Math	429.6	427.5	430.9
SAT Writing	426.4	428.6	426.4
GPA	**7.98**	**8.09**	**7.96**
Honors	**0.27**	**0.3**	**0.27**
Number of Years in English	3.8	3.79	3.8
Number of Years in Math	3.69	3.7	3.69
Number of Years in Science	3.31	3.34	3.3
Study Help	0.42	0.45	0.42
Degree Goal	4.02	4.1	4
College 4-Year	0.9	0.92	0.9
College 2-Year	0.11	0.13	0.11
College 2&4 Year	0.93	0.95	0.92
Certain about Major	2.41	2.48	2.38
Family Income	**6.22**	**5.71**	**6.34**
Financial Aid	2.74	2.76	2.74
Work in College	2.51	2.55	2.5
Parents Education	**5.62**	**5.49**	**5.65**
Sports	0.66	0.65	0.66
Arts and Music Activities	0.8	0.82	0.8
N	558583	145006	385606

Estimated Model

A Logistic Regression is utilized for this study and is consistent with the works of **Lichtenberger** & **George-Jackson, 2013.** It tests what factors are important to Black students interested in going into STEM.

Stem = f (Individual, Family, School)

An Ordinary Least Squared (OLS) model is utilized for this study to examine what contextual factors influence the scores seen on the SAT test for Black Students.

SAT Scores = f (Individual, Family, School)

Comparison of Research Article results for majoring in STEM

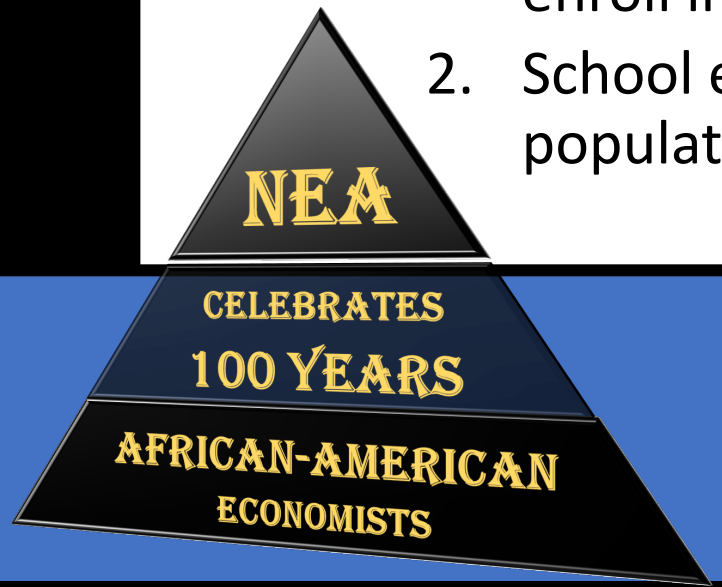
SAT Variable (DV STEM)	SAT Odds Ratio	ACT Odds Ratio	ACT Variable (DV STEM)
Sex	.0791***	1.302***	Gender: Male
Writing SAT	0.994***	0.966***	ACT English
Math SAT	1.009***	1.033***	ACT Math
Verbal SAT	0.995***	0.982***	ACT Reading
GPA	**1.027*** **	**0.945**	***HS GPA (Average of 3 categories)**
Number of Years in English	0.943***	0.887***	Semesters of English
Number of Years in Math	**1.036*** **	**1.016**	**Semesters of Math**
Number of Years in Science	1.114***	1.198***	Semesters of Science
Study Help	**1.015**	**0.942***	**Need Study Help**
Degree Goal	**1.046*** **	**0.597*** **	**Highest Expected Degree (Average of 2 categories)**
College Years Preference	**0.936*** **	**1.456*** **	**College Pref. Voc/.Tech/4yr**
Certain about Major	1.115***	1.192***	Field of Study
Financial Aid	**0.947*** **	**0.982**	**Expected to Received Aid**
Work a Job in College	**1.004*** **	**1.040**	**Expected to Work During College**

Factors that Influence SAT Scores

	SAT Total	Verbal SAT	Math SAT	Writing SAT
Sex	1.568***	0.351***	2.463***	-0.999***
GPA	3.506***	1.060***	1.227***	1.201***
Honors	14.259***	4.747***	5.324***	4.263***
Number of Years in English	**-0.05**	**0.072****	**-0.807*****	**0.276*****
Number of Years in Math	**2.596*****	**0.573*****	**1.700*****	**0.459*****
Number of Years in Science	**2.179*****	**0.873*****	**0.732*****	**0.693*****
Study Help	-1.731***	-0.906***	-0.464***	-0.560***
Degree Goal	1.660***	0.543***	0.489***	0.541***
College Preference	4.406***	1.526***	1.051***	1.679***
Certain about Major	-3.744***	-1.116***	-1.117***	-1.134***
Family Income	**0.960*****	**0.377*****	**0.302*****	**0.334*****
Financial Aid	0.241**	0.313***	0.046*	0.114***
Work in College	**0.121***	**0.070*****	**-0.058*****	**0.038**
Parents Education	1.726***	0.670***	0.501***	0.602***
Sports	**-1.568*****	**-0.814*****	**0.158*****	**-0.607*****
Arts and Music Activities	2.389***	0.876***	0.291***	1.073***
Constant	61.292***	20.112***	19.810***	20.189***
N	129459	299131	299131	129459

Conclusion

1. **STEM Factors**
    1. Schools should consider the impact of activities and programs that emphasize STEM Achievement, this includes honors and AP courses.
    2. Schools should consider increasing exposure to academic counseling specializing in career paths.
2. **Factors that Effect SAT Scores**
    1. Schools should provide increased academic counseling earlier for students to enroll in more math and science courses.
    2. School emphasis on the Arts should be encouraged for this student population.



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Future Research

- Will be a combination of data from the College Board and the National Student Clearinghouse
- Score sends, either by DI or DI category (including institution type, in particular designation as a Historically Black College or University).
- Following Hoxby (2015): we will build a better choice set.
- This will take into consideration the type of colleges that are applied to by the student.
- This will allow for heterogeneity within HBCUs as well.

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Questions and Suggest Feedback for Consideration

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