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Racing to Math: Racial Identity, Math Anxiety, and Achievement Motivation amongst College Students

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Racing to Math: Racial Identity, Math Anxiety, and Achievement Motivation
Amongst College Students

Senior Project Submitted to
the Division of Science, Mathematics, and Computing
of Bard College

by

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May 2023

*Dedicated to Melissa, Michael, Nathaniel, Natalia,
Janelle, Julian, Jordan, and Arya*

Because your lives matter.

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Abstract

A person's racial identity can inform their choices in life as well as their perceptions. Existing literature typically investigates how racial identity is involved in the development of one's overall self-growth throughout their childhood and adolescence and how it influences their adulthood. The aim of this present study was to see if racial identity is associated with the feelings college students hold towards math, specifically math anxiety, as well as achievement motivation. The study also explored the relationship between math anxiety and achievement motivation. The sample was made up of college students in their first year, ages 18-19 ($N = 18$, $M = 18.5$, $SD = .6$) from Bard College located in Annandale-on-Hudson, NY. Participants responded to three questionnaires: the cross ethnic-racial identity scale-adult, abbreviated math anxiety scale, and the revised achievement motivation scale. The findings illustrated that racial identity did not influence the relationship between math anxiety and achievement motivation. In addition, the findings also showed that there was no statistically significant relationship between math anxiety and racial identity, racial identity and achievement motivation, and math anxiety and achievement motivation. Descriptive statistics illuminated variations of beliefs of racial identity, math anxiety, and achievement motivation based on race.

Keywords: racial identity, math anxiety, achievement motivation

Racing to Math: Racial identity, Math Anxiety, and Achievement Motivation Amongst
College Students

Introduction

Intersections between race and identity have been politicized as individuals not only are thinking about who they are, but how history has played a role in shaping who they become. Identity is not the same for everyone. Identity is like a compass. It directs our choice of environment, friendships, and even our creation of boundaries (Durkee & Williams, 2015). What happens around us influences how we think about ourselves and how we behave in other environments. Racial identity also serves as a compass (Maiya et al., 2021). It has the ability to dictate the behaviors that an individual partakes in, stereotypes one faces, or even a person's well-being (Townsend & Belgrave, 2000; Thomas, Hoxha, & Hacker, 2013; Davis, Aronson, Salinas, 2006). Scholarship on racial identity not only takes into account historical experiences that have been associated with a specific race, but also the modern-day translations of racism. These translations can seep into culture and uphold unjust systemic structures used to disenfranchise targeted groups.

The study will examine beliefs about racial identity, math anxiety, and achievement motivation through the usage of three measures: the cross ethnic-racial identity scale, the abbreviated math anxiety scale, and the achievement motivation scale-revised. This study works with the intent to inform social research on the way that one's racial identity influences their feelings about math and achievement motivation, constructs that, when applied, assist in navigating the world around us (Alliman-Brissett & Turner, 2010). Math anxiety is not a common topic to be linked to racial identity. The linkages are complex and they can be traced

back to the history of eugenics, intelligence, and ability that were highly Eurocentric and not applicable to everyone. Thus, this study can be seen as innovative.

The overall goal of this study is to understand the influence of racial identity and if it can be used to increase agency over decision-making in marginalized individuals (Krueger et al., 2022; Cotter et al., 2015). Though it is thought that all persons are free, there are still structures that subtly work to mentally imprison marginalized groups. Therefore, this study looks to also inform the conversation of decision-making, so that, hopefully, if an individual understands what has happened to them, they can then have full autonomy of how they choose to go about their lives.

My literature review will first discuss how racial identity is developed throughout a person's life. This is done as a means to understand how one's sense of racial identity is informed and what may cause differentiations in racial identity between persons. This topic will then be followed by a discussion of math, its importance, and the role it has played throughout history amongst individuals. After the discussion of math comes the topic of math anxiety as a way to explain the results of math being used as an indicator of success and its impact over different individuals. The next section will then discuss achievement motivation and variations of achievement motivation between persons based on race and gender. The last section will discuss the transition of adolescence to adulthood (Jones et al., 2014) as a way of explaining the reasoning behind the composition of participants of the study.

Racial Identity

When discussing the topic of identity, it should be understood that identity is composed of multiple subfields, one being racial identity. Racial identity refers to the way one perceives

themselves through the lens of their race (Broman, 2015). Therefore, in this study, I will be examining racial identity as a means to understand its influence on other areas of life.

Racial identity is often viewed through the lens of racial discrimination. This is a common occurrence as stereotypes towards a particular racial group can impact the way in which a person that is a part of that group views themselves. Such a discussion also raises the concept of racial identity contestation. Racial identity contestation explains the scenario of when a person who belongs to a specific racial group is not seen as being a part of the group either by themselves or others (Vargas & Kingsbury, 2016). Though this is a possibility, it is also true that many individuals also view their identities in the way that people of their race are viewed.

Importance of Intersectionality

Racial identity and its relevance to its influence on math anxiety and achievement motivation is important to highlight when it comes to the conversation of creating an equal playing field for all individuals. Individuals that fall in the intersections of constructs such as race and gender oftentimes experience the extremes of both. The treatment as a result of these extremes lead to long-lasting consequences that can impact the way that they view subjects such as math or the motivation to achieve.

Janie Victoria Ward (2018) gives an example of individuals who fall into these intersections— specifically black girls and women. Ward argues that black women who practice the resistance strategy of refusing to be victimized or victim-blamed in turn develop a critical perspective towards the world. This argument essentially highlights that the mindset of an individual dictates their awareness of self and what they can achieve in the world. However, Ward shares that many “resistance strategies adopted by African Americans are [not] liberatory”

(Ward, 2018). One non-liberatory resistance strategy that is commonly practiced by black mothers is giving young, black girls a “negative critique” of the world in hopes that it bars them from the harsh treatment of society. Though, this strategy, rather than preparing black girls, limits their confidence and sense of capability. Additionally, this strategy creates invisibility that manifests into black girls misbehaving in academic settings as a way to be seen and cope with feeling less than (Ward, 2018).

Ward communicates that, instead, there should be an increase in “resistance-building truth-telling strategies” as they invoke critical affirmations in black girls (Ward, 2018). In doing so, black girls would be equipped to combat the idea that they are not worthy of the best that is typically affirmed by lack of resources and access to success-centered facilities. Black girls, as well as all black people, would be able to understand their own experiences in the world, understand how world events apply to them, and then dictate how it impacts their next steps. Furthermore, such an understanding would work to foster consciousness of one’s agency.

Racial Identity Development

Umaña-Taylor et. al Adaptation Framework

World renowned Swiss psychologist, Jean Piaget (1976), coined the Stages of Cognitive Development theory that communicates four different stages of cognitive development: sensorimotor, preoperational, concrete operational, and formal operational. Each stage takes place over a range of years and corresponds with a specific type of cognitive progress such as the development of thought classifications or quantity. Piaget also discusses the ideas of assimilation and accommodation within the theory. The theory suggests that one develops their identity through assimilation and accommodation, meaning that as one encounters different situations

their identity looks at its composition and determines if something is similar or different. Thus, if something is similar, then one's cognitive schema assimilates the information. If different, then one's cognitive schema expands to accommodate this new information. In order to understand the development of racial identity, researchers Umaña-Taylor and colleagues (2014) adapted Piaget's theory.

Umaña-Taylor and colleagues (2014) have conceptualized how racial identity develops through the four different stages communicated by Piaget. They also share various informational sources throughout the stages that influence what information is gathered. They state that during childhood, racial identity begins to take shape through cognition that is informed by family members and others who are immediately around a child. They also communicate that children's racial identity is informed by Piaget's theory of assimilation and accommodation. Thus, if similar, then, in the current discussion, the child will *assimilate* the new aspect into their identity. If different, then one's identity will change, *accommodating* the new piece of information. By the middle of childhood, a person is then also being informed by their peers and media. Such is expected as this is when a child begins going to school and getting into televised entertainment. In regards to adolescence, a person is now adding on the informed perspective of puberty and worldly demands (Umaña-Taylor et al., 2014).

Adolescents begin not only having thoughts spurred by puberty, but the desire to be socially accepted increases, then advising how their racial identity is further constructed. As they reach young adulthood, these thoughts take on a deeper form, helping to establish a more firm sense of racial identity. These thoughts paired with the freedom associated with adulthood causes even more change in an individual's perception of their racial identity. Moreover, Umaña-Taylor

and their colleagues argue that because individuals are interacting with numerous sources of information, social environmental context is crucial when trying to understand the development of a person's ethnic/racial identity (Umaña-Taylor et al., 2014).

Other Racial Identity Development Frameworks

Umaña-Taylor and their colleagues are not the only researchers who communicate a framework for understanding racial identity development. Brittian (2012) communicates a relational developmental systems framework for African American youth that goes beyond the typical idea that identity is formed through adaptation. It instead suggests that the idea of race causes a person of color to constantly think about their identity in respect to their circumstance. Therefore, when it comes to conceptualizing identity development in African Americans, there must be a consideration of the risks that they encounter as a result of their race.

Another framework that is conveyed in research with the purpose of understanding racial identity development is the measurement of context. One important contextual factor is the measuring of the importance of recognition. Neville, Viard, and Turner (2015) adapted the work of the Francophone Afro-Caribbean psychiatrist, Frantz Fanon, to study the impacts of how recognition from others influences self-identified Black adults from four different countries. They found that the way in which Black individuals were recognized, played a key role in their personal sense of Blackness. Further, another contextual factor that also proves essential to ethnic identity development is the environment in which they grow up in. Researchers found that urban areas have a negative impact on African American youth; however, these effects can be regulated through the practice of racial socialization (Bennett, 2006).

Thus, various frameworks have been developed and implemented with the intention of measuring racial/ethnic identity development. Such diversity of measures helps to emphasize the complexity of racial identity and one's ability to measure it accurately. There is no perfect measure as no two persons are exactly the same. Therefore, it is important to keep in mind the fluid nature of identity and how it develops from person to person.

Math

Along with racial identity, this study will also be looking at math. Math or mathematics is the study of abstractions of numbers, space, and change (Ziegler & Loos, 2017). Math is important as it translates to multiple aspects of the world around us. Math is not only found in classrooms, but in the way we do our taxes, saving money, and even in the composition of our computers. Hence, math is unavoidable in today's society.

Importance of Math

There is a common thread amongst the mass media that speaks to the benefits of math. We live in a world where math surrounds us ubiquitously. When we think about math, it is commonly understood that it is an essential part of receiving a holistic education (Harackiewicz et al., 2012). Such an idea is affirmed by the composition of standardized tests like the SATs or ACTs. We even see this composition in the requirements of secondary education as a math-related class is mandatory for the graduation of college students. Therefore, with such importance, it begs us to question: why is math important? Yes, it helps us when calculating how much money to put aside from a paycheck to pay a bill, but what life skills arise when we prioritize the study of math?

From infancy we all have an understanding of quantity, which contributes to our overall number sense, the ability of understanding and working with large numbers (Wang & Feigenson, 2019). Understanding large quantities, as well as the difference between whole numbers and fractions, has been found to be essential in applied problem solving (Ernest et al., 2016). It is also important to note that math also encourages the practice of asking questions. Such a practice is crucial in a world filled with various nations and cultures. With difference amongst people comes misunderstandings, which may lead to problems. Therefore, it is necessary to know what questions must be asked and answered as a way to contribute to the progression of society. Taking it one step further, on a more personal level, knowing what questions to ask helps us to self assess and become aware of what is needed to become the best version of ourselves. Though this is so, it must also be said that much of the importance of math is defined by society, meaning that it is not something that comes natural to us, but rather taught.

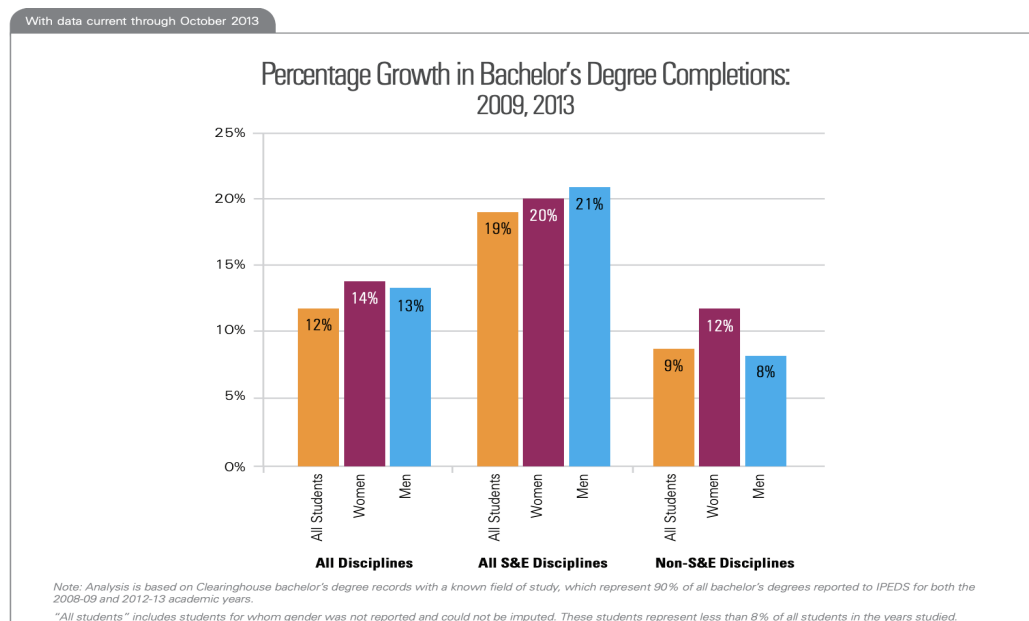


Figure 1.1. A comparison between genders and bachelor's degrees in the field of science and engineering and non-science and engineering degrees from throughout the years of 2009 to 2013 (Tizon, 2013).

With this knowledge it is not surprising that schools are motivated when it comes to STEM. It has more prestige than the humanities. This is evident in increases seen in bachelor degrees earned in the realm of science and engineering (See Figure 1.1; Tizon, 2013). In Figure 1.2, we also see this trend in the difference of pay between those who pursue careers in STEM versus those who pursue careers in non-STEM fields (Jaschik, 2016). Despite all individuals receiving a doctoral degree, a degree with high regard, those in STEM-related fields still made a significantly higher amount of money compared to those in fields within the humanities. Moreover, such a pay gap highlights the importance that is directed towards STEM, meaning that there is an automatic disadvantage if a person is not interested in pursuing a career in the field.

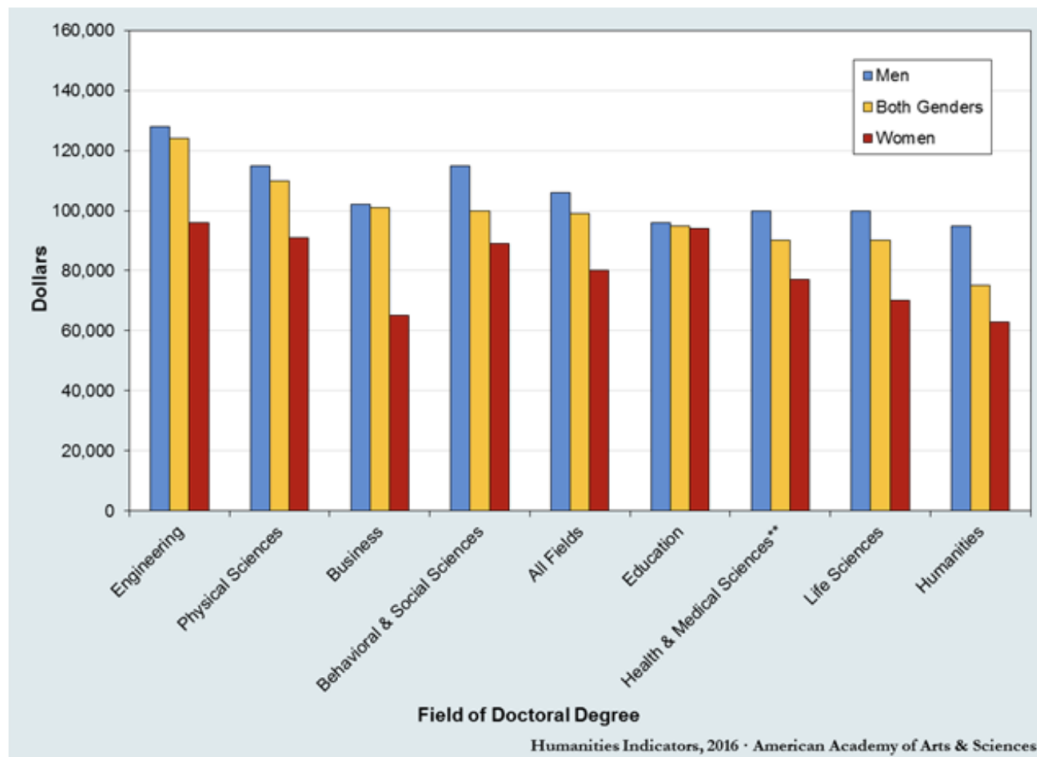


Figure 1.2. Median annual earnings of PhDs by field and gender from the year 2016 (Jaschik 2016).

Disparities in Math

Eugenic Principles and Education

A trope often observed throughout history is that the things that are regarded as important are oftentimes mistreated and then misused for the benefits of certain groups. With math being important, it was misused throughout history, turning from a study in education to a weapon to keep people within certain classes of society (O'Neil, 2016). Eugenics is a theory that helped to push this narrative. Eugenics is a pseudoscientific theory that arose in the early 1900s that emphasized that achievement was based on heredity (Turda, 2022). With this in mind, scientists looked at aspects and people of society who were not *up to societal par* and created initiatives and paths that would hinder the abundance of them. Psychologist, Robert Guthrie (2006), communicates that eugenics did not speak to any deficits in an individual's intelligence, but were rather means to genetically control those who were deemed as "feeble-minded" or socially "undesirable". As seen in history, and in today's society, black people and people not of the white race were seen as inferior and the cause of bad facets of society. Therefore, they automatically were targeted as people who were not intelligent, or genetically superior, and thus, as people who should not reproduce. This led to a series of discriminatory practices against them (Turda, 2022).

The principles of Eugenics did not only hold space in genetic engineering and conversations of social class, but it also entered into the classroom. Leta Stetter Hollingworth, an American psychologist and feminist, was an individual who played a big role in introducing eugenics in education, through the creation of gifted programs (Klein, 2000). Hollingworth sought to educate kids who were deemed *biologically superior* (Selden, 2000). Though, Hollingworth did not deem biological superiority through scientific means, but rather through the

occupation of a child's parent. She then went on to base it on racial ethnicity, deeming settlers as more intellectually superior than migrants (Selden, 2000). Gifted programming was, and in most recent years, administered and encouraged amongst white children by white adults. Gifted programs, historically and contemporarily, use math as a quantitative way to measure one's academic success. Therefore, many individuals were excluded from educational opportunities and considered unintelligent due to pseudoscientific ideologies.

In addition to gifted programs, eugenics also encouraged the development of Intelligence Quotient (IQ) tests. IQ tests have historically and contemporarily been used as a method of entrance into gifted programs (Gossett, 2022). IQ tests have aimed to measure intelligence amongst individuals; however, they have been considered to be controversial (Kovacs & Conway, 2019). Historically, IQ tests found that people of color, and those at the lower end of the social ladder, have had lower IQ scores, which helped affirm the agenda of the Eugenics movement (Turiel, 2020). However, the same outcomes are what are criticized to be the reason that IQ tests are ineffective. It can be expected that IQ tests will result in low IQ scores for people who have grown up in environments that have not afforded them the opportunity to invest in education. It is unfair to state that those who have more exposure to educational opportunities and then score higher on IQ tests should be regarded as smarter or more intellectual. Instead it is argued that IQ tests, if wanting to continue their usage, must come in variations that incorporate the effects of marginalization and inequality amongst disadvantaged groups (Kovacs & Conway, 2019). However, even though there is an argument to make IQ tests more equitable, there is also the argument that they will never be more equitable as they have historically been used as a way to disenfranchise individuals (Gillborn, 2016). Therefore, the argument should not be about the

content of IQ tests, but rather the usage of them. Even if modified to include aspects that highlight a more holistic understanding of intelligence, it can still be used in a manner that can disadvantage targeted groups.

It is important to highlight such an argument because it points to how eugenics is still present in today's society, but rather in a hidden form. Oftentimes throughout history, the discussion of eugenics has been explicit with scientists and public officials openly speaking about biological inferiority; however, discussion of eugenics has been more subtle. David Gillborn (2016) shares that officials hide eugenic-based agendas by sharing comments about the statistics generated from IQ tests and how it is necessary to let those who perform better rise to the top. Gillborn also shares the comments of Michael Portillo, a former conservative member of the British parliament, who states that he has no problem "in using genetics for responsible purposes". Individuals recognize that if they are able to *color* their wording or utilize biased tools to push their agenda, then they will not be questioned, affording them the ability to continue applying eugenics theory. Furthermore, this agenda is also pushed through the continual underfunding of public schools, schools that are primarily composed of children of color and children from lower socioeconomic communities (Gossett, 2022).

Race and Math

Being that eugenics was used to endorse racism, it becomes understandable that the institution of mathematical education was instrumentalized to keep marginalized groups outside of the realm of success. We are able to see this exclusionary behavior in rates of educational success and financial elevation (Asai, 2020). Access to the education of math has been limited on both the basis of race and gender. Amongst African American youth, boys held more positive

views about their capabilities in math and science than girls (McClendon & Wigfield, 1998). However, African American girls who did not achieve highly, compared to boys who performed similarly, thought that they put in more effort than the boys. Whereas, the same attitude was carried by boys who achieved highly when they compared themselves to girls.

Black people have had less opportunities to excel in math and this is evident in the lack of people of color and women who have earned doctoral degrees in the STEM (science, technology, engineering, and technology) disciplines (Lee et al., 2020). Moreover, this finding is not a result of differences in intelligence. It is instead a result of agendas pushed through educational institutions that are meant to purposely keep certain individuals away from math, as well as science, technology, and engineering (Lee et al., 2020). People of color's lack of access to STEM-based education has created the narrative that they have a lack of intelligence—or better said, it affirms the pseudo scientific narrative that people of color are biologically unintelligent. This flawed way of thinking must first be struck with the fact that race is a construct, and no scientific testing has successfully concluded biological differences that allude to intelligence (Smedley, 1993).

Both Black and Hispanic kindergarteners showed low advancement in mathematics and science when compared to their white counterparts; however, a factor that played a role in this finding was socioeconomic status (Morgan et al., 2023). Large populations of students of color can be found in low socioeconomic communities and it does not help that the school facilities are typically under-resourced and have underqualified teachers (Darling-Hammond & Sykes, 2003). Thus, math is being weaponized, creating disparities between different races, especially people

of color. Therefore, intelligence cannot be tied to race, but rather exposure, upbringing, and access to academic opportunities.

Gender and Math

Along with racial disparities present in the realm of math, we also see gender disparities. When fourth graders were examined, both boys and girls showed similar levels of liking, confidence, and value in mathematics (Ghasemi & Burley, 2019). However, this is not necessarily the case when individuals grow older. Nosek and colleagues (2002) found that men had more negative implicit attitudes regarding math for women in STEM, while women had similar attitudes about themselves when compared to attitudes about the arts and humanities. This finding showcases the ingrained standards that are adapted from history and society. Therefore, even if it is not an institution that is working to uphold discrimination and bias, there is the reliability of biased standards to keep people, particularly women from entering STEM based spaces. In a study looking at high schoolers and math achievement, Wang and colleagues (2015) found that males were more likely to have higher scores on math examinations compared to their female classmates. Thus, taking into consideration the strong impact of biased standards on an individual's motivations towards math, it is beneficial to explore the other factors that may work to affirm said standards.

Social Class and Math

Alongside race and gender, we also observe the impacts of social class on disparities within math. Social class typically dictates where and what a person can afford to live, as well as the lifestyle that they choose to carry out (Manstead, 2018). Social class can also play a role in where one receives education and the quality of that education. Factors such as school zoning

and transportation can mean that a student is automatically limited on where they can attend school (Castro et al., 2022). Oftentimes, schools in lower socioeconomic communities lack the most up to date resources necessary for a child to excel academically. Therefore, if a child does not have transportation and has lack of access to a good education, then they can be put at a disadvantage. Though there may be some programs offered to students that encourage seeking out a better future, their surrounding environment can have a stronger pull on students (Ferguson et al., 2013). This can cause them to shift their focus from what may seem academically important, to what may seem important for survival. Hence, what happens when you have a student whose physical and mental needs exceed their educational needs?

Beverly Daniel Tatum (2017) answers this question in her book, *Why Are Black Kids Sitting Together in The Cafeteria?*, through the communication of the upholding of segregation-based principles despite the overturning of segregation policies. Tatum communicates that people of color are typically forced to live in hypersegregated and low socioeconomic communities, which puts them at risk of delinquency and poor educational advancements. She also emphasizes how the majority of classrooms are filled with low income students of all races who come from different backgrounds who are under the instruction of White teachers who cannot relate or understand their circumstances. Therefore, not only are low socioeconomic students at risk of not having qualified teachers, but they are also faced with teachers who cannot fully sympathize with their personal needs. Such a conclusion is devastating because personal needs, especially those crafted by hardship, can impact the way in which a student can be best taught.

Lack of access to adequate educational facilities, as well as teachers, does not only impact educational advancements, but it also can influence work-related choices. Therefore, knowing that children in low socioeconomic communities are less likely to pursue STEM-related fields, it is crucial to also look at what their future social capital may look like. Children who grow up in low socioeconomic communities are less likely to seek out STEM related fields (Rozek et al., 2019). A part of this is due to stress and anxiety felt when having to take assessments that are STEM-related. Studies found that students from low-income families, specifically Black and Hispanic children, were put into classes marked for lower performance (DeCuir-Gunby, 2007). Moreover, they have also found that they were more likely to do poorly in the subject of mathematics when compared to white students.

Self-Esteem and Math

Along with the acquisition of problem-solving skills, being versed in mathematics works to build self-esteem in oneself. The relationship between math and self-esteem can go multiple ways. One way being that those who have more self-confidence are more likely to have higher levels of math achievement (Çiftçi & Yildiz, 2019). Another way that the relationship between math and self-esteem can unfold is that those who have higher math achievement are more likely to have higher self esteem (Cvencek et al., 2020). A part of this is a result of the assurance gained through finding the correct answer to a problem. Thus, math interventions can be used as a way to increase self-esteem within an individual, more specifically during childhood (Cvencek et al., 2020).

Self-esteem development can also be contingent on physical classroom environments and the expectation of student participation. Benefits can be noted in regards to in-person

teaching and its influence on math self-concept. The simplest moment when a student shouts out the right answer has the ability to increase a student's self-esteem (Nabila & Widjajanti, 2020). This is affirmed by findings that students who were online learners found it more difficult to grasp ideas and concepts (Bringula et al., 2021). They instead preferred to be in-person with their peers as it felt more gratifying. In addition to educational environments, teaching techniques are also beneficial to increasing a student's self-esteem in regards to math. Contextual teaching and learning approaches allow students to relate mathematics back to everyday life and can help to boost their self-esteem (Nabila & Widjajanti, 2020). This is because students recognize that problem-solving skills are not just applied to their current mathematical equation, but also in regards to problems they may encounter outside of the classroom.

Moreover, society's high values are frequently reflected in what we value as people. Hence, it is not surprising that success in math can have an influence over how we feel about ourselves. It is common to observe rejoicing in students who get high scores on the math portion of their standardized tests as it can mean acceptance into an Ivy League institution or access to high paying jobs. Therefore, if math and being good at math are what society attributes to being intelligent, then it becomes understandable that it could elevate one's self-esteem.

Math Anxiety

With understanding the significance of math and its prevalence in today's society, it is essential to also understand how math's deemed importance can generate feelings towards the subject. One common feeling experienced towards math is math anxiety. Math anxiety refers to feelings of fear or anxiousness when faced with math related matters (Sokolowski & Ansari, 2017). Thoughts about the origin of math anxiety often vary. Researchers suggest that it could be

a cause of a particular teacher, teaching strategies, or internalized expectations from a teacher by the student (Turner et al., 2002). Moreover, whatever the cause, math anxiety, when experienced, has an ability to affect one's math performance.

In the generation of negative feelings, math anxiety can influence a person's mental state, interfering with how they perform when facing math (Commodari & La Rosa, 2021). One idea that is believed to be caused by math anxiety is a process taking place within working memory (Ashcraft & Kirk, 2001). Some argue that math anxiety leads to a decrease in the amount of one's working memory capacity (Ashcraft & Kirk, 2001). Such limited working memory capacity could cause for there to be less space for the components of the math task at hand. In addition to interference of working memory, it is also important to recognize that math anxiety's influence on math performance may vary based on the type of math a person is working on. Researchers have found that when in an instance of learning math, math anxiety is associated with written calculations (Commodari & La Rosa, 2021). They have also observed that when faced with math exams, math anxiety is typically reported, as it is thought to be an effect of time pressure, pacing, and response accuracy. Thus, it is important to note the different thresholds of math anxiety and how it may differentiate between individuals. This helps create the argument that principles that exist within the realm of math can be applied to the self—and most importantly how one views themselves.

Math Competency and Math Anxiety

Along with the discussion of math performance, in regards to math anxiety, competency should too be discussed. Math competency refers to a person's ability to comprehend, conceive, and apply mathematical concepts and principles (García Perales & Ruiz, 2021). It has been found

that those who had higher math competency experienced lower math anxiety amongst students with and without learning disabilities (Pollack et al., 2021). On the other hand, other studies have found that those with high math competency reported higher feelings of math anxiety and the opposite for those with low math competency (Weissgerber et al., 2022). They thought such results to be an outcome of high expectations of advancement within those who were highly competent. Though both findings contradict one another, such contradiction emphasizes the universality of math anxiety.

Gender and Math Anxiety

Having spoken about gender and math, we will now discuss the relationship between gender and math anxiety. Being that experiences in math have historically differed between individuals, it is essential to highlight variation between gender. Historically, the sciences and mathematics have been heavily gendered, with both subjects being garnered towards those who identify as men (Halpern et al., 2007). A previous study observed that elementary and middle school aged boys were better at math compared to girls who were found to be better at reading (Ehrmann & Wolter, 2018). In addition, they saw that girls who held beliefs of equality between men and women performed better in math than girls who thought otherwise. Therefore, with such knowledge in mind, it begs to question the depth of history's role in the relationship between gender and math anxiety.

When examining math anxiety on the basis of gender, we begin to see individual differences poke through again. When examined, high school girls showed higher levels of math anxiety compared to high school boys, which then correlated with poor math performance (Devine et al., 2012). When observing younger ages, levels of math anxiety between elementary

girls and boys were similar; however, when looking at math performance they too found that girls showed poorer math performance than boys (Van Mier, Schleepen, & Van den Berg, 2019). They believed that such findings could be a product of time pressure. It was also suggested that the findings were a result of those with high math anxiety choosing to avert math related matters. Furthermore, such differences should be highlighted to emphasize the complexity of math anxiety and how it varies from person to person.

Race and Math Anxiety

In this paper, I explore race and math anxiety. Although this is my aim, existing literature on the topic is in short supply. Thus, in the conversation of variation between individuals, it is also important to point out how math anxiety differs between racial groups. Keeping in mind historical disadvantages that have been pinned against people of color, it becomes understandable that differences in expressed math anxiety between races exist. Though there is a lack of research on how math anxiety varies on the basis of race, research has been found, more recently, that people of color who experience math anxiety are more likely to have poorer math performance (John Buck, 2019).

Achievement Motivation

Oftentimes in conducting research in math anxiety, researchers also observe achievement motivation, as higher levels of anxiety may cause lower achievement motivation when navigating academia (Pollack et al., 2021). Achievement motivation refers to an individual's motive to achieve goals and carry out the success of those goals (Steinwayr et al., 2019). In regards to this study, I am not only interested in the relationship between math anxiety and achievement motivation, but also racial identity and achievement motivation. This is exemplified

in my hypothesis that high levels of achievement motivation can be explained by moderate levels of racial identity. Such a thought is based on the finding which showed that African-American students, who had hope, exhibited high levels of the five psychosocial components that make up an “achievement-oriented psychosocial profile” (Dixson & Stevens, 2018). Furthermore, my hypothesis also draws support from another study that found that African-American youth who had lower levels of self-perception showed higher levels of negative stereotype endorsement when it came to academic achievement (Okeke et al., 2009).

Based on the history of disparities in math based on race, as well as feelings of math anxiety, it is critical that we understand how they can influence an individual’s motivation to achieve. Achievement motivation is seen as a concept that can be broken down into smaller subjects that act as areas that a person may want to succeed in, such as identity development. Therefore, signifying that achievement motivation can be exhibited in various situations. Researchers have found that those who exhibit higher levels of achievement motivation are more likely to show higher levels of academic achievement (Sarangi, 2015). Along these same lines, research suggests that it is beneficial for teachers to incorporate aspects of achievement motivation as it leads to educational successes (Awan, Noureen, & Naz, 2011). Thus, it is evident that achievement motivation can be a key factor in the attainment of success.

Adolescence to Adulthood

It is recognized that the years that encompass adolescence are a time where humans are going through many changes both physically and emotionally. Yet, there are also many cognitive changes that are taking place during these years. The frontal and parietal cortices undergo synaptic reorganization in the process of brain maturation, which are thought to play a role in an

adolescent's understanding of social stimuli (Choudhury, Blakemore, & Chartman, 2006). As adolescents are growing and navigating the world, they are encountering various sources of information such as the home, school, work, and numerous platforms of social media. These sources work to inform their sense of self, especially in situations where there is the feeling of empowerment (Makhoul et al., 2012).

Though adolescence captures a time period of multifaceted growth and development amongst human beings, the transition from adolescence to adulthood represents a deeper sense of internal change. During this transitional period, individuals are faced with more consideration of their quality of life. Adolescents going into adulthood have an increase in seeking out social support and ways to cope with and solve problems (Leipold, Munz, & Michèle-Malkowsky, 2019). Researchers pose that this could be due to the expectation of independence and greater responsibility driven by societal norms and individual necessities. In addition, adolescents during this transition are likely to experience drops in life satisfaction due to stress typically associated with becoming an adult (Henkens, Kalmijn, & de Valk, 2022). However, recovery takes place once the individual becomes accustomed to their new acquisitions made during the transition.

Hypotheses

Based on theoretical and conceptual evidence, there are anticipated associations between racial identity, math anxiety, and achievement motivation. I hypothesize that high levels of math anxiety are associated with high scores on the racial identity measure. Such a prediction is premised on the notion that Black and Indigenous people of color (BIPOC) may carry the burden of feeling like they have to outperform their non-BIPOC peers in math (McGee et al., 2020). In addition, I hypothesize that low levels of math anxiety are associated with high levels of

achievement motivation. This is based on the finding that those with higher math anxiety were more likely to have poorer performance when being assessed for math (Commodari & Rosa, 2021). Therefore, such a finding may suggest that participants who experience higher levels of math anxiety may exhibit an attitude of defeat and having lower levels of achievement motivation. Lastly, I hypothesize that racial identity will mediate the relationship between math anxiety and achievement motivation. Furthermore, this thought is based on the historical nature of people of color not being given an adequate education, especially when pertaining to STEM-related professions (Lee et al., 2020).

Methodology

Participants

Participants were composed of first year college students who were ages 18-19 years old ($M = 18.5$, $SD = .6$). The study intended to have two sampling pools, one being Bard College located in Annandale-on-Hudson, New York and the other being Rutgers University- New Brunswick located in Piscataway, New Jersey. This was done because Bard College is considered a predominantly white institution (PWI) and Rutgers University-New Brunswick is considered to be a more racially-diverse institution. Therefore, the objective of having both sampling pools was to gauge how diversity influences an individual's beliefs. However, though this was the intention, and despite promotion of the study at Rutgers, no participants were gathered from Rutgers. Thus, only data from Bard college was collected and used for analysis.

The sample population size for Bard college was 18 participants (Bard, $N = 18$). Participants reported their ethnic identities as follows: Black/African-American ($n = 2$ [11%]; 100% cisgender female), Hispanic ($n = 1$ [6%]; 100% cisgender female), Asian ($n = 5$ [28%]; 60

% cisgender female, 20% transgender female, 20% cisgender male), and White ($n = 10$ [56%]; 50% cisgender female, 40% gender variant/non-conforming, 10% other). Socioeconomic status, regarding household income, was reported by participants as follows: 150,000 or greater ($n = 5$ [28%]), 100,000 to 149,999 ($n = 4$ [22%]), 75,000 to 99,999 ($n = 1$ [6%]), 50,000 to 74,999 ($n = 3$ [17%]), 25,000 to 49,999 ($n = 3$ [17%]), 1 to 9,999 ($n = 1$ [6%]), Prefer not to answer ($n = 1$ [6%]). Participants also reported the region of America that they grew up in, if they grew up in the United States of America, as follows: Northeast ($n = 12$ [67%]), Southeast ($n = 1$ [6%]), Southwest ($n = 1$ [6%]), and West ($n = 1$ [6%]). Three participants noted that they did not grow up in the United States of America, therefore, they did not respond to the region question. Lastly, participants also reported their majors.

Participants were given a demographic questionnaire as a way to gauge how aspects such as race and socioeconomic status serve as a differentiating factor between participants. Informed consent forms and debrief forms differed based on institution (See Appendix A, F, G, H, and I). Recruitment flyers for Bard College were distributed throughout Bard's campus, as well as through social media, and club listservs. Recruitment flyers for Rutgers were distributed by a first year general psychology professor at Rutgers, as well as a lab manager from a lab in the Psychology department. Thus, all participants received a debrief form online at the completion of the survey. Participants were also asked to give their email address so that they would be entered into a raffle where two participants would receive a \$50 Visa Vanilla gift card (See Appendix J).

Exclusion criteria for study participation included students that were not the age of 18 or 19, who were not first year students, and who did not attend Bard College or Rutgers University-New Brunswick. Participants were also excluded if they did not complete all three

scales of the survey. Abiding by the exclusion criteria, 6 participants were removed, bringing the sample size down from 18 to 12 (Bard, $N = 12$). Thus, only 12 participants were included in the analysis process.

Instruments

CERIS-A. The cross-ethnic racial identity scale-adult (CERIS-A) was created by Frank C. Worrell, Rodolfo Mendoza-Denton, and Amanda Wang in 2019 (Worrell, Mendoza-Denton, & Wang, 2019). It was constructed through the rewording of the questions on the Cross Racial Identity Scale.

The CERIS-A is a measure composed of 29 items that are broken up into 7 subscales—Anti-dominant, Assimilation, Ethnic-racial Salience, Ethnocentricity, Miseducation, Multiculturalist Inclusive, and Self-hatred. The scale works to measure 7 different attitudes in regards to racial/ethnic development. These attitudes are observed through the 7 subscales. Participants rate their responses on a Likert-scale of 1 (strongly disagree) to 7 (strongly agree). The CERIS-A measure was a modified scale derived from the Cross Racial and Identity Scale (CRIS) (Ponterotto & Taylor, 2007). The original scale instead had 6 subscales—Assimilation, Anti-White, Miseducation, Nationality, Multiculturalist, and Racial Self-Hatred, with 10 filler questions unlike the CERIS-A that has 1 filler question. The filler questions were used as a way to decrease bias. The CRIS measure was developed based on the nigrescence model. Thus, it primarily looked to explore the beliefs of African-Americans. Moreover, the questions on the CERIS-A are garnered to reflect the ethnic-racial experiences of each participant.

The CERIS-A has great internal consistency with the overall alpha coefficients ranging between .74 and .91 (Worrell, Mendoza-Denton, & Wang, 2019). It is important to note that the

scale was created before the debut of the Netflix bio series, “When They See Us”, that focused on the lives of five young boys that were falsely accused and imprisoned. Similarly, it also came out before the Black Lives Matters movement had gone into full force in 2020 after the horrific and wrongful murder of George Floyd by police. Therefore, the scale may not reflect feelings that were generated by events that have had a national impact.

AMAS. The abbreviated math anxiety scale (AMAS) was constructed by Derek Hopko and colleagues in 2003 based on the psychometric properties and generalizability of the previously generated abbreviated math anxiety (Hopko et al., 2003; Alexander & Matray, 1989). The AMAS is a 9-item measure that measures feelings of math anxiety. The measure was created using aspects of the Math Anxiety Rating Scale- Revised (MARS-R) (Brown & Sifuentes, 2016). The measure asks participants to rate their perceived sense of math anxiety when in specific situations on a Likert-scale of 1 (low math anxiety) to 5 (high math anxiety). The items are broken up into two subscales—Learning Math Anxiety (LMA) and Math Evaluation Anxiety (MEA). The AMAS had great internal consistency (AMAS $\alpha = .90$; LMA $\alpha = .85$; MEA $\alpha = .88$), test-retest reliability over a 2-week period (AMAS $\alpha = .85$; LMA $\alpha = .78$; MEA $\alpha = .83$), and strong convergent validity between the two subscales (LMA $\alpha = .88$; MEA $\alpha = .92$) (Hopko et al., 2003).

AMS-R. The revised achievement motives scale (AMS-R) was created in 2006 by Jonathan W. B. Lang and Stefan Fries (Lang & Fries, 2006). The scale was developed through the revision of the original Achievement Motives Scale using confirmatory factor analysis. The AMS-R is a 10-item scale that measures perceptions of success and failure amongst participants. Participants will respond on a Likert-scale of 1 (strongly disagree) to 4 (strongly agree). The

scale was derived from the achievement motivation scale that is composed of 30-items. The AMS-R Scale has good internal consistency (Cronbach's $\alpha = >.70$).

Procedures

Participants were recruited through flyers that were distributed physically throughout the campuses of both institutions (Bard and Rutgers). Flyers were also distributed through the social media platform of Instagram through my personal account. Interested participants were able to click on a link on my Instagram story that brought them directly to the Qualtrics survey. Bard College, being predominantly white, and Rutgers, being more diverse, were chosen as a way to observe how different environments contribute to individual differences in perceptions of racial identity. Participants were limited to being freshmen in college and the ages of 18 and 19 due to the intent to capture a time period where participants are leaving adolescence and transitioning into adulthood. Being that much development takes place over one's adolescent years, I was hoping to see any impact of racial identity on their perceptions of aspects of the world around them.

Participants upon consenting to participate in the study will be asked to fill out a 20-minute questionnaire. They will first be met with questions regarding their demographics (i.e., school, age, race/ethnicity, household income, etc.). They will then respond to the cross ethnic-racial identity scale (CERIS-A), where they will be asked questions about their beliefs about their race/ethnicity and how it pertains to their experiences throughout life (i.e., "we cannot truly be free as a people until our daily lives are guided by values and principles grounded in our ethnic/racial heritage"). The CERIS-A measure will be received first as a way of priming participants to respond to the other measures through the gaze of their racial identity. They will

then receive the abbreviated math anxiety scale (AMAS) and the achievement motivation scale-revised (AMS-R). However, the order in which they receive the AMAS and AMS-R scales will be randomized as a way of counterbalancing the effects of the order of measures affecting participants' responses. Upon completion, participants were prompted to give their email address, so that they could be entered into a raffle for a chance to win one of two \$50 Visa Vanilla gift cards.

Data Analysis

All participant responses were recorded through the Qualtrics online survey platform, which allowed participants to complete all aspects of the study entirely online. The scoring that was used for the CERIS-A measure was the one used by Worrell and colleagues (2019). Therefore, the 29 questions were broken up into 7 subscales, each holding four items, that were summed up based on the participants' response of 1-7 on each item, and then averaged. Question 1 was not scored. In addition, the scoring that was used for the AMAS measure was the process of summation of scores for each item. The summed result served as the final score (Carey et al., 2017). Final scores ranged from 9 to 45. The same scoring process was used for the participant responses of the AMS-R. The final scores ranged from 10 to 40.

Being that participants responded to three separate measures, I examined potential associations between the constructs of racial identity, math anxiety, and achievement motivation. Therefore, the data was analyzed using mediation analysis. The mediation analysis looked for whether racial identity served as a mediator between math anxiety and achievement motivation. There were also regression analyses carried out that looked at the relationship between racial

identity and math anxiety, the relationship between math anxiety and achievement motivation, as well as the relationship between racial identity and math anxiety.

Results

Mediation Analyses

After some reflection on the research questions and hypotheses, mediation analysis was thought to best answer and address the research question. Therefore, mediation analyses were not pre-registered. Thus, rather than using simple regression analyses as the primary method of analysis, as originally pre-registered, they instead were used as complementary analyses for the mediation analyses conducted.

Mediation analyses were conducted in Jamovi, using the “medmod” function, to analyze the effect of racial identity on the relationship between math anxiety and achievement motivation. Being that the CERIS-A scale is composed of subscales, seven mediation analyses were performed to examine whether racial identity served as a mediator for the relationship between math anxiety and achievement motivation.

CERIS-A (AM). The assimilation subscale measured feelings about assimilation into a racial/ethnic group (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the assimilation subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not statistically significant ($N = 12$; *indirect* = .02, $SE = .04$, $z = .57$, $p = .57$; *direct* = -.01, $SE = .11$, $z = -.08$, $p = .94$). Thus, assimilation, in regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (MD). The miseducation subscale measures feelings about relevance of stereotypes pertaining to one's own racial/ethnic group (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the miseducation subscale was the mediator, and achievement motivation was the dependent variable, the indirect and direct effect were not statistically significant ($N = 12$; $indirect = .03$, $SE = .06$, $z = .61$, $p = .54$, $direct = -0.02$, $SE = .10$, $z = -.21$, $p = .84$). Therefore, miseducation, in regards to racial identity, did not serve as the mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (SH). The self-hatred subscale measures feelings of self-hatred towards one's racial/ethnic group (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the self-hatred subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not statistically significant ($N = 12$; $indirect = .01$, $SE = .04$, $z = .22$, $p = .82$; $direct = .01$, $SE = .12$, $z = .05$, $p = .96$). Therefore, self-hatred, in regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (AD). The anti-dominant subscale measures feelings that are against the *dominant* racial/ethnic group (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the anti-dominant subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not statistically significant ($N = 12$; $indirect = -.02$, $SE = .04$, $z = -.48$, $p = .63$; $direct = .03$, $SE = .11$, $z = .29$, $p = .77$). Thus, feelings of anti-dominance, in regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (ET). The ethnocentricity subscale measures feelings that orient the idea that one's racial/ethnic group is better than other groups (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the ethnocentricity subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not statistically significant ($N = 12$; *indirect* = $-.02$, $SE = .04$, $z = -.48$, $p = .63$; *direct* = $.03$, $SE = .11$, $z = .29$, $p = .77$). Therefore, feelings of ethnocentricity, in regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (MI). The multiculturalist inclusive subscale measures feelings of open-mindedness about the inclusivity of racial/ethnic groups (Worrell, Mendoza-Denton, & Wang, 2019). In the case that math anxiety was the predictor, the multiculturalist inclusive subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not significant ($N = 12$; *indirect* = $-3.84e-4$, $SE = .07$, $z = -.01$, $p = 1.0$; *direct* = $.01$, $SE = 0.13$, $z = .10$, $p = .92$). Therefore, multiculturalist inclusive feelings, in regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

CERIS-A (ERS). The ethnic-racial salience subscale measures feelings of importance and relevance of race/ethnicity in a situation (Worrell, Mendoza-Denton, & Wang, 2019; Douglass, Wang, & Yip, 2016). In the case that math anxiety was the predictor, the ethnic-racial salience subscale was the mediator, and achievement motivation was the dependent variable, both the indirect and direct effects were not significant ($N = 12$; *indirect* = $.02$, $SE = .06$, $z = .36$, $p = .72$; *direct* = $-.01$, $SE = .12$, $z = -.07$, $p = .95$). Therefore, feelings of ethnic-racial salience, in

regards to racial identity, did not serve as a mediator in the relationship between math anxiety and achievement motivation.

Simple Regression Analyses

In the understanding of mediation analysis, Baron and Kenny (1986) share that for there to be a significant mediation between at least three variables, there has to be significant associations between the variables. Therefore, the following relationships in this study would have to be significant: racial identity and achievement motivation, racial identity and math anxiety, and math anxiety and achievement motivation. If these relationships do not deem statistically significant, then it is more than likely that the mediation between the three variables is not significant. Thus, three simple regression analyses were conducted between the seven subscales of the CERIS-A, the AMAS, and the AMS-R to understand why the mediation analyses were not significant (See Table 1.1).

In Table 1.1 in section A, when the CERIS-A subscale scores were associated with achievement motivation score, all associations were deemed not statistically significant. In section B, when the CERIS-A subscale scores were associated with AMAS scores, all associations were also deemed not statistically significant. Lastly, the same findings were found for the association between AMAS scores and AMS-R scores. Thus, based on the rationale offered by Baron and Kenny, it makes sense that the majority of the mediation analyses conducted were not statistically significant.

Linear Regression Analyses

A.					
Model Fit Measures					
Model	R	R ²			
1	0.775	0.601			

Model Coefficients - AMS-R_Score					
Predictor	Estimate	SE	t	p	
Intercept	42.740	10.781	3.964	0.011	
CERIS_AM	-0.796	0.878	-0.907	0.406	
CERIS_MD	-1.733	1.994	-0.869	0.424	
CERIS_SH	2.684	1.396	1.922	0.113	
CERIS_AD	-1.609	1.835	-0.877	0.421	
CERIS_ET	NaN	NaN	NaN	NaN	
CERIS_MI	0.362	1.446	0.251	0.812	
CERIS_ERS	-1.326	1.871	-0.709	0.510	

Note. Linear model contains aliased coefficients (singular fit)

B.					
Model Fit Measures					
Model	R	R ²			
1	0.741	0.549			

Model Coefficients - AMAS_Score					
Predictor	Estimate	SE	t	p	
Intercept	5.5541	29.75	0.18671	0.859	
CERIS_AM	-1.7479	2.42	-0.72168	0.503	
CERIS_MD	-3.7986	5.50	-0.69045	0.521	
CERIS_SH	2.6520	3.85	0.68849	0.522	
CERIS_AD	0.9691	5.06	0.19143	0.856	
CERIS_ET	NaN	NaN	NaN	NaN	
CERIS_MI	4.8394	3.99	1.21322	0.279	
CERIS_ERS	-0.0231	5.16	-0.00448	0.997	

Note. Linear model contains aliased coefficients (singular fit)

C.					
Model Fit Measures					
Model	R	R ²			
1	0.0481	0.00231			

>

Model Coefficients - AMAS_Score					
Predictor	Estimate	SE	t	p	
Intercept	21.976	29.311	0.750	0.471	
AMS-R_Score	0.125	0.819	0.152	0.882	

Table 1.1. Linear regression analyses conducted between the CERIS-A subscale scores and the AMS-R scores, between the CERIS-A subscale scores and the AMAS scores, and between the AMAS scores and the AMS-R scores ($N = 12$). * $p < .05$

Pertinent Descriptive Statistics

Math Anxiety Scores By Race

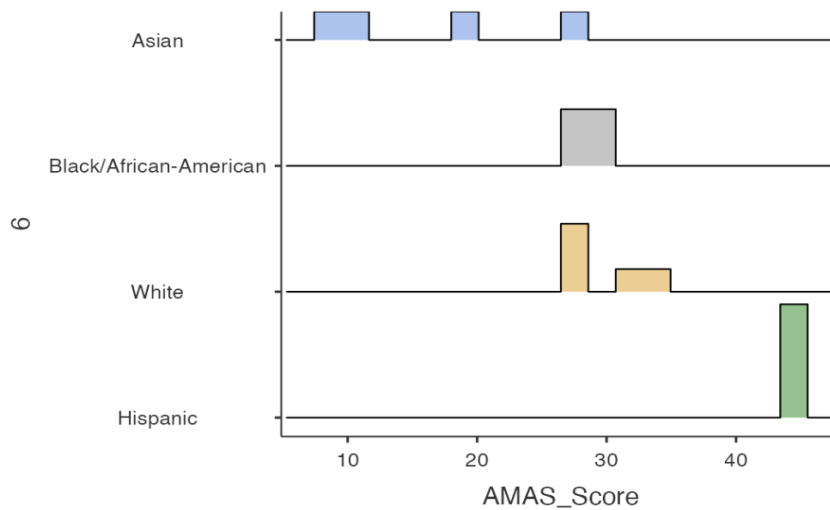


Figure 1.3. Math anxiety scores, across participants, by race ($N = 12$).

Figure 1.3 displays the scores of individual participants by race on the AMAS measure. As seen in the figure, the Hispanic participant rated the highest on the measure, while Black/African-American and White participants scored in the middle range. Asian participants, though distributed throughout the possible response scores, scored the lowest on the scale in comparison to other participants.

Ethno-Racial Salience Subscale Scores By Race

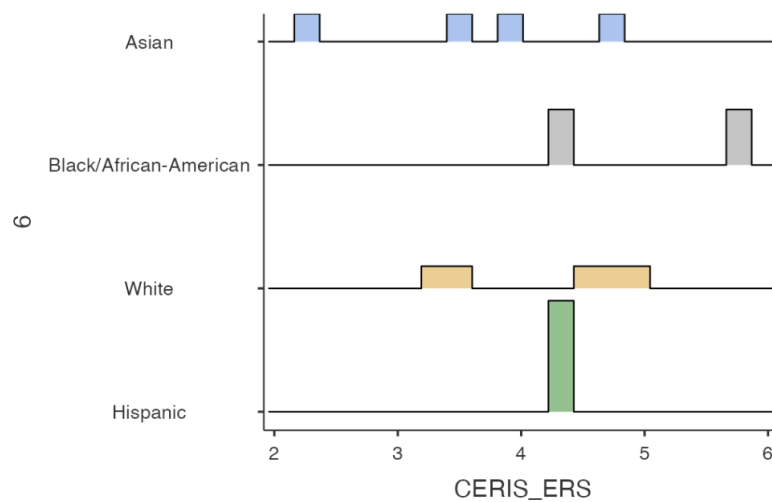


Figure 1.4. Ethno-racial salience subscale scores from the CERIS-A measure, across participants, by race ($N=12$).

Figure 1.4 shows the scores on the ethno-racial salience subscale of the CERIS-A measure. Black/African American participants scored the highest on the scale, while White and Hispanic participants scored around the middle range of the scale, with scores closer to the upper range. Lastly, Asian participants, though distributed throughout the possible response scores, scored the lowest on the scale.

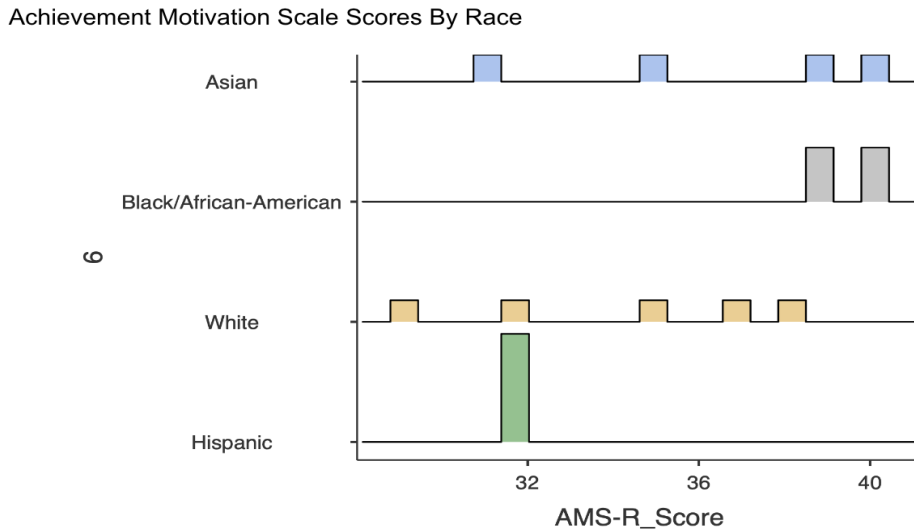


Figure 1.5. Achievement motivation scale- revised scores, across participants, by race ($N = 12$).

Figure 1.5 shows the scores on the achievement motivation measure based on the race of the participants. Black/African-American participants scored on the far upper range of the scale. Asian participants also scored on the far upper range of the scale; however, their responses were distributed within a 10-point radius of the other participants. White participants' scores were also distributed throughout the scale within a 10-point radius of the scores of the Asian and Black/African-American participants, but they scored the lowest on the measure. The Hispanic participant scored the second lowest on the scale, although they scored within a 10-point range of the other participants.

Math Anxiety Scores By Gender

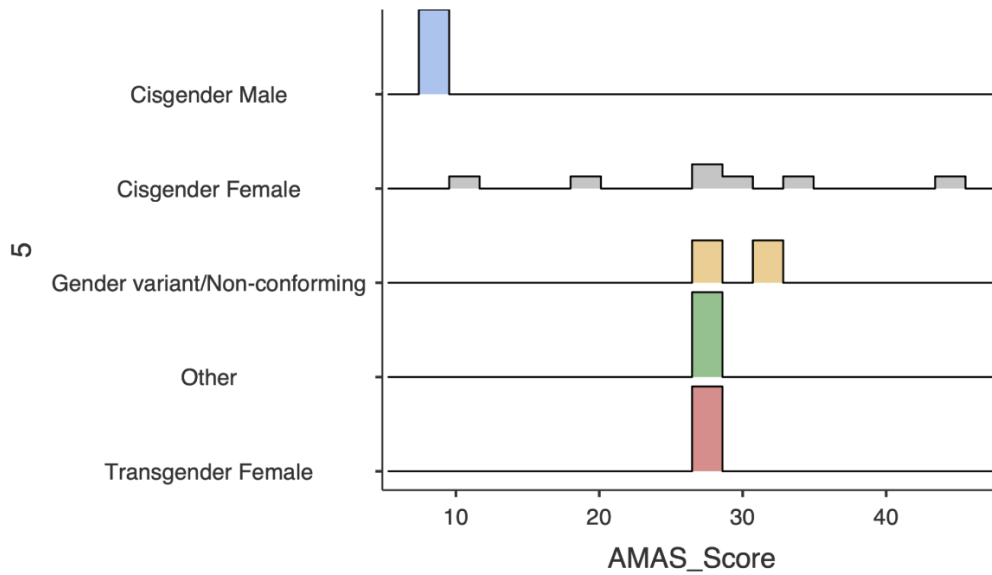


Figure 1.6. Math anxiety scores from AMAS measure, across participants, by gender ($N = 12$).

Figure 1.6 shows the scores of participants on the racial identity measure based on race, representing the measure of importance of racial identity to the individual. Cisgender females scored the highest on the scale though their scores were distributed throughout the range of possible response scores. Gender-variant/non-conforming participants, participants who responded with Other, and the transgender female participant scored slightly above the middle range of possible response scales. Cisgender males scored the lowest on the scale.

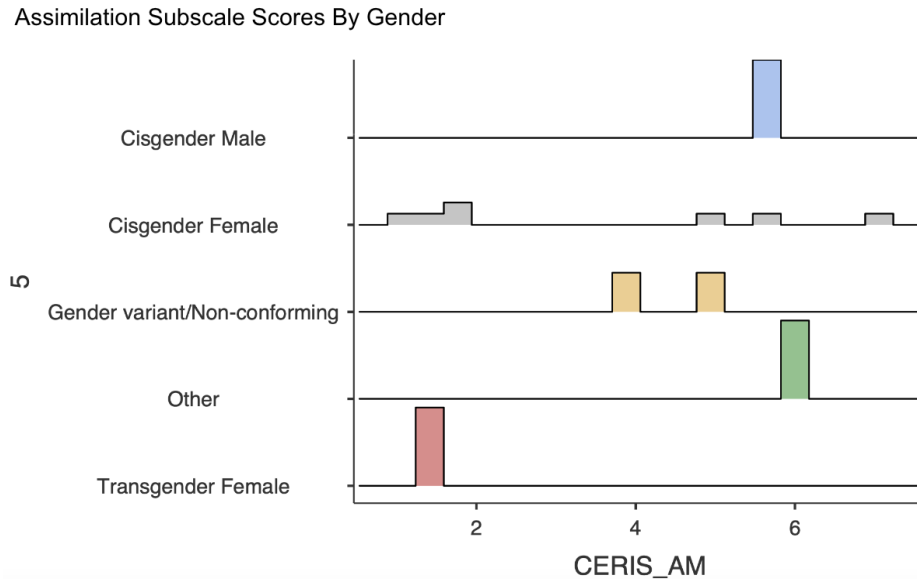


Figure 1.7. Assimilation subscale scores from CERIS-A measure, across participants, by gender ($N = 12$).

Figure 1.7 shows the scores of participants on the assimilation subscale of the CERIS-A measure based on gender. Cisgender females, though distributed on the possible response scores on the scale, scored the highest on the assimilation subscale of the CERIS-A. The participant who responded with Other scored the second highest on the subscale. The Cisgender male participant scored the third highest, while the Gender-variant/non-conforming participants scored slightly lower in the middle range of the possible responses on the subscale. Lastly, the Transgender female participant scored the lowest, scoring on the lowest end of the possible responses on the subscale.

Figure 1.8 shows the responses of participants on the AMS-R measure based on gender. Cisgender females, though distributed throughout the range of possible response scores, scored the highest on the scale. The Transgender female participant scored the second highest on the scale, while the Gender-variant/non-conforming participants scored third highest as they scored slightly lower than the Transgender female participant. The participant who responded with

Other scored the second lowest on the scale; however, they scored within a 10-point radius of the other participants. Lastly, the Cisgender male participant scored the lowest on the scale though it was also within a 10-point radius of the other participants.

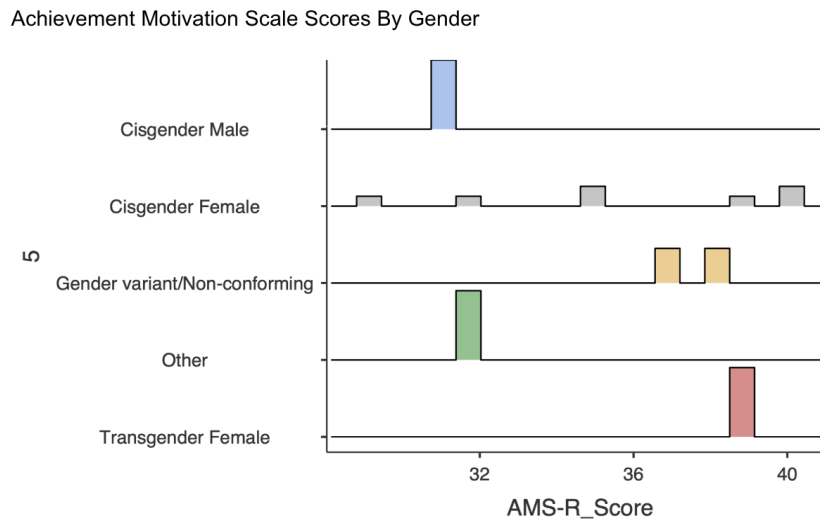


Figure 1.8. Achievement motivation scale- revised measure scores, across participants, by gender ($N = 12$).

Discussion

All mediation analyses had similar compositions: math anxiety as the predictor, one of the subscales of the CERIS-A measure as the mediator, and achievement motivation as the dependent variable. All analyses rendered were not statistically significant. The three simple regression analyses exploring the relationships of: math anxiety and achievement motivation, math anxiety and racial identity, and racial identity and achievement motivation, also deemed not statistically significant. Though this is so, these results may be explained by the limitations of the study presented below.

In trying to understand the results, as well as trying to draw conclusions, it is important to look at the scales used and the sample population, specifically the CERIS-A measure. As stated

previously, the CERIS-A scale was derived from the CRIS measure. The CRIS measure was developed with the means of measuring racial identity in African-American populations (Vandiver et al., 2000). Therefore, the questions were garnered towards African-Americans. As the scale was expanded, subscales were added and changed (Worrell et al., 2020). For example, one of the original subscales in the CRIS measure was anti-white; however, in the CERIS-A measure, the subscale was, instead, known as anti-dominant (Worrell, Mendoza-Denton, & Wang, 2019). Though the questions were adjusted to become reflective of a dominant racial group, rather than White people, the production of the intent of the change parallels the results of the original questions. Thus, the origins of the CERIS-A suggest that though the measure intended to measure racial identity across racial/ethnic identities, the scale may have been more effective in measuring racial identity in African-American participants.

With knowing the origins of the CERIS-A scale, and knowing that African-Americans were the intended population of those origins, it points to reasons as to why the results were deemed not statistically significant. The sample population, after participants were excluded, included only 2 African-American participants. The rest of the sample population was highly composed of White ($n = 5$) and Asian ($n = 4$) participants, and a Hispanic participant ($n = 1$). This is not surprising being that Bard College is a predominantly White institution. Therefore, the results may have been an outcome of a high number of participants who were of a racial/ethnic group that were not of the intended population that the measure was created to examine. It should also be said that this in combination with a small sample size may have contributed to the results of the experiment. Moreover, future researchers should aim to utilize a scale that is representative of all racial/ethnic groups in regards to its composition. In addition,

future researchers should look to have equal amounts of participants based on racial/ethnic groups.

Despite the results not being statistically significant, and the descriptive statistics being inconclusive, the latter, nevertheless, illustrates interesting data points in distant support of the hypotheses, which may inspire future research. When looking at subscales of the CERIS-A, specifically the ethno-racial salience subscale, both Black/African-American and Hispanic participants scored on the upper half of the scale (See Figure 1.4). This finding aligns with previous studies that have found that people of color value their sense of belonging to their ethnic groups and its role in their identity development (Charmararan & Grossman, 2010). In addition, these results may potentially be an outcome of Bard College being a PWI, which may cause students of color to think more about their race than if they were at an institution with more students who looked like them.

In regards to examining math anxiety and its role as predictor in the mediation analyses, as well as its role as a variable in the simple regression analyses, the results could have been an outcome of participants' pursuits in school. Participants were asked to report their majors at the beginning of the experiment. Five out of the twelve participants used for analysis were considered to be math-related majors. Such a report may hint at two attitudes that could be upheld by participants. The first being that participants who are not required to take multiple mathematics courses may be less likely to carry immediate negative responses to math-related concepts. The second attitude could be the opposite of the first in that those who are not math-related majors may have more negative responses to mathematics, as more exposure to

math may decrease the amount of math anxiety one feels (Supekar et al., 2015). Thus, these factors may have played a role in how participants responded to the math anxiety measure.

Pertaining to the math anxiety measure (i.e., AMAS), the Hispanic participant scored the highest on the math anxiety measure compared to their black and white counterparts who scored in the middle range (See Figure 1.3). Asian participants scored the lowest. Such findings align with previous research studies that found that, due to unpreparedness in school, many Latinx students may have high levels of math anxiety (Fernandez et al., 2021). Regarding the scores of Asian participants, Asian participants could have scored lower on the math anxiety scale as a result of stereotype threat (McGee, 2018). Asian individuals are often expected to perform well in STEM, creating the stereotype that all Asians must do well. However, good performance in STEM is not something that should be representative of all Asian individuals. Therefore, Asian participants may have reported low on the math anxiety score as a response to a manifestation of the expectation that they should be good at math. Lastly, when math anxiety responses were broken down by gender, the cisgender male participant scored the lowest on the math anxiety scale. Furthermore, this too is similar to previous research that found that men reported lower feelings of math anxiety when compared to their women counterparts (Devine et al., 2012).

When looking at achievement motivation, Asian and Black/African American participants scored the highest on the AMS-R measure. Whereas, White participants scored on the lowered half of the scale, and the Hispanic participant scored on the very low end of the scale (See Figure 1.5). The findings of the Black/African-American participants uphold previous research that found that African-American youth who had high hopes were more likely to exhibit the components that make up an achievement-oriented personality (Dixson & Stevens, 2018).

This could also be a result of the location in which participants were gathered from. Being that Bard College is a predominantly white institution, students of color may feel a need to outperform their white counterparts (Bernard, Jones, & Volpe, 2020). Pertaining to gender, women-identifying participants scored higher on the achievement motivation scale than their men counterparts. This finding is different from past studies looking at gender differences in achievement motivation, as males were typically found to show more achievement motivation than females (Naz, Shah, & Qayum, 2020). Thus, being that the current study's sample size was small, a larger sample size may be more effective in drawing conclusions about gender differences in achievement motivation.

Limitations and Future Research

The first limitation that is important to mention is the study's measure of racial identity. The cross ethnic-racial identity scale may not have captured all aspects of racial identity amongst participants or may have captured racial identity in one participant more than the other. Going into the study, I held theoretical assumptions in regards to marginalized individuals and their beliefs towards racial identity and its influence. Assumptions such as marginalized individuals who score higher on the racial identity measure would score higher on the math anxiety scale. Such assumptions may have also played a role in my decision to use the CERIS-A scale to measure racial identity, rather than the Multidimensional Model of Racial Identity (MMRI) scale often used by other researchers (Sellers et al., 1998). Though this scale has also been proven as a useful tool to measure, I felt that the questions were outdated, and could not fully speak to feelings about racial identity, especially after increased instances of police brutality and the emphasis of the Black Lives Matter movement in 2020.

With substantial events that have shifted the conversation on race and experiences of racism in America, it is important to highlight another assumption— the assumption that I would be able to fully measure beliefs about racial identity. Racial identity is very complex, meaning that it would be a disservice for it to only be measured by a scale. Not to mention, a scale that was also developed by human beings who too have racial identities that could have influenced questions implemented in the scale. Identity is dynamic and ever-changing. It can be influenced both culturally and politically (Collins, Mandel, & Schywiola, 2021). Therefore, someone who is seriously looking to study racial identity, especially marginalized people, must aim to be more representative. They must think about the time period of when the study is being conducted, or even the composition of parents, such as biracial couples. Future research could look to include an intervention in the study as a way of capturing any nuances in responses that exist between participants.

In regards to the organizational limitations of the study, the sample size from Bard can be deemed as very small (Bard: $N = 12$), which may have caused higher variability between participants. In addition, study promotion at Rutgers was not successful in comparison to Bard. Therefore, there was no data from Rutgers to be included in the analysis process. For future studies, it would be beneficial to have data for two racially different institutions as it could speak to the power of diversity and its influence on beliefs.

It should also be noted that Bard College is a small liberal arts institution that embraces diversity in all forms. Therefore, participants at Bard College may have responded differently than students at a different institution based on the morals associated with their school. In addition, Bard College is a predominantly white institution, which may have caused participants

to juxtapose their beliefs on racial identity with their experience at the school. Hence, it would be beneficial for future research to look at various types of institutions as a way to gauge how open-mindedness, as well as racial diversity, influence measures of racial identity.

Another limitation would be the age of participants. Since I was interested in capturing the influence of the transition from adolescence to adulthood, eligible participants had to be either 18 or 19 years old. Thus, the study's findings can only be applied to people of this age group. In addition, the study also required participants to be first years in college, once again limiting the generalizability of the findings. Therefore, future studies should include a wider age range, as well as a wider variety of where an individual is in their life.

In regards to the demographics questionnaire, future researchers could make changes to the question on race. Being that my study was looking at racial identity, it was important that I include a question on race. However, the options of answers to the question did not include multi-racial identity (see Appendix B). Though some researchers may not be interested in the inclusion of a "Multi-racial" option, it could have proven beneficial to this study. The option could have provided insight on how being multi-racial may influence an individual's perceptions of racial identity, math anxiety, and achievement motivation. Therefore, including this option in future research could provide another perspective about racial identity's influence on a person's beliefs.

Conclusion

My senior project, through the focus of racial identity, math anxiety, and achievement motivation, worked to shed light on the influence of racial identity. It also worked to showcase a potential example of how racial identity influences the way we think and see ourselves. Being

that math has so many applications in the real world, feelings of math anxiety may point to a grander problem, especially when viewed in combination with racial identity. Though all results of the study were deemed not statistically significant, we still see differences in race when it comes to feelings of math anxiety and achievement motivation. Thus, providing support towards conversations that question how experiences that are attached to one's race can dictate the way an individual navigates life. Therefore, it is important that future research looks to further explore the influence of racial identity, whether it be from a belief standpoint or a decision standpoint.

References

- Asai, D. J. (2020). Race matters. *Cell*, *181*(4), 754–757.
<https://doi.org/10.1016/j.cell.2020.03.044>
- Alexander, L., & Martray, C. (1989). The development of an abbreviated version of the mathematics anxiety rating scale. *Measurement and Evaluation in Counseling and Development*, *22*(3), 143–150. <https://doi.org/10.1080/07481756.1989.12022923>.
- Alliman-Brissett, A. E., & Turner, S. L. (2010). Racism, Parent Support, and Math-Based Career Interests, Efficacy, and Outcome Expectations Among African American Adolescents. *Journal of Black Psychology*, *36*(2), 197–225.
<https://doi.org/10.1177/0095798409351830>
- Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General*, *130*(2), 224–237. <https://doi.org/10.1037/0096-3445.130.2.224>
- Awan, R., Ghazala, N., & Anjum, N. (2011). A Study of Relationship between Achievement Motivation, Academic Self Concept and Achievement in English and Mathematics at Secondary Level. *International Education Studies*, *4*(3), Article 72.
<https://doi.org/10.5539/ies.v4n3p72>
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182.
<https://doi.org/10.1037/0022-3514.51.6.1173>

- Bennett, M. D. (2006). Culture and context: A study of neighborhood effects on racial socialization and ethnic identity content in a sample of African American Adolescents. *Journal of Black Psychology, 32*(4), 479–500.
<https://doi.org/10.1177/0095798406292470>
- Bernard, D. L., Jones, S. C. T., & Volpe, V. V. (2020). Impostor phenomenon and psychological well-being: The moderating roles of John Henryism and school racial composition among Black college students. *The Journal of Black Psychology, 46*(2–3), 195–227. <https://doi.org/10.1177/0095798420924529>
- Bringula, R., Reguyal, J. J., Tan, D. D., & Ulfa, S. (2021). Mathematics self-concept and challenges of learners in an online learning environment during COVID-19 pandemic. *Smart Learning Environments, 8*(1), Article 22.
<https://doi.org/10.1186/s40561-021-00168-5>
- Brittian, A. S. (2012). Understanding African American adolescents' identity development: A relational developmental systems perspective. *Journal of Black Psychology, 38*(2), 172–200. <https://doi.org/10.1177/0095798411414570>
- Broman, C. L. (2015). Race Identity. In *International Encyclopedia of the Social & Behavioral Sciences*, 833–836. Elsevier.
<https://doi.org/10.1016/B978-0-08-097086-8.32120-1>
- Brown, J. L., & Sifuentes, L. M. (2016). Validation study of the abbreviated math anxiety scale: Spanish adaptation. *Journal of Curriculum and Teaching, 5*(2), Article 76.
<https://doi.org/10.5430/jct.v5n2p76>

- Carey, E., Hill, F., Devine, A., & Szűcs, D. (2017). The modified abbreviated math anxiety scale: A valid and reliable instrument for use with children. *Frontiers in Psychology, 8*, Article 11. <https://doi.org/10.3389/fpsyg.2017.00011>
- Castro, A. J., Siegel-Hawley, G., Bridges, K., & Williams, S. E. (2022). Narratives of race in school rezoning: How the politics of whiteness shape belonging, leadership decisions, and school attendance boundaries. *AERA Open, 8*, 1-14. <https://doi.org/10.1177/23328584221091274>
- Charmaraman, L., & Grossman, J. M. (2010). Importance of race and ethnicity: An exploration of Asian, Black, Latino, and multiracial adolescent identity. *Cultural Diversity & Ethnic Minority Psychology, 16*(2), 144–151. <https://doi.org/10.1037/a0018668>
- Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience, 1*(3), 165–174. <https://doi.org/10.1093/scan/nsl024>
- Çiftçi, Ş. K., & Yıldız, P. (2019). The effect of self-confidence on mathematics achievement: The meta-analysis of trends in international mathematics and science study (TIMSS). *International Journal of Instruction, 12*(2), 683–694. <https://doi.org/10.29333/iji.2019.12243a>
- Collins, R. N., Mandel, D. R., & Schywiola, S. S. (2021). Political identity over personal impact: Early U.S. reactions to the COVID-19 pandemic. *Frontiers in Psychology, 12*, Article 607639. <https://doi.org/10.3389/fpsyg.2021.607639>

- Commodari, E., & La Rosa, V. L. (2021). General academic anxiety and math anxiety in primary school. The impact of math anxiety on calculation skills. *Acta Psychologica, 220*, 103-413. <https://doi.org/10.1016/j.actpsy.2021.103413>
- Cotter, E. W., Kelly, N. R., Mitchell, K. S., & Mazzeo, S. E. (2015). An investigation of body appreciation, ethnic identity, and eating disorder symptoms in Black women. *Journal of Black Psychology, 41*(1), 3-25. <https://doi.org/10.1177/0095798413502671>
- Cvencek, D., Paz-Albo, J., Master, A., Herranz Llácer, C. V., Hervás-Escobar, A., & Meltzoff, A. N. (2020). Math is for me: A field intervention to strengthen math self-concepts in spanish-speaking 3rd grade children. *Frontiers in Psychology, 11*, 593-995. <https://doi.org/10.3389/fpsyg.2020.593995>
- Darling-Hammond, L., & Sykes, G. (2003). Wanted, a national teacher supply policy for education: The right way to meet the “highly qualified teacher” challenge. *Education Policy Analysis Archives, 11*(33). <https://doi.org/10.14507/epaa.v11n33.2003>
- Davis, C., Aronson, J., & Salinas, M. (2006). Shades of threat: Racial identity as a moderator of stereotype threat. *Journal of Black Psychology, 32*(4), 399-417. <https://doi.org/10.1177/0095798406292464>
- DeCuir-Gunby, J. T. (2007). Negotiating identity in a bubble: A critical race analysis of African American high school students’ experiences in an elite, independent school. *Equity & Excellence in Education, 40*(1), 26-35. <https://doi.org/10.1080/10665680601093507>
- Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for

test anxiety. *Behavioral and Brain Functions*, 8(1), Article 33.

<https://doi.org/10.1186/1744-9081-8-33>

Dixson, D. D., & Stevens, D. (2018). A potential avenue for academic success: Hope predicts an achievement-oriented psychosocial profile in African American adolescents. *Journal of Black Psychology*, 44(6), 532–561.

<https://doi.org/10.1177/0095798418805644>

Douglass, S., Wang, Y., & Yip, T. (2016). The everyday implications of ethnic-racial identity processes: Exploring variability in ethnic-racial identity salience across situations. *Journal of Youth and Adolescence*, 45(7), 1396–1411.

<https://doi.org/10.1007/s10964-015-0390-1>

Durkee, M. I., & Williams, J. L. (2015). Accusations of acting white: Links to Black students' racial identity and mental health. *Journal of Black Psychology*, 41(1), 26–48.

<https://doi.org/10.1177/0095798413505323>

Ernest, P., Skovsmose, O., van Bendegem, J. P., Bicudo, M., Miarka, R., Kvasz, L., & Moeller, R. (2016). *The Philosophy of Mathematics Education*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-40569-8>

Ehrtmann, L., & Wolter, I. (2018). The impact of students' gender-role orientation on competence development in mathematics and reading in secondary school. *Learning and Individual Differences*, 61, 256–264. <https://doi.org/10.1016/j.lindif.2018.01.004>

Ferguson, K. T., Cassells, R. C., MacAllister, J. W., & Evans, G. W. (2013). The physical environment and child development: An international review. *International Journal of Psychology*, 48(4), 437–468. <https://doi.org/10.1080/00207594.2013.804190>

- Fernández, L. M., Wang, X., Ramirez, O., & Villalobos, M. C. (2021). Latinx students' mathematics anxiety and their study habits: Exploring their relationship at the postsecondary level. *Journal of Hispanic Higher Education, 20*(3), 278–296.
<https://doi.org/10.1177/1538192719852205>
- García Perales, R., & Palomares Ruiz, A. (2021). Comparison between performance levels for mathematical competence: Results for the sex variable. *Frontiers in Psychology, 12*, Article 663202. <https://doi.org/10.3389/fpsyg.2021.663202>
- Ghasemi, E., & Burley, H. (2019). Gender, affect, and math: A cross-national meta-analysis of trends in international mathematics and science study 2015 outcomes. *Large-Scale Assessments in Education, 7*(1), Article 10. <https://doi.org/10.1186/s40536-019-0078-1>
- Gillborn, D. (2016). Softly, softly: Genetics, intelligence and the hidden racism of the new geneism. *Journal of Education Policy, 31*(4), 365–388.
<https://doi.org/10.1080/02680939.2016.1139189>
- Gossett, E. C. (2022). WHO IS ANOINTED? The psychological and social justice implications of gifted and talented programs in the United States. *Senior Projects Spring 2022*. https://digitalcommons.bard.edu/senproj_s2022/154
- Guthrie, R. V. (2004). *Even the rat was white: A historical view of psychology* (2nd ed). Allyn and Bacon.
- Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest, 8*(1), 1–51.
<https://doi.org/10.1111/j.1529-1006.2007.00032.x>

- Harackiewicz, J. M., Rozek, C. S., Hulleman, C. S., & Hyde, J. S. (2012). Helping parents to motivate adolescents in mathematics and science: An experimental test of a utility-value intervention. *Psychological Science, 23*(8), 899–906. <https://doi.org/10.1177/0956797611435530>
- Henkens, J. H. D., Kalmijn, M., & de Valk, H. A. G. (2022). Life satisfaction development in the transition to adulthood: Differences by gender and immigrant background. *Journal of Youth and Adolescence, 51*(2), 305–319. <https://doi.org/10.1007/s10964-021-01560-7>
- Hopko, D. R., Mahadevan, R., Bare, R. L., & Hunt, M. K. (2003). The abbreviated math anxiety scale (AMAS): Construction, validity, and reliability. *Assessment, 10*(2), 178–182. <https://doi.org/10.1177/1073191103010002008>
- Jaschik, S. (2016, October 30). Where Ph.D.s work and what they earn. *Inside Higher Education*. <https://www.insidehighered.com/news/2016/10/31/new-analysis-shows-gaps-between-humanities-phds-and-others-doctorate>
- John Buck, J.E. (2019). Consequences of math anxiety and stereotype threat: an intersectional perspective. *UNLV theses, dissertations, professional papers, and capstones*, Article 3811. <http://dx.doi.org/10.34917/18608678>
- Jones, S. C. T., Lee, D. B., Gaskin, A. L., & Neblett, E. W. (2014). Emotional response profiles to racial discrimination: Does racial identity predict affective patterns? *Journal of Black Psychology, 40*(4), 334–358. <https://doi.org/10.1177/0095798413488628>

- Klein, A. G. (2000). Fitting the school to the child: The mission of Leta Stetter Hollingworth, founder of Gifted. *Roeper Review*, 23(2), Article 97.
<https://doi.org/10.1080/02783190009554075>
- Kovacs, K., & Conway, A. R. A. (2019). A unified cognitive/differential approach to human intelligence: Implications for IQ testing. *Journal of Applied Research in Memory and Cognition*, 8(3), 255–272. <https://doi.org/10.1016/j.jarmac.2019.05.003>
- Krueger, N. T., Garba, R., Stone-Sabali, S., Cokley, K. O., & Bailey, M. (2022). African American activism: The predictive role of race related stress, racial identity, and social justice beliefs. *Journal of Black Psychology*, 48(3–4), 273–308.
<https://doi.org/10.1177/0095798420984660>
- Lang, J. W. B., & Fries, S. (2006). A revised 10-Item version of the achievement motives scale. *European Journal of Psychological Assessment*, 22(3), 216–224.
<https://doi.org/10.1027/1015-5759.22.3.216>
- Lee, M. J., Collins, J. D., Harwood, S. A., Mendenhall, R., & Hunt, M. B. (2020). “If you aren’t white, asian or indian, you aren’t an engineer”: Racial microaggressions in STEM education. *International Journal of STEM Education*, 7(1), Article 48.
<https://doi.org/10.1186/s40594-020-00241-4>
- Leipold, B., Munz, M., & Michèle-Malkowsky, A. (2019). Coping and resilience in the transition to adulthood. *Emerging Adulthood*, 7(1), 12–20.
<https://doi.org/10.1177/2167696817752950>
- Maiya, S., Carlo, G., Landor, A. M., & Memmott-Elison, M. K. (2021). Ethnic-racial and religious identity as mediators of relations between ethnic-racial socialization and

- prosocial behaviors among black young adults. *Journal of Black Psychology*, 47(1), 31–50. <https://doi.org/10.1177/0095798420971388>
- Makhoul, J., Alameddine, M., & Afifi, R. A. (2012). “I felt that I was benefiting someone”: Youth as agents of change in a refugee community project. *Health Education Research*, 27(5), 914–926. <https://doi.org/10.1093/her/cyr011>
- Manstead, A. S. R. (2018). The psychology of social class: How socioeconomic status impacts thought, feelings, and behaviour. *British Journal of Social Psychology*, 57(2), 267–291. <https://doi.org/10.1111/bjso.12251>
- McClendon, C., & Wigfield, A. (1998). Group differences in african american adolescents’ achievement-related beliefs about math and science: An initial study. *Journal of Black Psychology*, 24(1), 28–43. <https://doi.org/10.1177/00957984980241003>
- McGee, E. (2018). “Black genius, Asian fail”: The detriment of stereotype lift and stereotype threat in high-achieving Asian and Black STEM students. *AERA Open*, 4(4). <https://doi.org/10.1177/2332858418816658>
- McGee, E. O., Botchway, P. K., Naphan-Kingery, D. E., Brockman, A. J., Houston, S., & White, D. T. (2022). Racism camouflaged as impostorism and the impact on Black STEM doctoral students. *Race Ethnicity and Education*, 25(4), 487–507. <https://doi.org/10.1080/13613324.2021.1924137>
- Mitchell, L. L., Adler, J. M., Carlsson, J., Eriksson, P. L., Syed, M. (2021). A conceptual review of identity integration across adulthood. *Developmental Psychology*, 57(11), 1981–1990. <https://doi.org/10.1037/dev0001246>

- Morgan, P. L., Hu, E. H., Farkas, G., Hillemeier, M. M., Oh, Y., & Gloski, C. A. (2023). Racial and ethnic disparities in advanced science and mathematics achievement during elementary school. *Gifted Child Quarterly*, *67*(2), 151–172.
<https://doi.org/10.1177/00169862221128299>
- Nabila, L. A., & Widjajanti, D. B. (2020). Self-esteem in mathematics learning: How to develop it through contextual teaching and learning approach? *Journal of Physics: Conference Series*, *1581*(1), Article 012049.
<https://doi.org/10.1088/1742-6596/1581/1/012049>
- Naz, S., Shah, S. A., & Qayum, A. (2020). Gender differences in motivation and academic achievement: A study of the university students of KP, Pakistan. *Global Regional Review*, *5*(1), 67–75. [https://doi.org/10.31703/grr.2020\(V-I\).09](https://doi.org/10.31703/grr.2020(V-I).09)
- Neville, H. A., Viard, B., & Turner, L. (2015). Race and recognition: Pathways to an affirmative black identity. *Journal of Black Psychology*, *41*(3), 247–271.
<https://doi.org/10.1177/0095798414523290>
- Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math = male, me = female, therefore math \neq me. *Journal of Personality and Social Psychology*, *83*(1), 44–59.
<https://doi.org/10.1037/0022-3514.83.1.44>
- Oakes, J. (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science*. Rand Corp.
- Okeke, N. A., Howard, L. C., Kurtz-Costes, B., & Rowley, S. J. (2009). Academic race stereotypes, academic self-concept, and racial centrality in African American youth.

Journal of Black Psychology, 35(3), 366–387.

<https://doi.org/10.1177/0095798409333615>

O’Neil, C. (2016). *Weapons of math destruction: How big data increases inequality and threatens democracy* (1st ed.). Crown.

Piaget, J. (1976). Piaget’s Theory. In B. Inhelder, H. H. Chipman, & C. Zwingmann (Eds.), *Piaget and His School* (pp. 11–23). Springer Berlin Heidelberg.

https://doi.org/10.1007/978-3-642-46323-5_2

Pollack, C., Wilmot, D., Centanni, T. M., Halverson, K., Frosch, I., D’Mello, A. M., Romeo, R. R., Imhof, A., Capella, J., Wade, K., Al Dahhan, N. Z., Gabrieli, J. D. E., & Christodoulou, J. A. (2021). Anxiety, motivation, and competence in mathematics and reading for children with and without learning difficulties. *Frontiers in Psychology*, 12, Article 704821. <https://doi.org/10.3389/fpsyg.2021.704821>

Ponterotto, J. G., & Park-Taylor, J. (2007). Racial and ethnic identity theory, measurement, and research in counseling psychology: Present status and future directions. *Journal of Counseling Psychology*, 54(3), 282–294. <https://doi.org/10.1037/0022-0167.54.3.282>

Rozek, C. S., Ramirez, G., Fine, R. D., & Beilock, S. L. (2019). Reducing socioeconomic disparities in the STEM pipeline through student emotion regulation. *Proceedings of the National Academy of Sciences of the United States of America*, 116(5), 1553–1558. <https://doi.org/10.1073/pnas.1808589116>

Sarangi, C. (2015). Achievement motivation of the high school students: A case study among different communities of Goalpara District of Assam. *ERIC*, 6(19), 140-144. Retrieved November 18, 2022, from <https://eric.ed.gov/?id=EJ1079528>

- Selden, S. (2000). Eugenics and the social construction of merit, race and disability. *Journal of Curriculum Studies*, 32(2), 235–252. <https://doi.org/10.1080/002202700182736>
- Sellers, R. M., Smith, M. A., Shelton, J. N., Rowley, S. A. J., & Chavous, T. M. (1998). Multidimensional model of racial identity: A reconceptualization of African American racial identity. *Personality and Social Psychology Review*, 2(1), 18–39. https://doi.org/10.1207/s15327957pspr0201_2
- Smedley, A. (1993). *Race in North America: The origins and evolution of a worldview*. Boulder, CO: Westview.
- Sokolowski, H. M., & Ansari, D. (2017). Who is afraid of math? What is math anxiety? And what can you do about it? *Frontiers for Young Minds*, 5, Article 57. <https://doi.org/10.3389/frym.2017.00057>
- Steinmayr, R., Weidinger, A. F., Schwinger, M., & Spinath, B. (2019). The importance of students' motivation for their academic achievement – replicating and extending previous findings. *Frontiers in Psychology*, 10, Article 1730. <https://doi.org/10.3389/fpsyg.2019.01730>
- Sternberg, R. J., Grigorenko, E. L., & Kidd, K. K. (2005). Intelligence, race, and genetics. *American Psychologist*, 60(1), 46–59. <https://doi.org/10.1037/0003-066X.60.1.46>
- Supekar, K., Iuculano, T., Chen, L., & Menon, V. (2015). Remediation of childhood math anxiety and associated neural circuits through cognitive tutoring. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, 35(36), 12574–12583. <https://doi.org/10.1523/JNEUROSCI.0786-15.2015>

- Tatum, B. D. (2017). *“Why are all the black kids sitting together in the cafeteria?”: And other conversations about race* (3rd ed.). Basic Books.
- Thomas, A. J., Hoxha, D., & Hacker, J. D. (2013). Contextual influences on gendered racial identity development of African American young women. *Journal of Black Psychology*, 39(1), 88–101. <https://doi.org/10.1177/0095798412454679>
- Tizon, C. (2013). *Growth in science and engineering (SandE) Bachelor's Degrees by Gender Between 2009-2013*. Available online at:
<http://nscresearchcenter.org/snapshotreport-degreeattainment3/#more-2111>
- Townsend, T. G., & Belgrave, F. Z. (2000). The impact of personal identity and racial identity on drug attitudes and use among African American children. *Journal of Black Psychology*, 26(4), 421–436. <https://doi.org/10.1177/0095798400026004005>
- Turda, M. (2022). Legacies of eugenics: Confronting the past, forging a future. *Ethnic and Racial Studies*, 45(13), 2470–2477. <https://doi.org/10.1080/01419870.2022.2095222>
- Turiel, E. (2020). Eugenics, prejudice, and psychological research. *Human Development*, 64(3), 103–107. <https://doi.org/10.1159/000512492>
- Turner, J. C., Midgley, C., Meyer, D. K., Gheen, M., Anderman, E. M., Kang, Y., & Patrick, H. (2002). The classroom environment and students’ reports of avoidance strategies in mathematics: A multimethod study. *Journal of Educational Psychology*, 94(1), 88–106. <https://doi.org/10.1037/0022-0663.94.1.88>
- Umaña-Taylor, A. J., Quintana, S. M., Lee, R. M., Cross, W. E., Rivas-Drake, D., Schwartz, S. J., Syed, M., Yip, T., Seaton, E., & Ethnic and Racial Identity in the 21st Century Study Group. (2014). Ethnic and racial identity during adolescence and into young

adulthood: An integrated conceptualization. *Child Development*, 85(1), 21–39.

<https://doi.org/10.1111/cdev.12196>

Vandiver, B. J., Cross, W. E., Fhagen-Smith, P. E., Worrell, F. C., Swim, J., & Caldwell, L.

(2012). *Cross Racial Identity Scale* [Data set]. American Psychological Association.

<https://doi.org/10.1037/t01825-000>

Van Mier, H. I., Schleepen, T. M. J., & Van den Berg, F. C. G. (2019). Gender differences regarding the impact of math anxiety on arithmetic performance in second and fourth graders. *Frontiers in Psychology*, 9, Article 2690.

<https://doi.org/10.3389/fpsyg.2018.02690>

Vargas, N., & Kingsbury, J. (2016). Racial identity contestation: Mapping and measuring racial boundaries: Measuring and mapping racial identity contestation. *Sociology Compass*, 10(8), 718–729. <https://doi.org/10.1111/soc4.12395>

Wagner, D., Bakker, A., Meaney, T., Mesa, V., Prediger, S., & Van Dooren, W. (2020). What can we do against racism in mathematics education research? *Educational Studies in Mathematics*, 104(3), 299–311. <https://doi.org/10.1007/s10649-020-09969-w>

Wang, J., & Feigenson, L. (2019). Infants recognize counting as numerically relevant. *Developmental Science*, 22(6). <https://doi.org/10.1111/desc.12805>

Wang, M.-T., Degol, J., & Ye, F. (2015). Math achievement is important, but task values are critical, too: Examining the intellectual and motivational factors leading to gender disparities in STEM careers. *Frontiers in Psychology*, 6, Article 36. <https://doi.org/10.3389/fpsyg.2015.00036>

- Ward, J. V. (2018). Staying woke: Raising black girls to resist disconnection. In N. Way, C. Gilligan, P. Noguera & A. Ali (Eds.), *The crisis of connection: Roots, consequences, and solutions*, pp. 106–128. New York University Press.
- Weissgerber, S. C., Grünberg, C., Neufeld, L., Steppat, T., & Reinhard, M. A. (2022). The interplay of math anxiety and math competence for later performance. *Social Psychology of Education, 25*(4), 977–1002.
<https://doi.org/10.1007/s11218-022-09700-y>
- Worrell, F. C., Mendoza-Denton, R., Vandiver, B. J., Fhagen, P. E., & Cross, W. E. (2020). Incorporating a race salience subscale into the cross racial identity scale (CRIS). *Journal of Black Psychology, 46*(8), 638–658.
<https://doi.org/10.1177/0095798420967598>
- Worrell, F. C., Mendoza-Denton, R., & Wang, A. (2019). Introducing a new assessment Tool for measuring ethnic-racial identity: The cross ethnic-racial identity scale–adult (CERIS-A). *Assessment, 26*(3), 404–418. <https://doi.org/10.1177/1073191117698756>
- Ziegler, G. M., & Loos, A. (2017). “What is mathematics?” and why we should ask, where one should experience and learn that, and how to teach it. In G. Kaiser (Ed.), *Proceedings of the 13th International Congress on Mathematical Education*, pp. 63–77. Springer International Publishing. https://doi.org/10.1007/978-3-319-62597-3_5

Appendix A

Recruitment Flyer

RACIAL IDENTITY STUDY

ARE YOU A FIRST YEAR INTERESTED IN PARTICIPATING IN RESEARCH?

WHAT WILL I BE ASKED TO DO?

- YOU WILL BE ASKED TO FILL OUT A QUESTIONNAIRE THAT SHOULD TAKE ABOUT 20 MINUTES.

WHO CAN JOIN?

- ANYONE IN THEIR FIRST YEAR, 18-19 YEARS OLD.

WILL I BE PAID?

- YOU WILL BE ENTERED INTO A RAFFLE FOR A CHANCE TO WIN A \$50 DOLLAR GIFT CARD!

HOW CAN I JOIN?

- JUST SCAN THE QR CODE!

QR CODE
INSERT

ANY QUESTIONS?
Email md2664@bard.edu

Appendix B

Demographics Questionnaire:

1. What school do you go to? (Open Response Box)
2. What is your major? (Open Response Box)
3. How old are you? (Open Response Box)
4. Gender: (Multiple Choice)
 - a. Cisgender male
 - b. Cisgender female
 - c. Transgender male
 - d. Transgender female
 - e. Gender variant/non-conforming
 - f. Other: (Text-Box)
 - g. Prefer not to answer
5. Race/Ethnicity:
 - a. Black/African-American
 - b. White
 - c. Hispanic
 - d. Native American/Alaska Native
 - e. Asian
 - f. Native Hawaiian/Other Pacific Islander
6. Were you born in America?
 - a. Yes
 - b. No
 - c. Unsure
7. If yes, which region in America?
 - a. Northeast
 - b. Southwest
 - c. West
 - d. Southeast
 - e. Midwest
8. What is your household income?
 - a. 1 to 9,999
 - b. 10,000 to 24,999
 - c. 25,000 to 49,999
 - d. 50,000 to 74,999
 - e. 75,000 to 99,999
 - f. 100,000 to 149,000
 - g. 150,000 or greater
 - h. Prefer not to answer

Appendix D

Abbreviated Math Anxiety Scale

Instructions: Please rate each item below in terms of how anxious you would feel during the event specified using the 5-point scale below.

	1 Low Anxiety	2 Some Anxiety	3 Moderate Anxiety	4 Quite a bit of Anxiety	5 High Anxiety
1. Having to use the tables in the back of a mathematics book.					
2. Thinking about an upcoming mathematics test one day before.					
3. Watching a teacher work an algebraic equation on the blackboard.					
4. Taking an examination in a mathematics course.					
5. Being given a					

<p>homework assignment of many difficult problems which is due the next class meeting.</p>					
<p>6. Listening to a lecture in mathematics class.</p>					
<p>7. Listening to another student explain a mathematics formula.</p>					
<p>8. Being given a “pop” quiz in a mathematics class.</p>					
<p>9. Starting a new chapter in a mathematics book.</p>					

Appendix E

Achievement Motivation Scale- Revised

Instructions: Read each item and indicate **to what degree it reflects your own thoughts and feelings** using the 4-point scale below. There are no right or wrong answers. Base your responses on your opinion at the present time. **To ensure that your answers can be used, please respond to the statements as written**, and indicate your response by bubbling in the circle under your choice.

	1 Strongly Disagree	2 Somewhat Disagree	3 Somewhat Agree	4 Strongly Agree
1. I like situations, in which I can find out how capable I am.				
2. When I am confronted with a problem, which I can possibly solve, I am enticed to start working on it immediately.				
3. I enjoy situations in which I can make use of my abilities.				
4. I am appealed by situations allowing me to test my abilities.				
5. I am attracted by tasks in which I can test my				

abilities.				
6. I am afraid of failing in somewhat difficult situations, when a lot depends on me.				
7. I feel uneasy to do something if I am not sure of succeeding.				
8. Even if nobody would notice my failure, I'm afraid of tasks, which I'm not able to solve.				
9. Even if nobody is watching, I feel quite anxious in new situations.				
10. If I do not understand a problem immediately I start feeling anxious.				

Appendix F

Bard College

INTERNET-BASED INFORMED CONSENT

Title of Project: Perceptions of math across identities

Researcher: Amanda 'Mandy' Derrell

Adviser: Elena Kim, Ph.D.

Visiting Associate Professor in Psychology, Bard College

I am an undergraduate student at Bard College and I am conducting a study for my senior project. I am investigating perceptions of mathematical principles amongst individuals with different identities.

During this study, you will be asked to answer a series of questions pertaining to your experiences and perceptions. This study should take approximately 20 minutes to complete, and can be completed entirely online.

Some potential risks associated with this study include discomfort in the discussion of math. If you feel any discomfort at any point during the study, you are free to skip a question or exit the study without penalty.

There are no direct benefits to participating in this study.

You will be entered into a raffle, upon completion, for the chance to win a \$50 gift card.

All information provided will be kept confidential. There will be no recording of information including name, email, or IP address. All given information will be kept on a password-protected computer only to be accessed by either my faculty adviser or myself. All retrieved data will be destroyed after the submission of my senior project on May 3rd, 2023 at 5:00pm.

If you have any questions, you can contact me, Amanda 'Mandy' Derrell, at md2664@bard.edu or my faculty adviser, Dr. Elena Kim, at ekim@bard.edu. If at any time you feel uncomfortable during or after participation in the study, you can reach out to Bard Counseling Services at 845-758-7433 or the Substance Abuse and Mental Health Services Administration (1-800-662-4357) for support. If you have any questions about your rights as a research participant, you can contact the head of the Bard Institutional Review Board at irb@bard.edu.

By continuing with this survey, you affirm your consent to participate and acknowledge that you are 18 years of age or older.

Yes

No

Appendix G

Rutgers University- New Brunswick

INTERNET-BASED INFORMED CONSENT

Title of Project: Perceptions of math across identities

Researcher: Amanda 'Mandy' Derrell

Adviser: Elena Kim, Ph.D.

Visiting Associate Professor in Psychology, Bard College

I am an undergraduate student at Bard College and I am conducting a study for my senior project. I am investigating perceptions of mathematical principles amongst individuals with different identities.

During this study, you will be asked to answer a series of questions pertaining to your experiences and perceptions. This study should take approximately 20 minutes to complete, and can be completed entirely online.

Some potential risks associated with this study include discomfort in the discussion of math. If you feel any discomfort at any point during the study, you are free to skip a question or exit the study without penalty.

There are no direct benefits to participating in this study.

You will be entered into a raffle, upon completion, for the chance to win a \$50 gift card.

All information provided will be kept confidential. There will be no recording of information including name, email, or IP address. All given information will be kept on a password-protected computer only to be accessed by either my faculty adviser or myself. All retrieved data will be destroyed after the submission of my senior project on May 3rd, 2023 at 5:00pm.

If you have any questions, you can contact me, Amanda 'Mandy' Derrell, at md2664@bard.edu or my faculty adviser, Dr. Elena Kim, at ekim@bard.edu. If at any time you feel uncomfortable during or after participation in the study, you can reach out to the university mental health service, Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS) at 848-932-7884 or the Substance Abuse and Mental Health Services Administration (1-800-662-4357) for support. If you have any questions about your rights as a research participant, you can contact the head of the Bard Institutional Review Board at irb@bard.edu.

By continuing with this survey, you affirm your consent to participate and acknowledge that you are 18 years of age or older.

Yes

No

Appendix H

Debriefing Statement-Bard College

Dear participant,

Thank you for your interest and willingness to participate in this research study through the completion of the questions! The purpose of this study was to try and determine if an individual's racial identity can influence their perceptions of math and their motivations towards achievement. All participants were given three questionnaires: racial identity, math anxiety, and achievement motivation. The idea for this study came from personal experiences of marginalization and curiosity on how my experiences tied to my race influence other aspects of my life. If at any time you feel uncomfortable after participation in the study, you can reach out to the:

- Bard Counseling Services at 1-845-758-7433
or
- Off-campus mental health services at bard.thrivingcampus.com
or
- Substance Abuse and Mental Health Services Administration (SAMHSA) at 1-800-662-4357 for support.
or
- National Suicide Hotline at #988

If you have any further questions or concerns, feel free to contact myself at md2664@bard.edu or my faculty adviser, Elena Kim, at ekim@bard.edu.

Appendix I

Debriefing Statement- Rutgers University-New Brunswick

Dear participant,

Thank you for your interest and willingness to participate in this research study through the completion of the questions! The purpose of this study was to try and determine if an individual's racial identity can influence their perceptions of math and their motivations towards achievement. All participants were given three questionnaires: racial identity, math anxiety, and achievement motivation. The idea for this study came from personal experiences of marginalization and curiosity on how my experiences tied to my race influence other aspects of my life. If at any time you feel uncomfortable after participation in the study, you can reach out to the:

- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS), at 1-845-758-7433
or
- Substance Abuse and Mental Health Services Administration (SAMHSA) at 1-800-662-4357 for support.
or
- National Suicide Hotline at #988

If you have any further questions or concerns, feel free to contact myself at md2664@bard.edu or my faculty adviser, Elena Kim, at ekim@bard.edu.

Appendix J

Compensation Instructions

Bard

Please list your email address to be entered into a raffle for a chance to win a \$50 gift card.



Appendix K

Pre-Registration

1. **Data collection.** Have any data been collected for this study already?
 - a. No, I have not collected data yet.
2. **Hypothesis** What's the main question being asked or hypothesis being tested in this study?
 - a. How does racial identity influence math anxiety amongst college students?
 - i. H1: High levels of math anxiety can be explained by racial identity.
 - b. How does racial identity influence academic achievement motivation amongst college students?
 - i. H2: High levels of achievement motivation can be explained by low levels of math anxiety.
 - c. How are math anxiety and academic achievement motivation related?
 - i. H3: High levels of achievement motivation can be explained by moderate levels of racial identity.
3. **Dependent variable** Describe the key dependent variable(s) specifying how they will be measured.
 - a. The key response variables in this study will be perceptions of racial identity, math anxiety, and achievement motivation.
 - b. Both math anxiety and achievement motivation will be measured in response to racial identity.
 - c. Achievement motivation will also be measured in response to math anxiety.
 - d. These will be measured through the usage of the Cross Ethnic-Racial Identity Scale-Adult (CERIS-A), the Abbreviated Math Anxiety Scale (AMAS), and the Achievement Motivation Scale- Revised (AMS-R). The CERIS-A measure will be scored based on seven subscales: assimilation, ethnocentricity, ethnic-racial salience, miseducation, anti-dominant, and multiculturalist inclusive. The first question will not be included in the scoring process. Each subscale is made up of 4 questions that will be averaged. In addition, none of the items will be reverse-scored. Both the AMAS and AMS-R measures will be scored through the summation of participants' scores and averaging them to receive a final score. The AMAS scores will range from 9 to 45, while AMS-R scores will range from 10 to 40.
4. **Conditions** How many and which conditions will participants be assigned to?
 - a. There will be no conditions.
5. **Analyses** Specify exactly which analyses you will conduct to examine the main question/hypothesis.
 - a. H1: A simple regression analysis will be used to analyze how racial identity influences math anxiety.

- b. H2: A simple regression analysis will be used to analyze how math anxiety influences achievement motivation.
 - c. H3: A simple regression analysis will be used to analyze how racial identity influences achievement motivation.
 - d. A multiple regression analysis will be used to compare and analyze the influence of all constructs: racial identity, math anxiety, and academic achievement motivation.
6. **Outliers and Exclusions** Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.
- a. We will compute the overall mean and standard deviation across all three variables, and exclude observations that exceed those that are 4 standard deviations above/below the mean.
 - b. We will exclude participants who do not complete all three measures of the study (i.e., cross ethnic-racial identity scale-adult, abbreviated math anxiety scale, achievement motivation scale-revised).
 - c. We will exclude participants who are not ages 18 or 19, or in their first year of college.
7. **Sample Size** How many observations will be collected or what will determine sample size?
- a. The sample size of the experiment will be 60 students. The 60 students will be composed of 30 students from Bard College and 30 from Rutgers University-New Brunswick. I will conduct the experiment until at least 30 students from Bard and 30 students from Rutgers University- New Brunswick participate in the study or until May 3rd, 2023 (whichever comes first).
8. **Other** Anything else you would like to pre-register?(e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)
- a. A t-test of independent means will be used to compare all scores between participants gathered from Bard College and those gathered from Rutgers University- New Brunswick.
 - b. I will also include multiple regression analyses looking at the demographics of the participants and their responses on the scales measuring racial identity, math anxiety, and achievement motivation.
 - c. Social class/region/gender/major
 - d. Compare means (t-test independent)
9. **Name** Give a title for this AsPredicted pre-registration Suggestion: use the name of the project, followed by study description.
- a. Perceptions amongst college students- Racial Identity, Math Anxiety, and Achievement Motivation, Bard College and Rutgers University-New Brunswick, 2023
10. **Type of study.**
- a. Experiment
11. **Data source**
- a. Qualtrics