

Paper Title: Mathematics and the African American Males Graduation Success

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Purpose of the Study

The purpose of the study was to examine the relationships between reported mathematics self-efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty relationship, peer relationship, social capital, life satisfaction after graduation, and critical race identity among African American male graduates from predominantly white institutions and historically black college and universities. This study examined survey responses by the type of institution (PWI and HBCU) to determine whether participants' responses on the aforementioned variables are significantly different.

Theoretical Framework

Critical Race Theory is the theoretical framework that will aid in the understanding of the factors that affect the academic success of African American males in college. Stinson (2006) argued that African American males are stigmatized by the *discourse of deficiency* and the *discourse of rejection*. Critical race theory is often used by researchers as an analytical framework to address issues of race, racism, and inequality among African Americans. "Having a sense of self as a member of an African American community represents one protective factor or buffer that facilitates Black youth's development of positive achievement beliefs and subsequent academic adjustment" (Carter, 2008).

Professor Bell is credited for helping lay the foundation for Critical Race Theory. Smith et al. (2005) discussed how critical race theory movement was originated in the mid-1970s by a group of lawyers, activists, and legal scholars of color, such as Derrick Bell, Alan Freeman, and Richard Delgado. According to Delgado and Stefancic (2001), the critical race theory movement

was a collection of activists and scholars interested in studying and transforming the relationship among race, racism, and power, and drew upon philosophers and theorists such as Antonio Gramsci and Jacques Derrida, as well as Sojourner Truth, Frederick Douglas, Martin Luther King, Jr., W. E. B. DuBois and Cesar Chavez. This study examined how mathematics, deep learning critical race identity and other factors influence the academic success of African American males at predominantly white institutions (PWI) and historically black colleges and universities (HBCU).

Jett (2009) conducted a multiple case study research that explored how African American males gained access to college mathematics, succeeded in college mathematics, and how their race affected their performance.

The data revealed the following:

The participants' achievement and persistence in mathematics was explained, in part, by the participants' (a) internal characteristics such as strong cultural identities as African American men, persistent attitudes, and spiritual connections; (b) ability to negotiate racial injustices as African American men; (c) positive mathematics identities developed as undergraduate mathematics majors at historically Black colleges and universities (HBCUs); and (d) positive outlooks concerning the participation of African American male students in mathematics. (Jett, 2009, p. 8)

The following research questions guided this research.

Research Questions One

How did African American graduates from predominantly white institutions and historically black colleges and universities report their mathematics self- efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty/peer relationship, critical race identity and

their life satisfaction after graduation? Question one was answered with descriptive statistics using mean, standard deviation, frequency and range for each of the items being assessed.

Research Question Two

How did African American graduates from predominantly white institutions and historically black colleges and universities compare in their mathematics self-efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty/peer relationship, CRI, and their life satisfaction after graduation? Question two was answered by using a *t*-test of independent means

Research Question Three

What was the relationship between mathematics self-efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty/peer relationship, and critical race identity and life satisfaction after graduation? Question three was answered by using three correlation analyses: one for predominantly white institution, one for historically black colleges and universities and all students (PWI and HBCU).

Research Question Four

How were mathematics self-efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty/peer relationship, and critical race identity predict the life satisfaction after graduation of African American male students? Question four was answered by using multiple regression analysis.

Research Question Five

How did mathematics self-efficacy, mathematics anxiety, mathematics attitude, deep learning, faculty/peer relationship, and critical race identity and life satisfaction after graduation predict attendance at a PWI and HBCU? Question five was answered using a logistic analysis regression.

Data Gathering Techniques and Analysis

The electronic surveys were distributed to the respondents via e-mail with an attached digital copy of an informational letter to respondents. The letter explained the purpose of the study and the participation procedures regarding the completion of the survey, including specifying that one's participation was voluntary and that the respondents could withdraw from completing the survey at any time. The letter contained a link to the survey. In addition, the letter guaranteed anonymity and confidentiality of the responses and further provided for the respondent to participate in a raffle after completing the survey. All the participants completed the survey online using a survey monkey link.

The participants in the study were limited to African American males college graduate between the ages of 21–65, who graduated from a four-year institution in the United States, and earned a minimum of a bachelor's degree at an HBCU or PWI. The demographic data obtained were institution attended, major of study and age. There were 84 respondents, 51 percent graduated from HBCU and 49 percent graduated from PWI. In addition 46 percent of the respondents had STEM majors and 54 percent were non-STEM. Seventy seven percent of the respondents were between the ages of 21–45 yrs.

The survey consisted of 57-items. The survey was designed to measure graduates' mathematics self-efficacy, mathematics anxiety, mathematics attitudes, deep learning, faculty/peer relationship, and critical race identity and life satisfaction after graduation. The survey instrument was adopted from research literature and two published questionnaires. The respondents were asked to rate their level of agreement of each statement regarding mathematics self-efficacy, mathematics anxiety, mathematics attitudes, deep learning, faculty/peer relationship, critical race identity and life satisfaction after graduation. The participants were asked to indicate to what degree they agreed with a statement using a 5-point Likert type scale of 1= strongly agree 2= agree 3= slightly agree, 4= disagree and 5= strongly disagree.

A factor analysis of 54 responses was conducted to determine if the items in each subscale measured what they were designed to measure. The items were analyzed using the principal component analysis extraction method and varimax with Kaiser Normalization rotation method. The results revealed seven interpretable variables. An inspection of the eigenvalues on the screen plot showed a break after the seventh factor with no additional grouping. One of the nine variables was deleted and two were combined. The Peer Relationship and the Faculty Relationship were renamed Faculty/Peer Relationship.

Findings

Research question one was answered with descriptive statistics using mean, standard deviation, frequency and range for each of the items being assessed. The results of the survey instruments demonstrated that most students suffer from mathematics anxiety. The variable Mathematics anxiety consisted of 5-items with a range of 5 to 25. The mean score was 17.63 with a standard deviation of 5.85, which indicated that the respondents slightly agreed or

disagreed that mathematics anxiety had an influence on their college experience. An analysis of the findings in Table 1 revealed many different factors.

The variable mathematics self- efficacy consisted of 9 items with a range of 9 to 34. The mean score was 14.26 with a standard deviation of 6.00, which indicated that the respondents strongly agreed or agree that math self-efficacy had an influence on the college experience.

The variable Deep Learning consisted of 6 items with a range of 6 to 21. The mean score was 11.03 with a standard deviation of 3.73, which indicated that the respondents strongly agreed or agreed that deep learning had affected their college experience.

The variable math attitude consisted of 8 items with a range of 8 to 40. The mean score was 22.72, with a standard deviation of 9.01, which indicated that the respondents agreed or slightly agreed that mathematics attitude affected their college experience.

The variable critical race identity consisted of 6 items with a range of 6 to 20. The mean score was 10.92 with a standard deviation of 3.76, which indicated that the respondents strongly agreed or agreed that critical race identity affected their college experience.

The variable faculty/peer relationship consisted of 7 items with a range of 7 to 29. The mean score was 14.53, with a standard deviation of 5.44, which indicated that the respondents agreed that faculty/peer relationship affected their college experience.

The variable life satisfaction after graduation consisted of 5 items with a range of 5 to 24. The mean score was 11.84 with a standard deviation of 4.06, which indicated that respondents agreed that their college experience affected their life satisfaction after graduation. Table 1 reports the descriptive statistics for the five variables.

Table 1:

Descriptive statistics, distribution of scores and variables

	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>M/N</i>
Math anxiety	78	5.00	25.00	17.63	5.85	3.52
Math self-efficacy	72	9.00	34.00	14.26	6.00	1.58
Deep learning	74	6.00	21.00	11.03	3.73	1.83
Math attitude	78	8.00	40.00	22.72	9.01	2.84
Critical race identity	72	6.00	20.00	10.92	3.76	1.82
Faculty/peer relationship	74	7.00	29.00	14.53	5.44	2.08
LSAG	74	5.00	24.00	11.84	4.86	2.37
Valid N (listwise)	63					
(1-SA to 5- SD)						

Question two was answered by using a *t* test of independent means. The mean difference between HBCU and PWI on mathematics anxiety was approaching significance at $t(76) = 1.9$, $p = .067$ with the HBCU respondents reporting a higher mean score. However there was a significant difference in the mean score of faculty/peer relationship between the HBCU and PWI respondents, $t(72) = (-2.148)$, $p = .035$.

Table 2 shows the results of the test.

Table 2:

Independent t sample comparing PWI and HBCU to variables

		<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>D</i>	<i>M/N</i>
Math anxiety	HBCU	41	18.78	5.28	1.86	.067	.420	3.76
	PWI	37	16.35	6.24				3.27
Math self-efficacy	HBCU	39	14.00	6.05	-.404	.688	.096	1.56
	PWI	33	14.58	6.01				1.62
Deep learning	HBCU	40	10.82	3.69	-.503	.616	.117	1.80
	PWI	34	11.26	3.82				1.87
Math attitude	HBCU	42	22.02	9.02	-.733	.466	.167	2.75
	PWI	36	23.53	9.05				2.94
Critical race identity	HBCU	37	10.54	3.46	-.872	.386	.204	2.21
	PWI	35	11.31	4.06				1.88

Faculty/peer relationship	HBCU	38	13.24	4.66	2.14	.035	.497	1.89
	PWI	36	15.89	5.92				2.27
Life satisfaction after grad	HBCU	38	11.03	5.14	1.48	.141	.344	2.20
	PWI	36	12.69	4.47				2.54

The mean difference between HBCU and PWI on mathematics anxiety was approaching significance at $t(76) = 1.9, p = .067$, with the HBCU respondents reporting a higher mean score. The standardized effect size index, d was .420, indicating a medium effect.

There was no remarkable difference between the mean score of mathematics self-efficacy for HBCU and PWI respondents, $t(70) = -4.04, p = .688$. The standardized effect size index, d was .096, indicating no effect.

There was no remarkable difference between the mean score of deep learning, for HBCU and PWI respondents, $t(72) = -.503, p = .616$ even though the PWI respondents reported a higher mean. The standardized effect size index, d was .117, indicating a small effect.

There was no remarkable difference in mean score of mathematics attitude for HBCU and PWI respondents, $t(76) = -.733, p = .466$, even though the PWI respondents reported a higher mean. The standardized effect size index, d was .167, indicating a small effect.

There was no remarkable difference in mean score of critical race identity, $t(70) = -.874, p = .386$. The standardized effect size index, d was .204, indicating a small effect.

There was a remarkable difference in the mean score of faculty /peer relationship between the HBCU and PWI respondents, $t(72) = (-2.148), p = .035$. PWI ($M=15.88$) had a larger mean than HBCU ($M = 13.23$) meaning that HBCU reported a higher faculty/peer relationship. The standardized effect size index, d was .497, indicating a medium effect.

There was no remarkable difference in the mean score of Life Satisfaction after Graduation between the HBCU and PWI respondents, $t(72) = -1.487, p = 0.141$, even though the

PWI respondents reported a higher mean. The standardized effect size index, d was 0.344, indicating a small effect.

In order to examine the differences in the responses to the items pertaining to mathematics anxiety and faculty/peer relationship, an item analysis was conducted. The variable mathematics anxiety consists of five-items. As demonstrated in Table 3 more than 69 percent of graduates from HBCU institutions disagreed with item 13 and 14 as opposed to 50 percent of PWI respondents, which stated that students felt tense and nervous when doing mathematics. The major difference between HBCU and PWI was that 69 percent of graduates at HBCU disagreed with the statements Q13 (I got very tense when I had to do mathematics homework, and Q14 (I got very nervous doing mathematics problems). Q12 (I often feel nervous about how difficult it would be for me in a mathematics class) demonstrated that the HBCU graduates were far less nervous in a mathematics class than graduates from a PWI, and were less worried in getting poor grades (Q16 – I worried that I would get poor grades in mathematics).

Table 3:

Item analysis of Mathematics Anxiety

Item	Mathematics anxiety	HBCU			PWI			Diff Agreement(SA/A-SA/A)
		SA/A	SLA	SD/D	SA/A	SLA	SD/D	
								HBCU PWI
12	I often feel nervous about how difficult it would be for me in a mathematics classes	23.8	23.3	52.4	44.7	18.4	36.9	-20.9
13	I got very tense when I had to do mathematics	19.0	11.9	69.1	28.9	21.1	50	-9.9

14	homework I got very nervous doing mathematics problems	14.3	16.7	69.1	29.7	21.6	48.6	-11.6
15	I felt helpless when doing mathematics problems	9.5	11.9	78.6	16.2	24.3	59.4	-6.7
16	I worried that I would get poor grades in math	14.6	19.5	65.8	32.4	21.6	35.8	-24.5

The variable faculty/peer relationship consists of seven variables. As shown in Table 4, the item analysis indicates that 81 percent of respondents from HBCU Institutions agreed with item 47 (“I discussed course topics, ideas, or concepts with a faculty member outside of class”) as opposed to 58 percent of respondents from PWI that the students discussed concepts and topics with faculty outside of class. The item analysis also indicated that 76 percent of respondents from HBCU institutions agreed with item 45 as oppose to 58 percent respondents from PWI that the students talked about career plans with a faculty member.

Table 4:

Item analysis of Faculty/Peer Relationship

Item	Faculty/Peer Relationship	HBCU			PWI			Diff Agreement
		SA/A	SLA	SD/D	SA/A	SLA	SD/D	
38	I received emotional support from counsellors in college which fostered my desire to stay in college	55.00	22.5	22.5	41.7	25.0	33.4	13.3
45	I talked about career plans with a faculty member	76.3	15.8	23.7	58.3	13.9	27.8	18

46	I worked w/faculty on activities other than coursework (committees, student groups, etc.)	81.6	7.9	10.5	69.4	5.6	25.0	12.2
47	I discussed course topics, ideas, or concepts with a faculty member outside of class	81.6	10.5	7.9	58.3	22.2	36.1	23.3
48	I discussed my academic performance with a faculty member	81.6	13.2	5.3	72.2	11.1	16.6	9.4
49	I asked another student to help me understand course material	76.3	7.9	15.8	83.3	8.3	8.4	-7.5
50	I explained course material to one or more students	94.7	2.6	2.6	88.9	11.1	0	5.8
51	I worried that I would get poor grades in mathematics	81.6	13.2	5.3	83.6	13.9	2.8	-2.0

Question three was answered by using three correlation analyses one for PWI, another for HBCU, and last for all students (PWI and HBCU). The results indicated in reference to the HBCU respondents, on mathematics anxiety and mathematics attitude show a strong positive relationship, $r = .529$ which accounted for 27.98 percent of the variance. Mathematics self-efficacy and mathematics attitude show a strong positive correlation, $r = .639$ which accounted for 40.83 percent of the variance. In reference to the results of PWI, life satisfaction after graduation and faculty/peer relationship show a strong positive correlation, $r = .571$ which accounted for 32.60 percent of the variance. Mathematics Attitude and faculty /peer relationship

show a strong positive correlation, $r = .557$ which accounted for 31.02 percent of the variance.

However mathematics anxiety and mathematics attitude show a strong negative correlation, $r = -.567$ which accounted for 31.92 percent of the variance.

Table 5 displays the correlation analysis for the HBCU respondents.

Table 5:

Correlation of HBCU respondents

Table.4.8Correlat ion of HBCU respondents		Life satisfacti on after grad	Math anxiety	Math self- efficacy	Deep learning	Math attitude	Critical race identity	Faculty peer relationship
Math anxiety	r	-.187						
	r ²	3.24						
	N	37						
Math self- efficacy	r	.209	-.473**					
	r ²	.04	22.37					
	N	37	38					
Deep learning	r	.313	-.114	.453**				
	r ²	.10	1.21	.21				
	N	38	39	39				
Math attitude	r	.099	-.529**	.639**	.318*			
	r ²	.01	27.98	.41	.10			
	N	38	41	39	40			
Critical race identity	r	.165	-.050	.229	.268	.277		
	r ²	.03	.16	.05	.07	.07		
	N	37	36	36	37	37		
Faculty peer relationship	r	.117	.216	.049	.345*	.131	.146	
	r ²	.01	.04	.00	.12	.02	.02	
	N	38	37	37	38	38	37	
STEM or not	r	.234	-.199	.262	.156	.379*	.122	.132
	r ²	.05	3.61	.07	.02	.14	.01	.02
	N	38	40	38	39	41	37	38

** . Correlation is remarkable at the 0.01 level (2-tailed).

* . Correlation is remarkable at the 0.05 level (2-tailed).

Table 6 displays the correlation analysis for PWI.

The correlation table shows a strong correlation between Life Satisfaction after Graduation and Mathematics Attitude with a correlation of $r = 0.565$. The results indicated that the relationship accounted for 31.92 percent of the variance. The comparison between Life Satisfaction after Graduation and Faculty/Peer relationship show a strong positive correlation, $r = 0.571$. The results indicated that the relationship accounted for 32.60 percent of the variance. Mathematics attitude and mathematics self-efficacy show a medium negative correlation, $r = -.413$. The results indicated that the relationship accounted for 17.05 percent of the variance. Mathematics anxiety and Mathematics attitude show a strong negative correlation, $r = -.567$. The results indicated that the relationship accounted for 31.92 percent of the variance. Mathematics Anxiety and Critical Race Identity show a medium positive correlation, $r = 0.381$. The results indicated that the relationship accounted for 14.51 percent of the variance. Mathematics Anxiety and Faculty/Peer relationship show a medium negative correlation, $r = -.333$.

Table 6:

Correlation of PWI respondents

		Life satisfaction after grad	Math anxiety	Math self-efficacy	Deep learning	Math attitude	Critical race identity	Faculty Peer relationship
Math anxiety	r	-.299						
	r ²	8.41						
	N	36						
Math self-efficacy	r	.252	-.413*					
	r ²	.06	17.06					
	N	33	33					
Deep learning	r	.258	.017	.057				
	r ²	.06	.00	.00				
	N	34	34	31				

Math attitude	r	.565**	-.567**	.463**	.108			
	r ²	.32	.32.15	.21	.01			
	N	34	35	31	32			
Critical race identity	r	.087	.381*	.248	.317	.039		
	r ²	.01	.15	.06	.10	.00		
	N	35	35	32	33	33		
Faculty peer relationship	r	.571**	-.333*	.111	.673**	.557**	.100	
	r ²	.33	.11.09	.01	.45	.31	.01	
	N	36	36	33	34	34	35	
STEM or not	r	.208	-.512**	.439*	.149	.387*	-.119	.248
	r ²	.04	.26.21	.19	.02	.15	1.21	.06
	N	36	37	33	34	36	35	36

** . Correlation is remarkable at the 0.01 level (2-tailed).

* . Correlation is remarkable at the 0.05 level (2-tailed).

Question four was answered by computing a multiple regression analysis. After the examination of the variables, faculty/ peer relationship was the only variable that became part of the regression Model. In this model faculty/peer relationships accounted for 34.5 percent of the variance. Life satisfaction after graduation is expected to increase by .44 of a point when faculty/peer relationship increases by a point. The effect that faculty/peer relationship has on this model was found to be statically significant = 0.001. Table 7 displays the regression model.

No remarkable relationship was determined with life satisfaction and HBCU respondents hence no multiple regression analysis was performed for HBCU. Table 8 displays the coefficient values for Faculty /peer relationship.

Table 7:

Regression model

Black/White	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
PWI	1	.587 ^b	.345	.320	3.52034

- a. There are no valid cases in one or more split files. Statistics cannot be computed.
- b. Predictors: (Constant), Faculty/Peer Relationship.

Table 8:

Coefficients values for Faculty/Peer Relationship

Black white	Model		Unstandardized Coefficients		Standardized Coefficients		T	Sig.
			B	Std. Error	Beta			
PWI	1	(Constant)	6.158	2.039			3.021	.006
		Faculty/peer relationship	.435	.118	.587		3.698	.001

- a. There are no valid cases in one or more split files. Statistics cannot be computed.
- b. Dependent Variable: Life satisfaction after graduation.

The effect that faculty/peer relationship has on this model was found to be statically remarkable $p = 0.001$. This indicated that the overall faculty/peer relationship is a strong predictor of life satisfaction after graduation.

No answer was possible for question by employing a forward stepwise regression model so that the predictive value of each variable could be determined. Based on the previous correlation analysis indicating the only significant variable was faculty/peer relationship for PWI, it was not necessary to run the statistics for a logistic regression analysis.

Recommendation for Future Research

The majority of research in this area operated from a deficit point of view where African American male failures instead of achievement are amplified (Harper, 2010). There is a dearth of literature on the academic success of African Americans. These students were not only from HBCU, but also from PWI like Robert R. Taylor the first African American male who earned a degree from MIT. This study looked at successful graduates from both HBCUs and PWIs with several variables that affected students' success at college according to the literature. This study compared the relationships among the variables, and searched for the predictability of any of these variables on the attendance at a HBCU and PWI of African American students. Suggested, then, for future researchers are the following:

1. Consider replicating this study but using a larger sample size in order to have a more complete and comprehensive analysis.
2. The elimination of social capital after a factor analysis resulted in not establishing any relationship between social capital and any other variable. Also not established was whether social capital was a factor in predicting African American males' attendance at a HBCU and PWI. Social capital has been an important factor in the academic success of students in college. Thus, a suggestion is that future researchers consider investigating the influence social capital has on the academic success of African American males at HBCUs and PWIs by creating a variable that can be measurable.
3. Consider investigating other factors that contribute to the attendance of African American males at PWI and HBCU that were not explored in this study. Factors like first generation student, parents with a college degree, and persistence as a

variable. Further, demographic variables such as the type of program the students were enrolled in and how that may have influenced their environment and their academic success. Such programs would include liberal arts, such as art and music, business, sports management and the social sciences.

Future researchers should consider investigating how African American males engage and build relationship with faculty in a PWI and how that relationship affects their academic success. Consider investigating the influence of STEM majors on Life Satisfaction after graduation using a qualitative approach. In so doing, one will be able to understand reasons why African American males explore STEM majors at a greater percentage at a HBCU than at a PWI.

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