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Aamira Brown March 24, 2017

Paths From STEM: Undergraduate Experiences and Racial Gaps in STEM Attrition Rates

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Abstract

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Science, Technology, Engineering, and Math (STEM) related fields continue to rise in popularity across the globe. In recent years, the US has become increasingly focused on raising the number of graduates that leave higher education prepared to pursue careers in STEM, thus leading to an increase in focus on examining participation and attrition within STEM fields (Chen, 2013). The present study examines the qualitative differences in the overall collegiate experiences of Black and White Emory students who were formerly involved in the STEM fields. Twelve students, six black students and six white students with equal numbers of males and females within each group, were asked to provide in-depth oral history interviews about their college experiences during their time in the Emory STEM departments. Data from participants' interviews reveals that there are differences in the reasons that black and white students have for choosing to exit the STEM fields, with black students reasons being primarily related to negative experiences. Future directions for research are discussed.

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Introduction

The enrollment rates of black students in post-secondary education continue to grow. Between 1990 and 2013 black student enrollment has risen five percentage points, from ten percent in 1990 to fifteen percent in 2013 (Musu-Gilette et al., 2016). Despite the continuing climb in enrollment rates, college completion rates and completion rates specifically within the STEM fields continue to be lower for black students than for their white counterparts (Chen, 2016; Musu-Gilette et al., 2016). Much of the present research on attrition from science, technology, engineering, and math (STEM) fields focuses on explanations based primarily in academics – academic ability, course difficulty, etc. Researchers have suggested that other factors, such as student experiences, may also play a role in attrition rates (Chen, 2016; Musu-Gilette et al., 2016). The fact that attrition rates tend to be higher for black students even at the nation's top universities, where all students are required to meet a certain standard of academic ability, suggests that race and racism within institutions may be a factor in attrition rates.

Even still, academia tends to be a place that some consider free from the burdens of race and racism. Institutions, along with their administrations, faculty, and professors tend to be overwhelmingly silent on issues of race within academia. If I were to base my ideas of the role of race/racism within academia solely on the views of white faculty and students that I have encountered in my time as a student I would land in one of two places (1) race is not really an area of concern within academia or (2) its role is in some way related to affirmative action. In the last few decades, institutions have taken up the "fight" for diversity, which has in many ways become these institutions' answer to all questions dealing with race and racism. But in all actuality, race and racism continue to manifest themselves as prominent factors within academia and a call to increase diversity is not an adequate response.

I am studying the qualitative differences in the overall collegiate experiences of Black and White Emory students who were formerly involved in the STEM fields. In doing so, I am trying to determine whether or not there are in fact stark dissimilarities in these students' classroom and campus experiences and how these may explain the different reasons for white and black students' decisions to exit the STEM program. In examining these differences I hope to shed light on how certain experiences uniquely affect black students, thus negatively affecting the persistence of Black students in STEM fields. Ultimately, I aim to help my reader to understand how racialized experiences might be playing a role in the overall underrepresentation of Black students in STEM fields.

I begin this study by outlining some of the past and present research on attrition and retention rates. Next, I explain the continuing need for qualitative research to be conducted with students about their experiences in the STEM departments. After detailing my methods, I describe the results from the oral history interviews. Finally, I discuss findings and propose ideas to be explored that could improve the experiences of black STEM students.

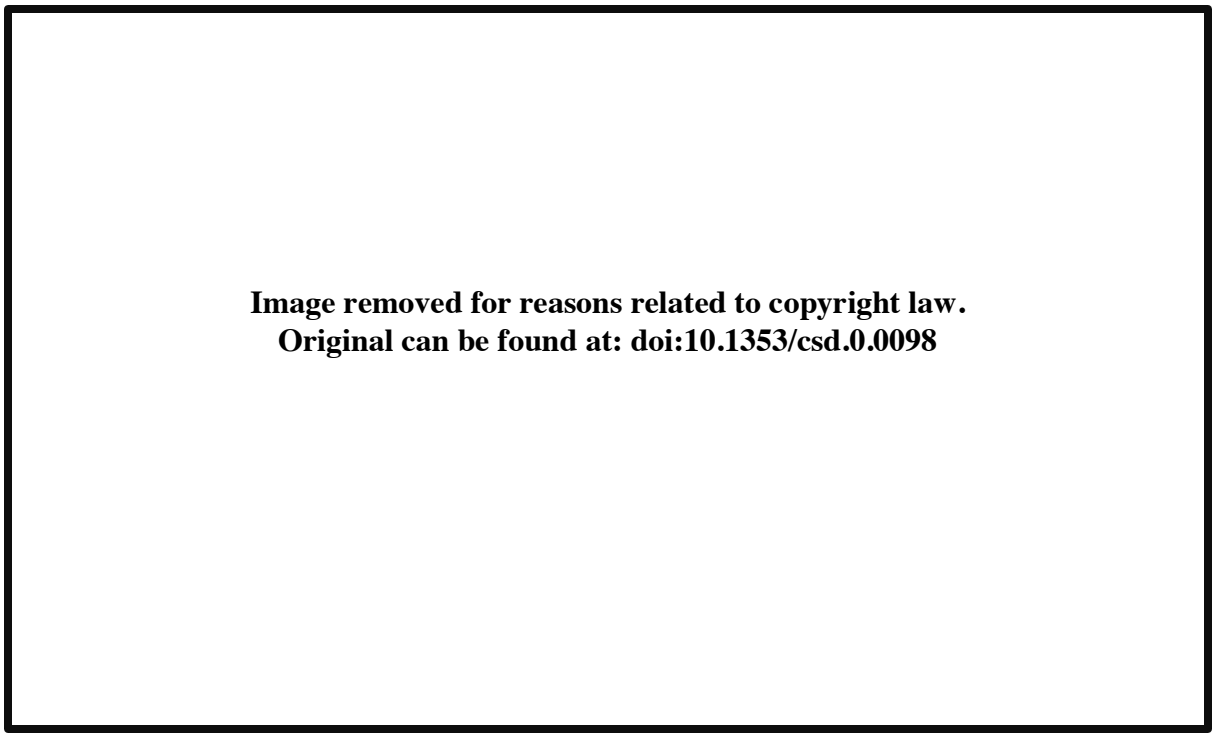
Background Literature

In recent years, the US has become increasingly focused on raising the number of graduates that leave higher education prepared to pursue careers in STEM (Chen, 2013). That being said, a lot of focus is presently being placed on examining participation and attrition within STEM fields. According to Chen (2013), around 48% of bachelor's students that had entered STEM fields between 2003 and 2009 had dropped out of those programs by the spring of 2009. Studies show that attrition rates tend to be higher for black students than for their white

counterparts, with black undergraduate students being 8% more likely to switch to a non-stem major than their white counterparts (Chen, 2013). Chen's study suggests that although academic backgrounds, interest levels, and issues with course difficulty are commonly presented as explanations for attrition there may be other factors such as student experiences that may also contribute to the different student attrition rates (Chen, 2013).

Research regarding both attrition rates and the experiences of college students is abundant across a number of disciplines. Critical race theorists and sociologists have been studying the experiences of black students in educational institutions for decades. In Reason's examination of college student persistence, he presents (Figure 1) A Comprehensive Model Of Influences On Student Learning And Persistence, which outlines the forces that affect a student's overall college persistence (2005).

Figure 1: "A Comprehensive Model of Influences on Student Learning and Persistence" (Reasons, 2005)



In the above model, the sizes of the respective boxes indicate the amount of influence that each factor has on student learning and persistence. Based on this model, the college experience, which encompasses the organizational context, which refers to the structural-demographic aspects of an institution, along with peer environment and individual student experiences, has a much larger influence on student persistence than do student precollege characteristics and experiences, i.e. academic performance (Reason, 2005). Thus the unique environment and experiences of each college student are key in his or her persistence and are, therefore, an important factor to be considered when studying attrition and retention within specific academic areas.

The university experiences of black students are different from those of their white counterparts in a variety of ways, with many of these ways being directly linked to students' racial identities. As stated by Brown-Nagin (2016), "students from underrepresented communities often become disillusioned once on campus. Stereotyping, uninspiring leadership, uninviting pedagogical styles, and hypercompetitive institutional cultures leave these students cold and alienated" (p. 303). The experiences of black students, especially on PWI campuses may be characterized by a number of negative factors, unique to their experiences.

In 1992, Claude Steele presented his article Race and The Schooling of Black Americans. The article posits that the underachievement of black students that is seen at all levels of education is not uniquely linked to academic ability, but is largely tied to the stigma that students face in the classroom (Steele, 1992). According to Steele, black students are forced to participate in academic environments that constantly devalue them. This devaluation is not necessarily obvious to the teachers and administrators and may not even be purposeful, but it does exist and creates an environment in which students of color are less likely to achieve even when they are

as or better prepared than white counterparts (Steele, 1992). According to both Steele's early work and the more current work of Omi and Winant, these feelings of devaluation may be linked to the lack of black bodies and faces in the media and as positive role models, which includes the alarmingly low number of black professors in higher education (Steele, 1992; Omi and Winant, 2015).

Daniel Solórzano and colleagues used critical race theory as a framework for examining campus climate as shaped by microaggressions. The study used qualitative analysis to demonstrate the ways in which microaggressions negatively impact campus racial climates. Solórzano and his colleagues provide a framework to study how race and racism affect the collegiate environment (Solórzano, Ceja, & Yosso, 2000). The students interviewed in the Solórzano study indicated that as a consequence of their blackness they were subjected to both verbal and nonverbal microaggressions. Diminished academic performance, a sense of discouragement, frustration, and exhaustion were all listed as effects of these negative racialized campus experiences (Solórzano, 2000). This study and many subsequent studies provide evidence that a negative or nonsupportive campus climate may be associated with poor academic performance and high dropout rates among African American students.

Nearly sixteen years after the Solórzano study was published negative racial campus climates continue to plague higher education. Smith, Mustaffa, Jones, Curry, and Allen (2016) conducted a qualitative study on the experiences of black men on PWI campuses. The negative racial campus climate described by study participants indicate that not only do race and racism still play a role in the experiences of black students, but they are linked to feelings of racial battle fatigue (Smith et al., 2016). Experiencing racial battle fatigue, which Smith and colleagues describe as encompassing frustration, sadness, shock, anger, defensiveness, apathy, academic

disidentification, hypersensitivity, hypervigilance, anxiety, irritability, depression, and feelings of helplessness or hopelessness, ultimately influences the quality of students collegiate lives (Smith et al., 2016).

As STEM fields grow in popularity at baccalaureate and post-baccalaureate levels it is important to continue to explore the racialized mechanisms that may be at work within the field. At present, much of the research pertaining to STEM attrition amongst underrepresented minority groups points to explanations that focus around things like student preparation and ability. According to NCES data, low high school GPA, highest high school level mathematics course, income, and parent's education can all point to who is more likely to be a STEM "leaver" (Chen, 2016). Because academic and preparatory concerns are considered the most popular reason for STEM attrition rates of underrepresented minority groups there have been a number of programs aimed at closing these gaps in preparation.

Palmer and colleagues (2011) showed that enrichment programs such as summer pre-college programs do increase the persistence and retention rates among minority students. While these programs do have some effect on overall preparation they do not speak to the issue of racially hostile classrooms and campuses, which have been shown to affect students at the collegiate level (Palmer, Maramba, & Dancy, 2011). A 2014 study by Robert Fairlie and colleagues found that the performance gap in terms of class dropout rates and grade performance between white and underrepresented minority students falls by 20 to 50 percent when taught by an underrepresented minority instructor, indicating that environmental and experiential factors do have the potential to heavily influence student retention.

The present study seeks to add to the current body of work focused around STEM attrition by providing an in-depth qualitative look at student experiences on PWI campuses. I

expect to find that there are differences in the reasoning behind white and black student's decisions to exit the STEM program. I believe that the unique characteristics of the black STEM students experience may create a number of factors that play a role in the decision for black students to exit the STEM program whereas they will not for white students.

Methods

Design

The primary goal of this study is to explore and examine the specific experiential conditions of particular groups of students within a particular context in order to ascertain how those experiences might be playing a role in the continued racial gap in STEM attrition rates. In order to explore and compare the experiences of Black and White students involved in the Emory STEM fields I conducted 12 oral history interviews. An oral history approach was chosen in order to provide a rich qualitative data set. Much of the prior research on attrition rates in STEM fields has relied on quantitative data and research methods. The ultimate aim of using the qualitative method of oral histories is to draw out personal student narratives that give meaningful insight of the specific lived experiences of students. Oral histories differ from other interview forms due to both their content and extent. In general, oral history interviews seek an in-depth account of personal experience and reflections, allowing sufficient time for interviewees to tell their stories to the fullness that they desire (Sommer & Quinlan, 2002). While this research method does not lend itself to claiming causality, it will provide a robust sample of data to provide future researchers with a frame to study the racialized mechanisms at work within STEM fields.

Study Sample and Site

This study was conducted amongst undergraduate students Emory University, a private, mid-size, research-intensive university, located in the southeast region of the United States. By

controlling for the University setting, the study ensures that all participants, having met the requirements for entry, are of a certain academic pedigree. This is important because it allows for participants to be compared on the basis of qualities that reach beyond either innate or learned academic ability – which has been cited by a number of studies as a prominent factor in the racial gap in attrition rates (Chen, 2016). Data from Emory's most recent admissions statistics boast an average high school GPA of 3.72 and an average SAT score of 1365 (on a 1600 scale).

Approximately 8,000 undergraduate students were enrolled across the university's four undergraduate programs at the time of data collection, with just under 6,000 students attending the College of Arts and Sciences. The undergraduate student population is composed of 40.2% White, 19.7% Asian or Other Pacific Islander, 16.6% Non-Resident Alien, 9.4% Black/African-American, and 8.4% Hispanic students, with the remaining 5.4% of students being classified as multi-racial or unspecified (Bolyard, 2016).

As of 2016, Emory hosts 535 regular full-time faculty members across its undergraduate programs. Across all departments, Emory undergraduate faculty is comprised of 59% male professors and 41% female professors. Of these professors, 15% are categorized as minority, which includes the following categories: American Indian or Alaskan Native, Asian or Other Pacific Islander, Black/African American, and Hispanic. Within the three STEM departments that study participants were most likely to have taken classes in, Biology, Chemistry, and Environmental Science, women accounted for nearly 25% of the faculty, while black professors made up just 2% of the faculty across the three departments (Department of environmental science faculty; Department of chemistry faculty; Biology department faculty).

Study participants were second, third, and, fourth-year students of the Emory college of Arts and Sciences between 18 and 22 years old. All participants were students that began their

college careers as freshman on Emory's main Atlanta campus. Oxford continuees were excluded from the sample to both control for campus and classroom climate and environment and to try to ensure that there was some overlap between the classroom experiences of student participants, such that these experiences were comparable. In addition to this, study participants needed to meet three requirements in order to be involved in the study: Participants must have entered the college with the intention or majoring in a STEM-field or completing STEM pre-requisites with the intention of pursuing a STEM career, such as pre-med; Participants needed to have taken at least two courses within the STEM department; Participants needed to have changed focus declared a major outside of STEM at the time of data collection with the intention of no longer pursuing a career in STEM. First-year students were excluded from the sample as they are unable to have met the requirements of the study due to their lack of time and experience at the university and their inability to have declared a major at the time of data collection.

My sample consists of 12 participants, 6 black students and 6 white students with equal numbers of males and females within each group. For the purpose of this study, I have chosen to look specifically at the experiences of black and white students. This methodological choice was based primarily on the fact that in order to examine differences related to race, I wanted to focus on the experiences of visible majority and minority groups. As a predominantly white institution, Emory's white student population makes up a clear majority and was therefore chosen as the majority group to be studied. Based on Emory's enrollment data, Asian, Black, and Hispanic students are all technically minority groups on campus. But accounting for nearly 20% of the student body, Asian students make up a fairly large proportion of the student population and were therefore not considered to comprise a small enough visible minority group.

Black and Hispanic students represent 9.4% and 8.4% of the student body, respectively, making them both viable options for a visible minority group. Although Hispanic/LatinX students could have acted as a good comparison group, Black students were ultimately chosen as the focus minority group for two reasons. First, the college experiences of black students have been studied and explored for years creating a current body of research that lends itself to exploring the research question at hand. There is a pervasive amount of information available regarding the differences in attrition rates between black and white students. While research has been done regarding both experiential differences and attrition rates with Hispanic/LatinX groups as the population of interest, this research is not as widespread. Secondly, while it may have been fruitful to include and compare the experiences of a number of different campus racial groups including those of Hispanic students, it was beyond the scope of this study to do so due to limitations related to both time and resources.

Data Collection

Participants were recruited for this study primarily using a variation of the snowball sampling technique. The initial subject was recommended by a former professor. Following his interview, he was asked to identify other possible study participants. All possible participants were contacted via students' university Microsoft Outlook accounts and screened using a similar email message that inquired about their involvement in STEM and interest in the study. This practice continued with each subsequent participant but not all participants were aware of other possible participants and so the sampling technique needed to be altered in order to obtain 12 participants. In addition to following leads provided by study participants, I reached out to other Emory students and STEM majors to obtain recommendations for other possible participants who were then contacted in the same manner.

All of the one-on-one oral history interviews were conducted in a mutually agreed upon location on Emory's Atlanta campus. This location was generally a reserved private study area in either the Woodruff or Pitt's Theology Library. For the most part, the interview environment remained constant for all participants. Prior to beginning each interview, I read each participant the same scripted study introduction and presented each participant with an informed consent form (see Appendix 1). Participants were given time to read through the consent forms and asked to raise any questions or concerns they might have about the process.

Interviews lasted between 40 minutes and 2 hours, with the average interview time being around one hour. The oral history interviews were guided by a set of questions (Appendix 2), but tended to be much more conversational in nature as participants were encouraged to expound upon topics and recount as much of their experience as possible. The questions used to guide the oral histories touched on topics such as participants' background demographics, high school experiences as related to preparation and STEM involvement, classroom and campus experiences, relationships with faculty and peers, and a reflection on their overall perception of their university experience. More specifically, participants were asked to talk about how they got involved in STEM, what their experiences were like in the STEM classes at Emory, and what made them decide to leave the STEM department. Participant pseudonyms and background demographic data collected during the interviews are shown below in Table 1.

TABLE 1: Participant Demographics

Participant Pseudonyms	*Race*	*Gender*	*Home State*	*High School*	*SES*	*Neighborhood Classification*
Shaun	B	M	McDonough, Georgia	Public	Middle Class	Majority White
Robert	B	M	Atlanta, Georgia	Private	Lower/Working Class	Majority Black
Kiara	B	F	Baltimore, Maryland	Private	Lower/Working Class	Majority Minority
Adrianna	W	F	Tucson, Arizona	Private	Upper Class	Majority White
Summer	W	F	Needham, Massachusetts	Private	Upper Class	Majority White
Logan	W	M	Westchester, New York	Public	Upper Middle-Class	Majority White - Upper Class
Megan	W	F	Orlando, Florida	Public	Lower- Middle Class	Mixed
Brittney	B	F	Powder Springs, Georgia	Private	Middle Class	Mixed/ Majority Black
Tim	W	M	Boston (Westwood), Massachusetts	Public	Upper Middle-Class	Majority White
Lena	B	F	Nashville, Tennessee	Private	Lower-Middle Class	Mixed
Todd	W	M	Chicago, Illinois	Private	Upper Middle-Class	Majority White
Eric	B	M	Cheverly, Maryland	Public	Lower/Working Class	Majority Black

Data Analysis

Each interview was recorded and transcribed. After transcribing all twelve of the interviews the data was analyzed manually using an inductive coding method borrowed from Grounded Theory (Glaser & Strauss, 1967). I began by using the Microsoft Word highlight and underline features to open code the transcribed interviews, making note of emerging concepts and themes as I reviewed the transcripts. Following this process, themes and concepts developed from open coding were transferred into various Microsoft Excel sheets where further grouping took place, by combining similar concepts and themes into broader categories.

After identifying the four initial codes categorizing student reasons for exiting the STEM field, I began, through multiple rounds or of re-reading and sub-coding the responses within those categories, using further inductive coding to draw out the main concepts and themes that seemed to influence those original codes. These concepts were further analyzed to identify the ways in which the codes and sub-codes connected to each other, and how they shaped and were

shaped by student STEM experiences. I used different text colors within Microsoft Excel to delineate and categories.

Results

Participants spoke in detail and at length about their experiences within the Emory STEM departments and in doing so, each participant provided a clear explanation for why he or she ultimately decided to discontinue his or her pursuit of a STEM major or career. Students' explanations for why they chose to leave STEM are further supported by their detailed accounts of their experiences during their time within the Emory STEM departments. By analyzing these experiences and taking into the consideration the similarities and differences between the explanations and accounts of black and white participants, I am able to make further deductions about various factors that seem to have played a role in students' decision to exit the STEM field and how these factors may be related to race. In the following section, themes are delineated and quotes from participants are presented to preserve the essential aspects of their experiences while preserving their anonymity.

Participants gave varied and complex explanations for why they had chosen to leave the STEM fields. While no two explanations were exactly the same, there were a number of commonalities in many of the participants' responses. Based on these commonalities, I defined four distinct categories of explanations. These categories signify the general tone and reasoning for students' exit from STEM as based on the specific details and experiences of participants. The four categories of explanation include: Academics/ Concern with Grades, Lack of Professor/Major/Department Engagement, Development of Other Interests, and Dissatisfaction as a Result of Pursuing Major/Burnout. Table 2 shows each participant's primary reason for choosing to exit the STEM departments. These categories of explanation are not void of overlap

and there were instances in which students' explanations included components that could be coded as belonging to one or more category. In these instance students were placed in the category that they fell more in line with based on the data as a whole and their overall account of experiences.

TABLE 2: Participants Exit from STEM

Participant Pseudonyms	*Race*	*Gender*	*New/Current Major*	*Primary Reason for Choosing to Leave STEM*
Shaun	B	M	Political Science	Academics/ Concern with Grades
Robert	B	M	African American Studies	Lack of Professor/Major Engagement
Kiara	B	F	Social Science	Lack of Professor/Major Engagement
Adrianna	W	F	Business & Sociology	Academics/ Concern with Grades
Summer	W	F	Linguistics & Portuguese	Development of Other Interests
Logan	W	M	Business/ Human Health	Academics/ Concern with Grades
Megan	W	F	Art History	Development of Other Interests
Brittney	B	F	Creative Writing	Dissatisfaction as a Result of pursuing STEM/ Burnout
Tim	W	M	Business	Development of Other Interests
Lena	B	F	Human Health/Public Health – Pre-Law	Dissatisfaction as a Result of pursuing STEM/ Burnout
Todd	W	M	Economics	Development of Other Interests
Eric	B	M	Linguistics & Anthropology	Lack of Professor/Major Engagement

Academics/ Concerns with Grades

Students that fall into this category made the decision to leave STEM based primarily on their actual or perceived inability to succeed academically within the STEM classes that they were involved in. While nearly all students reported that they faced academic hardship at one or more points during their STEM careers, only three of the twelve students interviewed indicated

that those hardships were the primary reason that they decided to exit STEM. Shaun, a Black fourth-year student, attributed his exit from STEM almost solely to his negative academic experiences saying, “"I just wasn't understanding anything. That's the bottom line.” Shaun’s interview also indicates that both his social life and affect were negatively affected by his time in the STEM department, describing the semester as, “one of the worst experiences that [he] ever had ever mentally, emotionally, and physically.” This fact suggests that Shaun may have also been experiencing feelings of dissatisfaction or burnout. But when asked if anything would have made him want to continue his pursuit of STEM he responds “no” again stating that “[he] didn’t understand the material.”

The other two students that identified academics as their primary concern for leaving STEM were both more concerned with how their grades would affect their future career prospects within the STEM fields. Adrianna and Logan, both white third-year students, were on the Pre-Health track with plans of attending medical school. For both of these students, the primary concern was that their academic performance would not be strong enough to reap real benefits in either field.

> It kind of made me realize that the pre-med cohort was very smart, like very smart. And my parents had always said that when I go to college they wanted me to be top third not middle third or bottom 3rd…I knew that that was my competition if these kids were all applying to med school they would get in over me and then I'd be screwed.

Logan, despite receiving passing grades in the STEM courses that he had taken, was particularly vocal about the fact that he felt his grades did not stack up against his peers.

The importance of grades and strong academic performance is something that all students

pursuing majors or careers in the STEM fields are cognizant of. As I mentioned earlier, although academics was only named a primary reason for exit for three of the twelve students interviewed, nearly all students described accounts of the academic struggles that they faced within their STEM courses. Indicating that while academic difficulty may not be a primary deciding factor for all students who exit STEM, it is definitely a relevant and visible part of the STEM experience.

Lack of Professor/Major/Department Engagement

A quarter of the students interviewed made the decision to exit STEM because they felt a lack of connection to their respective professors, majors or departments. Students in this factor cited lack of student-teacher relationships and a lack of outreach from their departments as major contributors to their exit from STEM. Many STEM majors and pre-professional tracks such as pre-health and pre-med require students to take a set schedule of introductory courses including Biology and Chemistry 141 and 142. These introductory courses are infamous for being relatively large and having a high teacher to student ratio. Most students interviewed reported that their introductory courses hosted anywhere between 70 and 100 students, creating a sense of overcrowding. All students interviewed were aware of and made note of the large STEM classes. Although many students felt that the large class sizes were an issue, only the three students in this category were so affected by that classroom environment that they decided to forego their aspirations to pursue STEM majors or careers. This particular reason for exit is especially interesting to me because it is not as commonly cited as explanations such as academic inability or the development of other interests. As such, this explanation is one of the core themes that will be discussed in greater detail in the second half of this section.

Dissatisfaction as a Result of Pursing STEM/Burnout

This category is comprised of students whose reasons for exiting STEM were related to general unhappiness or dissatisfaction with the major. These students, who had originally had great interest in the STEM fields, eventually reached a point where the negative feelings associated with the subject began to overshadow their original interest. These negative feelings were the result of a number of different things including the academic rigor of courses and dissatisfaction with related coursework or internships. Both students reported experiencing feelings of anxiety and stress related to their pursuit of a STEM major or career, and in both cases, these negative feelings began to spill over into other aspects of student life. Brittney, a black fourth-year student, had aspirations of pursuing a career as a veterinarian. During her sophomore year, Brittney made the decision to take three STEM courses a semester for both semesters. Taking on this overly strenuous course load eventually led Brittney to discontinue her studies within STEM:

> There was like one week in the summer--in the middle of the summer where I just came home and I said Mom I don't want to--. We were talking about like planning for next year and my classes and I was like I don't want to do science anymore. And I still love animals I still love working with them but I just don't want to be a vet and be responsible for lives one day… I think it did boil down to the class experiences that I had. Like if I maybe--if I didn't triple up I wouldn't have been so burnt out but at this point.

Brittney was not alone in feeling overwhelmed by her STEM courses. Seven of the 12 participants interviewed made reference to experiencing some form of stress or anxiety as a result of their time in the STEM departments.

Lena, a black fourth-year student, sums up her exit from STEM saying:

> After the second [test] I was just like you know what I don't want to do this anymore I hate my life doing bio and I hated it in chem too so this is a pattern. I was just like you know whatever money I thought I might make it as a doctor and whatever little help I was going to be to someone it's not worth it.

Lena had graduated from a private high school with AP and Honors credit, after having excelled in both science and math throughout her primary school education. Lena's aspirations to attend medical school and become an anesthesiologist had developed as a child. Despite these seemingly positive factors, Lena's experiences with STEM at the undergraduate level ultimately led her to feel disdain towards a field she had once loved.

Development of Other Interests

The remaining four participants interviewed left the STEM field in favor of pursuing other interests. These students, much like their peers, had come to Emory with strong interests in STEM and aspirations of pursuing STEM majors or STEM-related careers. Although many of the students within this category made mention of situations involving factors such as course difficulty or stress, they were clear that their primary reason for exiting STEM was the development of interests in other areas. This was the most common reason for leaving STEM accounting for the exits of four of the twelve participants. It is interesting to note that students who left STEM in favor of other interests were just as likely to have declared a STEM major to begin with (Appendix 3), indicating that there was likely some true interest in STEM initially. Summer, a white third-year student, expressed that although she had been interested in pursuing a career as a physician's assistant she had never loved the STEM fields:

> And I realized like I have--like I'm very interested in medicine but it's never been what I'm good at or what I love. I don't love science. I don't love biology. I've never loved biology. What I've always been good at from like elementary school until today is languages… But also I think my Spanish class is what made me decide to change my major to Spanish and Portuguese. I'm in a Spanish class called Spanish--translation studies with Professor D. It's a Spanish class but you learn about like translation theory which is something I've never like learned about and I absolutely loved it. Today was my last class and I was so sad because I love languages and I'm very interested in linguistics too. I always have been. And it was just like really cool for me to read about. There was one night where I was doing my reading for my ling--for my Spanish class and it was just about like basic translation theory and it was like from my textbook. And I--this was like amid so much stress and whatever and I started crying because I realized for the first time ever I was doing homework and doing reading for a class that I loved.

Summer was a student who had struggled with her STEM courses during her first year, but after making a conscious effort was able to improve her grades. When she decided to leave STEM in order to pursue a Portuguese Major she was earning grades that were slightly above average in her STEM courses. It is clear from this fact and the emotion that Summer expresses in the above excerpt that while other factors such as difficulty with courses may have played a role in her experiences, it was a love for Portuguese that pulled Summer away from STEM.

TABLE 3: Participants Primary Reasons for Exiting STEM by Race and Gender

	Race		*Gender*		*Total*
Primary Reason	*Black* (n = 6)	*White* (n = 6)	*Male* (n = 6)	*Female* (n = 6)	
Academics/ Concern with Grades	1	2	2	1	3
Lack of Professor/Major Engagement	3	0	2	1	3
Dissatisfaction as a Result of Pursuing STEM/ Burnout	2	0	0	2	2
Other Interests	0	4	2	2	4

As demonstrated in Table 3, there are patterns related to *who* makes the decision to leave STEM for *what* reason. Of the twelve participants interviewed three students contribute their exit from STEM to academics/concern with grades, three contribute their exit to lack of professor/major/department engagement, two contribute their exit to dissatisfaction as a result of pursuing the major/burnout, and four students contribute their exit to a development of other interests. Within those four categories, there are clear divides that seem to align primarily with the race of the participant. Of the three participants who left STEM due to lack of professor/major engagement, none of them were white. The same is true for the students who left due to burnout/dissatisfaction. And interestingly enough the opposite is true for those who left in pursuit of other interests. Gendered differences seem less apparent with both males and females being represented in nearly every category, the exception being those who left due to burnout/dissatisfaction. This category houses only female students. These differences in reasoning are tied to specific differences in the experiences of black and white students.

In the following section, three main themes are summarized, which emerged from the

oral histories collected as possible factors that contribute to racialized differences in reasons for attrition: (a) lack of meaningful student-teacher relationships, (b) feelings of isolation and otherness, and (c) overall negative perception of campus climate. These themes emerge either uniquely within the accounts of black students' experiences or in ways different than those for white students, highlighting them as factors that likely contribute to the differences in reasoning.

Lack of Meaningful Student-Teacher Relationships

Unlike the other two themes to be discussed in this section, the lack of meaningful teacher-student relationships was not unique to the black student experience. What was, however, unique, was the importance that these relationships, or the lack thereof, seemed to have on black students and their overall STEM experiences.

Of the twelve students interviewed, black participants were far more likely to talk about their lack of positive relationships with professors. They were also more likely to state that the lack of positive teacher-student relationships was in some way related to race. Kiara, a black fourth-year student, expressed her sentiments saying:

> I didn't have a relationship with my professors at all. I saw them in office hours. I don't think that they even recognized me or remembered who I was which was partly due to the fact that the classes were so big but also because I don't think that a lot of white professors take the time to remember their students of color. Um and still get confused, which is--there are only five at the most there were five black students in a class and I went in for office hours and would still get confused for another black student you know and so that is disrespectful but it's also racist… I didn't go out of my way to talk to professors about my interests mostly because I didn't feel like they were even interested in developing a relationship with me. And so based off of what I thought their character wasn't

> there like lack of interest in their students I didn't want to--I didn't want to work with them anyways.

For Kiara, the relationships that she did and didn't have with her professors were tied to how she felt they viewed her as a student and a black student in particular. Other participants spoke out about the lack of support that they felt they got from professors, while not necessarily attributing this lack to their race. Robert, black fourth-year student shared an account that he had with a white male Chemistry professor during his first year at Emory:

> I just didn't understand and so I obviously went to office hours and I can remember asking him if he could like--describe like write out the answer for me on the board and he just refused to do so. He was like "yeah I just told you the answer. What do I need to show you like, you don't get it?" And so in that moment I was--of course I had to refrain myself because I was like okay this is a professor but then I was just also just very much like I felt disrespected because I felt like as a professor this is your job to aid the student especially a student that's coming in for office hours especially if how your delivering the material doesn't really reach that student, try and change how you're teaching so the student understands if in fact your goal is that the students understands. And that was the moment where I felt like okay he really doesn't care about me as a student.

Although Robert never relates this particular experience back to race, these types of experiences are unique to the black student experience due to the bearing that they had over the students' overall outlook. In both of the aforementioned scenarios, the participants involved noted that their professors demeanor and overall lack of engagement did in some way shift the way they viewed their environment despite the fact that they may have had positive experiences or interactions in other classes or with other professors. For these students' negative interactions with professors led directly to continued negative experiences and views of STEM.

While the white students interviewed did not sing the praises of every professor they spoke about, their negative comments were generally much milder and seemed to have much less influence over their overall views of or experiences within STEM. More often than not white students attributed their lack of positive relationship with professors to class size and inability to obtain one-on-one time:

> I think I tried--I would try to go to office hours and there were like eight students in his office like a tiny office that's smaller than this room. And I was like I'm not even going to bother. – Summer

> So [the professor] was good. It's 30 people and he's extremely busy like literally always going to conferences and what not because he's like a big big deal and that world. But I mean he was cordial like he I don't know if he'd recognize me now but like he was just a good teacher like he'd be there if you need help and whatnot… I kind of like new within myself that if I needed something I could reach out. – Todd

> The professors were nice but I never thought that any of them were particularly approachable um so that was intimidating. – Megan

The sentiments of these students were echoed pretty heavily amongst their peers, with most white students noting that their classes were big and that their professors seemed busy. The primary differences between white and black students experiences is that (1) nearly all white students described their professors as nice or friendly, while their black counterparts did not and (2) most white students felt that they could be better served by one-on-one interactions, while their black counterparts noted that they still felt underserved even in one-on-one interactions with professors.

Kiara and Robert, like most Emory students of color, had no black professors and very

few non-white or white, female professors. Although some students failed to address this fact, students like Kiara spoke out about the lack of diversity within the Emory STEM professoriate:

> Imagine if white people only took classes taught by black women. That's not even something that I think white people ever think about. But it would be a radically different space and experience. Learning would be so much different for everyone… I'm just so sick of being taught by white people.

Another student echoes Kiara's views, not through only by voicing her opinions, but through her description of a positive relationship with a black STEM professor at Emory. Brittney, a black fourth-year student had a black male biology professor during her first year at Emory. Not only did she classify the relationship that she was able to build with this professor as far more positive than the relationships she had built with her other non-black professors, she describes in detail the ways in which this relationship was especially meaningful due to their shared "blackness":

> I had [Professor U] for first semester and he was like one of my favorite professors. And he was new that year I think. And he was um like the first black professor that I had seen in the science department and so I was like oh my gosh I'm so excited and he was a great professor…I felt more comfortable approaching him…[Professor U] like he was the one who--we could talk about like being black in science. We could talk about um--I mean he would go over the material and he was the one professor where I could say [Professor X] this is hard and he would just be like yeah yeah you're right this is hard and we could just talk about that. I didn't have that really relationship with any of my other ones but they were still nice to me and they respected me as a student.

Unlike Kiara, Brittney's relationships with all of her professors were generally characterized in a positive light. But it is clear that she felt her relationship with Professor U was different and special due in part to their shared racial experiences. For Brittney, it

was easier to build a relationship with a black professor and for that relationship had a positive impact on student performance, regardless of the difficulty associated with the work. Although the positive relationship that Brittney was able to form with Professor U did not keep her from leaving STEM, it could have made a difference for other black students:

> If I had more women that were teaching me or more people of color that were teaching me or non-white people that were teaching me I would most likely still been a neuroscience major because learning would have been different. This space would have been different. I would have been less--I would have--the entire experience would have been different and so I would have stayed. – Kiara

Feelings of Isolation And Otherness

Participants were asked a number of questions that were meant to draw on their feelings of belonging, both on campus and within the STEM fields. While the majority of students, both black and white, responded "no" to questions that directly asked if they felt isolated in their STEM classes either by professors or students, black students responses to other questions indicated that they were likely isolated on campus as a whole and within their STEM classes.

All six of the black students interviewed noted that they were often one of few black students in their STEM courses. Although these students did not readily admit to feeling isolated they were cognizant of the fact that they were a clear minority within their STEM courses. Robert described himself as feeling like an odd-man-out within his STEM classes:

> I wasn't really surprised it's like being a black student in the room that's mostly white because I had had that experience [in high school].

This "minority" status within STEM courses was a reality for nearly all of the black students

interviewed:

> During my first year for the most part the entire class was white. There were not a lot--I can count on one hand how many black students were in a class. – Kiara

> Especially when I was in the upper level bio classes one I was like one of the only black people there but then also I wasn't--I guess cuz I was younger at some times like I might be the only sophomore or even in like environmental studies I might be the only freshman or one of the only freshmen. – Brittney

These students were all aware of the fact that they were numeric minorities within their STEM classes and this was, in and of itself, a form of isolation for these participants.

When asked about classroom relationships with their peers, black students were far less likely to feel that they were able to develop relationships with classmates or work closely with peers. Five of the six white students interviewed stated that they had been able to build relationships and work closely with peers, whereas only three of the black participants felt this way. Amongst these three black students, all of the participants referenced the fact that they primarily built these working relationships with other students of color:

> Usually if there are like black people in the class I would say usually--at least I end up in a group with black people. And this was even in other classes not STEM. – Lena

> In the lab sessions it was very awkward at times with group work and it just didn't seem like there was a lot of community in that sense. – Robert

Black participants were not nearly as comfortable working amongst their peers as their white counterparts.

In addition to feeling a level of discomfort when dealing with peers a number of black

students also recounted negative interactions with their peers. These interactions were characterized by black students being made to feel like outsiders or less than in the classroom environment. For some students like Brittney these interactions were subtle albeit noticeable:

> So people kind of look at you sideways like you just got here what do you know about science. Sometimes it was about race and I don't--I don't like remember any direct comments that I got about--like oh you went to private school that's interesting I never would've guessed. Like I never got anything direct like that but it would just be like little side--like I would make a comment that I wasn't even thinking about and I would notice like a side eye for a second and it's just like yeah I know what I'm talking about.

Although Britney did not characterize these interactions as hostile, she did feel as though her classmates questioned her abilities and intelligence, making her feel as though she did not belong.

Kiara described similar experiences of being made to feel like an outsider. But in Kiara's accounts, these interactions not only made her feel as though she did not belong but as if she was invisible:

> If I made calculations and they were the first calculations that were made it would almost be as if I had never made those calculations. And we would wait--they, the students would wait that were in my group until either a man came up with something different or the same calculations any calculations or a white person made the calculations. And so that's when the conversation would start and they would wonder whether or not we have like gotten the right answer. And so yeah it was definitely--there were a lot of moments where I--like the communication would completely be one sided so I would feel like I'm engaged but they didn't see me or hear me and so the work I was doing was not even being looked at or considered.

The effects of not feeling as though one does not belong can be extremely negative especially if coupled with other negative experiences. For Kiara these negative interactions acted as the final straw that broke the camel's back:

> I stopped showing up actually I was so depressed that semester because I felt invisible.

In an already challenging classroom environment these students were further challenged by being isolated, both as a result of sheer numbers and due to the fact that they were questioned and silenced by their peers.

For the students interviewed, isolation was not limited to the classroom. These students were also, in a sense, isolated from their general campus environment. As with their classes, all six of the black students interviewed were cognizant of their minority status on campus and five of the six students interviewed noted that they spent all or most of their time within Emory's black and minority communities. When asked if they felt like they belonged to the Emory community at large nearly all black students interviewed responded with "no." Those who responded "yes", qualified that statement by noting that *their* Emory community was very much linked to black spaces and environments on campus:

> I have sort of what someone might call retreated back into the safety of Blackness at Emory because the black Community at Emory is lit… I participate very heavily in the communities that I've constructed and am involved with. – Eric

> I'd still say at large yeah even though 90% of the time I'm like interacting with black people… And all my friends pretty much are black and generally like similar to me in like multiple areas. – Lena

> I've built Community around myself. Um yeah--I understand how it's important to just find people who support you and who are there for you who advocate for you and so I found that. – Robert

This was true even for students like Brittney and Lena who had grown up in mixed environments and private schools where they spent much of their time with other white children. Both Lena and Brittney were surprised by the racial divides that they found existed amongst Emory's undergraduate students:

> Black people usually hang out with black people here and I was like oh that's different. I don't know why maybe because I don't know maybe because you usually end up living with black people that they end up being your friends. I don't know. – Lena

> With Emory it's like--I don't feel like everybody is as approachable as in high school Here it's like you see white kids hanging out with white kids and black kids hanging out with black kids and there's not a lot of mixing. – Brittney

Shaun, a fourth-year varsity student-athlete, was another student who had grown up in and gone to school in neighborhoods with white children throughout adolescence. When speaking about his family and childhood Shaun noted that a lot of his friends and classmates growing up had been white. Despite this fact, Shaun stated that at Emory he felt isolated not only in the classroom but by his sports team:

> Also, there was the racial aspect I was the only African-American on the cross-country team at the time. And I am again still but it's like--there were certain jokes if they were saying and maybe they didn't know that it was offensive but I was taking it--it was not acceptable to me… But it was--I was being left out of everything.

Lena, Brittney, and Shaun are good examples of the ways that black students are isolated even

outside of the classroom. These three students are especially interesting because they all come from mixed backgrounds where they had been members of mixed communities. Upon arriving at Emory, these students found that it was not as easy to exist within those mixed spaces thus resulting in a form of isolation that was not totally self-inflicted.

Overall Negative Perception of Campus Climate and Environment

TABLE 4: Participants Overall Perception Of Campus

	Race		*Total*
Overall Perception	*Black* (n = 6)	*White* (n = 6)	
Generally Positive	3	5	8
Generally Negative	3	1	4

There is a relatively stark contrast in the students' overall perceptions of campus climate and environment. Table 4 above shows participants' overall perception of campus climate by race. While nearly all white participants have a generally positive outlook on Emory's environment and campus climate, only half of this study's black participants view Emory in a generally positive light. What's more, the students who expressed having generally negative feelings towards the university were the same participants who had cited lack of professor/major engagement and isolation as prominent components of their experiences.

Three of the six black participants' experiences were so negative that they were characterized using language such as *hate*:

> I hated it. I couldn't have hated it any more than I did. I couldn't have. I was miserable… [The university] is prestigious. It is dishonest. People that aren't in

> this space you know get the impression that it's like a beautiful campus with people who are very happy to be here, which is just not the case. I think people are mistreated. People of color are mistreated. People from low-income backgrounds are mistreated. And for the most part there is really no--there's no--the university doesn't care. – Kiara

In addition to a lack of positive interaction and isolation both inside and outside of the classroom, these students' characterizations were also based on the fact that they did generally not feel that Emory's environment tried to be inclusive of or protective of the needs of both students and staff of color. Eric, another student that characterized his overall view of the university as generally negative, spoke about a faculty interaction that he had been made aware of:

> [Racism] is all over the place. Faculty definitely don't have their s**t together. Especially tenured faculty who say and do whatever they want… Earlier in the anthropology department a Professor--a black woman named Dr. M she actually left the department because of racial incidents that were going on. There was like a joke that an anthropologist professor told. And it was something like--something about like a ni**er in a haystack something to do with a needle in the haystack but it was some racist joke that they made. And Dr. M left. She said she wasn't putting up with it.

Both Kiara and Eric cited other specific negative racialized experiences that they had had either in non-STEM courses or in other spaces on Emory's campus. For these students Emory's inability to serve as a safe and inclusive space definitely aided in the cultivation of an overall negative perception of the campus environment.

Discussion

The findings discussed in the previous section provide a close examination of the differences in the experiences of former black and white STEM students on Emory's campus. More specifically, these results indicate that there are differences in the reasons that black and white students have for choosing to exit the STEM fields. Black students interviewed almost singularly chose to leave the STEM fields for reasons related to lack of professor/ major engagement and dissatisfaction as a result of pursuing STEM/ burnout. These reasons were influenced by three factors unique to the black STEM student experience: (a) lack of meaningful student-teacher relationships, (b) feelings of isolation and otherness, and (c) overall negative perception of campus climate. Ultimately the reasons that black students gave for leaving STEM and the factors influencing those reasons are combatable. Unlike, developing another interest, lacking professor major engagement is avoidable. It is something that with the necessary steps and programs could be avoided thus resulting in less attrition for reasons relating to it.

The detailed experiences of the students interviewed for this study provide further evidence for programs that will foster more positive and inclusive environments for black students. Literature notes that mentorship is an especially important factor for students from underrepresented groups (Brown-Nagin, 2016). The present studies findings seem to support that claim for students involved in STEM. The lack of black and minority faculty members within the STEM departments was a real and noticed issue for black students interviewed. The literature is clear on the impact that student-professor mentoring relationships have on students, but it seems that in the case of black students within stem these relationships may be that much more

important. If we take into consideration the other factors discussed in the paper it is possible that those mentoring relationships provide students with a sense of community/ belonging that they otherwise lack on PWI campuses.

In addition to stressing the importance of mentoring relationships, Brown-Nagin (2016) also stresses the need for campuses to take up initiatives that promote inclusion through interpersonal accountability. My data reveal a need for these types of initiatives within the STEM fields as well. The black students in the present study expressed a strong need for inclusion and community.

This study provides evidence of areas within the STEM department and overall university setting that are not beneficial to the progress of black students. It is necessary to use these students' stories as a start to addressing the issues that currently exist.

There are a number of limitations that must be taken into account when considering this study's findings, many of which stem from methodological issues. First, the oral-history interview method used was implemented in order to yield the most qualitatively rich data possible. While the interviews did result in fruitful data, the researcher conducting the interviews was not a practiced oral-historian and it is possible that this data could have been strengthened had it been collected by a more practiced researcher. Second, only one researcher conducted, transcribed, coded, and analyzed interviews, which may have proved positive in terms of consistency but does introduce the possibility for bias. Further, this study is limited to 12 in-depth oral history interviews, which is not representative of the student population as a whole at Emory University, elite universities as a group, or college in general. This study only intends to uncover patterns that may exist between students' STEM experiences and their reasoning for

exiting STEM.

Future Directions:

There are three key actions that future scholars and researchers interested in increasing the persistence of black STEM students should consider.

1. Continued Research
    a. I believe that in addition to conducting further qualitative and quantitative studies that examine the effects that certain experiences have on attrition rates, it is especially important for future research to look at how student experiences affect attrition rates at historically black colleges and universities (HBCU). Comparing the patterns and experiences found amongst black students here with those of students on HBCU campuses would help narrow down which effects are uniquely felt by black students at elite predominantly white universities and which are felt by black college students as a whole group.
2. Create Programming
    a. Mentoring programs have been shown to be beneficial to the persistence of underrepresented students within STEM fields. One large issue with the way that these programs are currently used is the short-lived nature of these types of programming. Administrations should continue to use these sorts of programs, but implement them on a long-term basis in order to provide students with continued support. It would also be useful to look at other forms of mentoring relationships that could act as a support for students of color.

Given that isolation was a relatively widespread factor amongst study participants, it would also be interesting to look at the effects that different types of community involvement might have on the Black students' persistence within STEM.

3. Increase racial diversity amongst faculty
    a. Currently, the STEM faculty at Emory is almost exclusively white and male. The evidence from this paper suggests that students of color would benefit from seeing and having more faculty that look like them. Universities should make an effort to increase the number of faculty members of color at their universities, especially within departments where both students and faculty of color are underrepresented.

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Appendix 1

Study Script

"Hi, My name is Aamira I'm currently a senior in the Honors Program in Emory's AAS department. I'm conducting a study to learn more about the experiences of undergraduate Emory students who were initially STEM majors but then decided to choose a non-STEM major. During this one-on-one oral history collection I will ask you to talk about your experiences in the STEM fields and your transition into your current area of academic interest. You will be compensated for your time with a $25 dollar Visa gift card. The study should take around an hour or so. Before we get started I'd like to walk you through and have you sign this informed consent form."

Read over and sign consent form

Start Interview

"Today is _____. I am interviewing _____ at Emory University. _____ is an Emory undergraduate student who was formerly involved with the Emory STEM departments and has since changed academic interests. We will be discussing _____ experiences in the Emory STEM Departments."

After interview has been completed debrief the participant and ask about future participants.

"Thank you for participating in my study. I would like to tell you a little bit more about how your oral history will be used. I am using the information from these oral histories to look at the qualitative differences in the overall collegiate experiences of Black and White Emory students because I am trying to determine whether or not there are differences in the campus experiences of black and white STEM students and how these differences in experiences may explain the differences in the reasoning for white and black student's decision to exit the STEM program. This research is exploratory, but ultimately aims to help my reader to understand how racialized experiences might be playing a role in the overall underrepresentation of Black students in STEM fields."

"I am still in need of x black/white male/female study participants. Do you know of any students similar to yourself who might be interested in participating in this study? If so would you mind providing me with their names and/or email addresses"

"Thank you again for your participation in this study. Here is your gift card. Please sign here to indicate that you were compensated for this study."

Oral History Informed Consent Release

Title: Emory STEM Experience Study

Principal Investigator: Aamira Brown

Funding Source: Department

Introduction

You are being asked to participate in an Honors research study. This form is designed to tell you everything you need to think about before you decide to consent (agree) to be in the study or not to be in the study. **It is entirely your choice. If you decide to take part, you can change your mind later on and withdraw from the research study. You can skip any questions that you do not wish to answer.**

Before making your decision:

- Please carefully read this form or have it read to you
- Please ask questions about anything that is not clear

You can take a copy of this consent form to keep. Feel free to take your time thinking about whether you would like to participate. By signing this form you will not give up any legal rights.

Study Overview

The purpose of this study is to gain detailed qualitative information about the experiences of former undergraduate STEM students at Emory.

Procedures

You are being asked to participate in an interview as a part of an Oral History Project about student experiences in the Emory STEM fields. You are being asked to participate because of your previous affiliation with the Emory undergraduate STEM departments. You will be asked about your memories and experiences as an undergraduate student in the Emory STEM departments. The interview will be audiotaped and transcribed. Most interviews will take approximately one to two hours. There are no anticipated risks to participation in this interview. During the interview you may request to stop the recording at any time to discuss or clarify how you wish to respond to a question or topic before proceeding. In the event that you choose to withdraw during the interview, any recording(s) made of the interview will be either given to you or destroyed, and no transcript will be made of the interview.

Compensation

You will receive a $25 Visa gift card upon completing the study visit.

Confidentiality

The records of this project will be kept private. In any sort of report we make public we will assign you a number and you will not be identified by name. Instead, we will also use pseudonyms when appropriate. Research records will be kept in a locked file; only the researchers will have access to the records. The recording of the interview will be destroyed after it has been transcribed, which we anticipate will be within two months of its taping.

Voluntary Participation and Withdrawal from the Study

You have the right to leave a study at any time without penalty. You may refuse to answer any questions that you do not wish to answer. If you choose to withdraw you may also request that your information not be used.

Contact Information

Contact Carol Anderson at carol.anderson@emroy.edu:

- if you have any questions about this study or your part in it.
- if you have questions, concerns or complaints about the research

Consent

I have read (or have had read to me) the contents of this consent form and I understand it. I have been encouraged to ask questions and I have received answers to my questions. I give my consent to participate in this study and I have indicated above my choices for participation or not in the certain activities of this study. I have received (or will receive) a copy of this consent form.

Indicate ***Yes*** or ***No***:

I give consent to be audiotaped during this study.

___Yes ___No

I give consent for tapes resulting from this study to be used for research purposes related specifically to this study:

___Yes ___No

I would like to review and edit the transcript prior to its use.

___Yes ___No

Please, print your name and sign below if you agree to be in this study. By signing this consent form, you will not give up any of your legal rights. We will give you a copy of the signed consent, to keep.

_____

Name of Subject

_____ _____

Signature of Subject Date Time

_____ _____

Signature of Person Conducting Informed Consent Discussion Date Time

Appendix 2

Guiding Questions

- Where are you from? What was it like there?
- Where did you go to high school?
- What was your experience like in high school?
- Did you excel academically in high school?
- Did you enjoy science/ math in high school?
- Were your science/math teachers helpful or encouraging or not?
- Can you recall any specific instances or examples?
- What's the highest level of education that your parents received?
- Where did your parents go to college?
- What do your parents do?
- Why did you pick Emory?
- What did you come to Emory wanting to major in?
- What made you want to major in _____ here?
- What was your overall experience like your first year at Emory like?
- Can you recall any specific instances or examples?
- How is Emory different from your high school - in terms of campus, people, and academicsetc.?
    - Is Emory's campus more/less diverse than home/high school?
- What STEM classes did you take during your first/second year at Emory?
    - What were those classes like?
    - What was the workload like?
    - Who were your professors?
    - Can you recall any specific instances or examples?
- What was your relationship with your professor like?
    - Were you able to work closely with your professor?
    - Can you recall any specific instances or examples?
- Did you receive a lot of support or encouragement from the faculty or staff in your department?
    - Can you recall any specific instances or examples?
- Were you interested in doing research in your department?
    - Did you have any opportunities to pursue that research?
        - If not, why do you think that was?
- Did you ever feel like your professor or the TA's ever questioned or assumed your abilities or intelligence?
    - Why do you think this was?
- Did you ever feel like you were being overlooked by your professors in the classroom?
- Did you ever feel like you professors/TA’s were surprised by your abilities?
- Were you able to develop relationships with your peers and classmates?
    - If not, why do you think this was?
- Did you feel like you were able to relate to the people around you?

    - Why/why not?Were you able to work closely with your peers?
    - If not, why do you think this was? Why/why not?
- Did you ever feel like your classmates questioned or assumed your abilities or intelligence?
    - Why do you think this was?
    - Were your opinions or ideas ever overlooked in a group discussion/work
    - Can you recall any specific instances or examples?
- Did you ever feel like you classmates were surprised by your abilities?
- Did you ever feel isolated in your classes?
    - Can you recall any specific instances or examples?
- When did you decide to change majors?
- What made you want to leave that department?
- Is there anything that would have made you want to stay in STEM?
- How are your relationships with other students on campus?
- What clubs or extracurricular activities do you participate in?
- Do you feel at home or like you're a part of the Emory community?
- Do you feel like the political/racial climate of the nation affects things that go on on campus?
    - How so?
    - Can you recall any specific instances or examples?

Appendix 3

Participants Involvement in STEM

Participant	*Race*	*Gender*	*Year*	*Interest in STEM*	*Preparation for STEM/ College*	*STEM Major/ Intended Stem Major*	*# Of STEM Classes Taken*	*STEM Classes Taken*
Shaun	B	M	Senior	Early on - Elementary School	Honors Track/ AP Courses	Biology - Declared	5	Bio 141, Bio 142, Math 112 Z, Chem 141, Developmental Biology
Robert	B	M	Senior	Before college - family health issues	Honors Track/ AP Courses	NBB - Declared	2	Chem 141, Chem 142
Kiara	B	F	Senior	Middle School - familial/personal health issues	Private School/ Summer Courses/ Johns Hopkins Research	NBB - Never Declared	3	Neuroscience – Precollege, Bio Pre-Requisites
Adrianna	W	F	Sophomore	Liked high school teachers - parents doctors	Private School - Advanced Math	Not Sure (Pre-Med) - Never Declared	2	Chem 141, Calculus
Summer	W	F	Junior	High School Anatomy - Not particularly	Private School/ AP Calc/ Honors classes	Biology - Declared	6	Chem 141 (x2), Bio 141, Chem 142, Bio 142,

Logan	W	M	Junior	Loved High School Biology	IB Diploma, HL Bio	Human Health - Declared (Pre-med)	3	Chem 141, Chem 142, Calculus
Megan	W	F	Senior	Since 4th or 5th grade wanted to be a doctor	Magnet School/ AP Classes	Biology, Environmental Science, - Pre-med Declared	4	Bio Lab, Chem 141, Chem 142, Environmental Science 385
Brittney	B	F	Senior	Middle School	AP Classes, **GLUE**	Environmental Science - Pre-Vet Declared	8	Bio 141, Bio 142, Chem 141, Chem 142, Life Sciences Calculus (x2), Biology Elective (x2)
Tim	W	M	Junior	High School - not particularly passionate	AP Classes	Not Sure (Pre-Med) - Never Declared	1	Bio 141
Lena	B	F	Senior	Early on - Elementary School	AP/Honors Classes	Biology - Declared	4	Chem 141 (x2), Bio 141, Multivariable Calculus, Life
Todd	W	M	Junior	High School/Dad's Death - AP Psych	AP/Honors Classes	NBB - Never Declared	3	Freshman Orgo I, Freshman Orgo II, Bio Lab,
Eric	B	M	Junior	Early Childhood	Magnet Program/ AP/Honors Classes/ HUES	Environmental Science - Pre-Med Declared	3	Bio 141, Bio 142, Calculus,