Examining Academic Coping Strategies Among Black American Students in Terms of Math
Resiliency

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Abstract

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Resiliency

Failure is the most commonly assumed outcome for Black American students studying math, which does not leave much room for understanding how Black American students do succeed in mathematics. Despite this assumption, many Black American students are resilient and able to have positive academic math outcomes. Studies suggest that mathematics literacy in Black American students is linked to identity construction at the intersection of their racial identity and math identity. Using Spencer's PVEST model as a theoretical framework, the current study examines the need for an inclusive framework that observes and accounts for the many factors that influence students' educational math outcomes. The current study observes academic coping skills as predictors for math computation outcomes. A group of 146 predominantly Black American students were recruited from an HBCU and completed an in-person computerized easy and hard math task with a word task as the control. The math task measured reaction time and accuracy. Participants also completed a survey with subscales from Patterns of Adaptive Learning Scales, Abbreviated Math Anxiety Scale, Beck Anxiety Inventory, Barratt Impulsiveness Scale-11, and subscales from the Metacognitive Awareness Inventory. Results revealed that none of the predicted coping strategies were able to predict the outcome on the math task. Data exploration was performed and found that comprehension was able to significantly predict impulsivity and academic efficacy, and planning was able to significantly predict impulsivity and academic efficacy.

keywords: math anxiety, resiliency, PVEST, mathematics, math computation

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Chapter One

Introduction

Statement of the Problem

Math is taught at a very early age, with the introduction of numbers, teaching to count with fingers, and teaching children to understand how old they are on their birthday. These forms of teaching mathematics are very important, as it begins to lay a solid foundation on which many applied and abstract math concepts are placed (Smith, 2017). Claessens and Engel (2013) found math skills to predict more than just math performance in later grades, they also predict performance in areas such as reading and science. This means that as children matriculate through school, those children that demonstrate difficulties in math are also likely to demonstrate difficulties in other aspects of their education.

A disproportionate number of Black American students have been labeled as underperforming and low achieving in comparison to their White peers, which is especially true for Black American students that have not been able to have a solid math foundation (Johnson, 2019). Though there are many Black American students who struggle with math, there are many Black American students that have developed adaptive coping skills and shown themselves to be resilient in the face of an imbalanced educational system. Research has been often focused on how Black American students are not as capable or many may not have the innate ability to excel in math learning, but not what skills they use to be able to excel (McGee & Martin, 2011).

Black American students are also often found to be systematically unable to participate in college-ready courses due to accessibility. In the 2011-2012 school year, only 57 percent of Black American students had access to a full range of math and science courses necessary for college readiness in comparison to 81 percent of Asian American students and 71 percent of

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White students (Tsoi-A-Fatt Bryant, 2015). Even when Black American students do have access to honors or advanced placement courses, they are greatly underrepresented with Black American and Latinx students only representing 29 percent of students enrolled in at least one AP course, but representing 38 percent of students in schools that offer AP courses (US Department of Education Office for Civil Rights, 2014). Black American students are often located in schools with less qualified teachers, teachers with lower salaries, and novice teachers. This systematic bias and underrepresentation have been shown to encourage teachers to have lower expectations of Black American students (Gershenson, Holt, & Papageorge, 2015). According to The Nation's Report Card (2019), the average math score for Black American 8th-grade students was 32 points lower than White students, and only seven percent of Black American 12th graders scored at or above proficiency on the math test, while 32 percent of White 12th graders scored at or above proficient.

Black American students that succeed are often students that are high in resiliency and adaptive coping skills (Fitz-Gerald, 2017). These students have developed academic coping skills, through family, social support and community support, and psychological factors, that have allowed them to navigate an educational system that is unequal in its resources and teaching methods (Kajander, Zuke, & Walton, 2008). As students grow and develop, they develop new adaptive and maladaptive coping skills that allow them to succeed or struggle through their math learning. This is best seen through Margaret Spencer's (1995) Phenomenological Variant of Ecological Systems Theory (PVEST) which conceptualizes resilience, helps identify risks, and supports academic strategy usage among Black American students. PVEST is a theoretical framework that describes the process of identity formation specific to Black American children over time.

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Study Conceptualization

The current study uses PVEST to interpret how Black American students navigate their math performance. This study will focus on the resiliency displayed through math computation and how adaptive and maladaptive coping skills affect the outcome.

Research Questions

1. What are the underlying adaptive and maladaptive coping strategies related to mathematics performance in our sample of Black American students?
2. Will students with higher maladaptive coping strategies have higher reaction times and lower accuracy on a math task than students with less maladaptive coping strategies?
3. What is the best model for predicting math performance using adaptive and maladaptive coping strategies?

Purpose of the Current Study

By examining academic coping strategies, the current study seeks to understand how adaptive and maladaptive coping strategies affect math performance as a measure of resiliency.

Chapter Two

Literature Review

Bronfenbrenner's Ecological Systems Theory

Bronfenbrenner's Ecological Systems Framework was developed out of the work of Urie Bronfenbrenner in the field of developmental psychology (Perron, 2017). Bronfenbrenner began to establish a broader human development approach, which focused on the progressive accommodation in the human lifespan (Bronfenbrenner, 1977). This information was based on Lewin's (1935) dynamic theory of personality, which states that behavior is a function of the person and the environment. Bronfenbrenner then goes on to expound this theory further, stating that human development moves through time and the environment. The Ecological Systems theory looks at the development of the child within the context of the relationships around the child that form their environment, with each of the layers having an influence on the child's development. Bronfenbrenner (1994) proposed that there are five major environmental subsystems that influence human behavior and development, including the individual, microsystems, mesosystems, exosystems, and macrosystems.

Bronfenbrenner (1994) proposed that there are five major environmental subsystems that influence human behavior and development, including the individual, microsystems, mesosystems, exosystems, and macrosystems [Figure 1]. The microsystem is closest to the child, and contains the structures that the child interacts with immediately, such as family, school, neighborhood, and childcare. This level is often bidirectional, with the relationships occurring both away from and towards the child (Bronfenbrenner, 1994). At the microsystem level, these

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bi-directional influences have the greatest impact on the child. The mesosystem is often referred to as the connections between microsystems that foster development (Perron, 2017). These relationships might be the relationships between the child's parents and their teacher, or the community center and the child's neighborhood. The structures in this mesosystem influence the child's development by interacting with those in their microsystem (Ryan, 2001). The next level is the exosystem, which often influences those mesosystems that the child interacts with. This might be community-based family resources, such as a free community system, or a parent's job stability or instability. These interactions often affect children in ways that they might not see directly, but can easily affect the direction of their day to day and future lives. Then there is the macrosystem, which consists of the values, laws, customs, and resources of a particular culture. The culture of a community and area where a child lives impacts the world of a child's life. The macrosystem may include the value placed on education at a federal or state level, which might influence the funding and types of opportunities and programs for a child (Ryan, 2001).

Bronfenbrenner's Ecological Systems theory does well with examining the interactions of the layers of the environment a child interacts with, but it does not fully take into consideration how these layers affect the child or family. This theory presumes that Black Americans and other minority children share the same spaces and experiences as White American children. The levels of the ecological systems weigh differently on Black American children and represent different variations in risks and vulnerability, stress, coping methods, emergence of stable identities, and adverse or productive life outcomes. The experiences of Black American children are not the same as White children, and this must be considered when taking into account how the environment affects these children.

Figure 1: Bronfenbrenner's Ecological Systems Theory

Phenomenological Variant of Ecological Systems Theory (PVEST)

The Phenomenological Variant of Ecological Systems Theory (PVEST) is a culturally sensitive inclusive ecological framework of human development [Figure 2.](Spencer, 1995; Spencer, Dupree, & Hartmann, 1997; Spencer, 2006). PVEST is a systems theory, therefore it allows for and considers the culture of an individual, the perceptions of the individual on themselves, and the historical impact of the system that the individual lives in (Spencer, 2006).

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This theory also describes the processes of how resilience and identity formation unfold over time. PVEST provides a cultural-ecological viewpoint that acknowledges the differences in protective factors, stressors, coping responses and strategies, and identity formation of minority youth in the United States of America (Philips Swanson, Spencer, Harpalani, Dupree, & Noll, 2003). Unlike Bronfrenbrenner's Ecological Systems Theory, PVEST looks at the development of an individual and their identity considering how interactions are interpreted through cultural lenses, multiple layers of the environment, social policy and historical factors, and normal human processes that develop over time. PVEST is also particularly helpful when understanding the development of children and adolescents, as identity formation occurs greatly during this time and is a part of their developmental outcome.

Figure 2: PVEST (Phenomenological Variant of Ecological Systems Theory)

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Educational experiences of racial minorities in the United States are often influenced by a history of oppression, lower socioeconomic status, and the social positions of race and class (Williams, Priest, & Anderson, 2016). These variables can increase or interfere with their developmental outcomes due to layers of racism, prejudice, and discrimination (Cunningham & Phillips Swanson, 2010). The educational experiences of racial minorities in predominantly minority neighborhoods are often different than their counterparts living in majority white neighborhoods, including academic opportunities like diverse course offerings and modern facilities. Spencer (2008) found that students' self-described risk and protective factors show variability, revealing that students have a range of ways to make sense of their lives. These risk factors can also become protective factors depending on the situation and circumstances.

Educational research and teaching are frequently done through the lens of European American middle class norms, which often do not take into consideration the social conditions and realities of those populations that are not the majority. Educational research has often not viewed the catalysts for adolescents to thrive in school through a social, cultural, and environmental context (English-Clarke, Slaughter-Defore, & Martin, 2012). Mathematics education researchers often ignore the social conditions and realities of the populations they study or view the negative outcomes of Black Americans as a cultural deficit (Slaughter-Defoe, 1995). PVEST allows us to view the educational development of people that belong to different racial groups, social classes, and genders through a broader lens. PVEST includes the coping strategies that individuals use to deal with their stress levels, whether these coping skills are adaptive or maladaptive.

PVEST Potential to Promote Math Identity

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Black American youth are socialized and taught messages about what it means to do math and what it means to be a success or a failure at math. Martin (2007) believed that the experiences that individuals and groups have within a variety of contexts such as school, family, peer groups, and the workplace legitimize or inhibit meaningful participation in math. Black American youth are socialized through their parents, teachers, and other important adults around them the worthiness of math. The information received about math and math learning determines if students believe they are able to become math learners.

Many Black American adults were tracked out of higher-level math courses in school or discouraged from majoring in mathematics or the sciences unless they were seen as superior and able to excel in math (Martin, 2007). These Black American adults who were not identified as excelling in math, often go on to place a lower value on math to their children. If these Black American adults who did not excel in math have children that do excel in math, they often must rely on others in the community to help push their child to continue to see themselves as a math learner (Hill Morton, 2014).

Mathematical identity is a stable and continuous overarching construct that is developed through identity development and can change over time based on a person's experiences and perceptions (English-Clarke, Slaughter-Defoe, & Martin, 2012). Within the PVEST framework of identity formation, mathematical identity could be viewed as an identity that forms over time, developing from one's risks (such as learning difficulties related to math) or protective factors (such as a math enriched environment and family supports), and maladaptive and adaptive coping strategies (such as avoiding novelty or debugging strategies). Adolescents' attitudes about math learning are closely related to their mathematical identities. Mathematics identity has the ability to change over time, and adolescents are able to increase their belief in being a math

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learner if they experience situations in which they can see the usefulness of math outside of the classroom and into their real life.

PVEST Role in Building Resiliency

Over the past two decades research has shown resilience to be an important outcome for racial and ethnic minority adolescents. Resilient youth demonstrate positive outcomes in their academic trajectories and psychosocial processes (Taylor, 2010). Resilience is defined as a dynamic process encompassing positive adaptation within the context of significant adversity (Luther, Cicchetti, & Becker, 2000). Luthar (2006) found that resiliency may be domain specific, with an adolescent being resilient in one area while remaining vulnerable in another. Those adolescents who experience multiple adverse conditions such as lower socioeconomic status, poor parental mental health, maltreatment, and community violence must be highly resilient in order to thrive in those environments. PVEST helps us to understand the role of risk contributors and stress engagement in the role of developing reactive coping methods in adolescents. Scholars and the media have often touted those children who are able to survive and thrive in high risk environments as special, while ignoring the adaptational skills and systems used by highly resilient children (Schmitt, Branscombe, Postmes, & Garcia, 2014).

Resiliency in the Face of Adversity

The term resilience in socio-ecological literature also appears as essentially equal to social, intentional stressors (Pizzo, 2015). Schooling has long been a way of reproducing the social order as a maintenance of power and displaying the dominant culture's beliefs. This restricts minorities from acquiring resources for social mobility and becoming successful members of their communities. Schooling in the United States is often governed by teachers within a classroom setting that is based on normalized standards of the dominant class (Bourdieu

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& Passeron, 1977). This is especially true for the teaching of mathematics. When adolescents are faced with going to schools that don't have qualified math teachers, they are encountering variables that can help create math deficits and reduce the likelihood of students seeing themselves as math learners. Lewis (2004) explained that schools are sites of identity formation, that through racial imbalances can continue to distinguish Whites from non-Whites through markers of "otherness".

Carter (2005) argues that a lack of success in minority students is the consequence of cultural marginalization, not of students rejecting success or lacking the ability. This means that the cultural norms embedded in the language and practices of schools do not reflect the experiences or cultural expectations of Black American students. As a result of this, many Black Americans and other minority students feel alienated from school, become disengaged, and consequently do not experience success (Calhoun, Snodgrass Rangel, & Coulson, 2019). Often schools do not recognize the different ways that families, social networks, and the community are involved in a child's learning and thus restrict the ways that parents can be involved in their children's schooling (Mapp, 2003; Williams & Bryan, 2012).

Risk Contributions

Research has shown us that minority students are at risk of experiencing negative academic outcomes due to specific stressors they experience which affect all aspects of the Black American students lives. Historical and current economic and social barriers are often not considered when understanding the influences that shape and develop how Black American students view themselves as math learners (Spencer, 2011). In recent times, Black American students are seeing images of outward discrimination constantly and easily due to the accessibility of social media. Many Black Americans also experience this racial discrimination,

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including stereotypes, labeling, discriminatory practices, and prejudices in classrooms and workplaces. These events can and do influence structural and systemic power structures, political ideologies, and institutionalized practices (Spencer, 2008).

Discrimination creates negative effects on psychological well-being, academic engagement, and performance (Schmitt, Branscombe, Postmes, & Garcia, 2014). Discrimination can act as an obstacle to Black American student achievement, as this is a time during which students are still developing their identity and coping skills. The imbalance of systemic power structures in which Black American students and their families do not have the traditional power creates an environment that can negatively impact how a student feels about identifying as a math learner (Spencer, 2008).

Racial Imbalances in Mathematics Education

While many other subjects students are taught are often easily integrated with lessons that allow Black American students to see themselves reflected in the material, math classrooms are often seen as a color-blind, race-neutral environment in which students are unable to see their cultural identity (McGee & Martin, 2011). Ignoring and not appreciating the Black American student within their cultural framework and how they will interpret math through this cultural framework, is at a disadvantage to the student. This reinforces the thought process that mathematics ability is innate, and this produces disadvantages for Black Americans and other minority children who have not traditionally had mathematics be a part of their academic culture (Battey, Leyva, Williams, Belizario, Greco, & Shah, 2017). This helps to reinforce the belief of teachers who believe that math ability is solely innate, allowing for the teacher to have less responsibility and control in encouraging student learning and encourage unconscious stereotyping (Jordan, Glenn, & McGhie-Richmond, 2010). The narratives that Whites and

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Asians are better at math are then turned into a reality in terms of how Black American and Latinx students are treated in math classrooms, the types of instruction available and what courses they are offered. This can easily turn into different testing outcomes or “achievement gaps.” Through less than quality instruction, tracking, and reduced funding, these racial ideologies about mathematics learning are continued and reinforced by the educational system (Battey Leyva, Williams, Belizario, Greco, & Shah, 2017; O’Day & Smith, 2016). Race-comparative approaches to documenting and acknowledging disparities in math education have created a pyramid with Black American children on the bottom of a racial hierarchy of mathematics abilities (Martin 2012; Mamolo & Pinto, 2015).

Protective Factors to Counter Risks

Research has shown us time and time again that minority students are at risk of experiencing negative academic outcomes due to the unique and specific stressors they experience in all aspects of life. Researchers are only recently exploring different protective factors to counter the risks that at-risk minority students are facing. Protective factors are those characteristics of a persons environments, situations, and experiences that appear to make up the psychopathology based on a individual’s risk status (Garmezy, Masten, & Tellegen, 1984). The presence of protective factors helps those students who are deemed at risk, succeed academically and go on to live successful lives (Gutman, Sameroff, & Eccles, 2002). These protective factors may help students buffer the risks that they interact with in their environments (Kajander, Zuke, & Walton, 2008).

While it would be assumed that family support would be beneficial for student success, it is particularly helpful for students from minority and low socioeconomic status communities. Research has shown us that parent involvement is positively correlated with academic success

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for most students, and the more parents are involved with a child's education, the more successful the child will be (Ingram, Wolfe, & Lieberman, 2007). The relationship between parental involvement and academic achievement is strongest if the parental involvement was defined as parental expectations for academic achievement of their child and weakest if defined as homework assistance (Wilder, 2014). Family emotional support has been found to be beneficial for academic outcomes as it promotes psychological well-being and greater student engagement (Roksa & Kinsley, 2019).

PVEST and the Current Study

Understanding that Black American students have a unique academic experience that differs from majority White American experiences, the current study looks at math computation, as a factor of resiliency, through the understanding of their academic adaptive and maladaptive coping responses. This study will focus on math computation as resiliency, using PVEST as the theoretical framework in which the discussion is interpreted.

Academic Coping Strategies

In a series of studies underway in the Cognitive and Behavioral Intervention lab at Virginia State University, Oliver Hill and his colleagues have been exploring cognitive processes undergirding math performance among African American students at different levels of development (Hill, Serpell, & Faison, 2016; 2016; Watkins, B; 2019; Watkins, Kendall Brooks, JohnFinn, Clemons, Talley, & Hopkins, 2020).. For example, in a recent dissertation evaluating that research, Watkins revealed several cognitive adaptive and maladaptive strategies associated with academic performance and adaptive and maladaptive coping strategies (Watkins, 2019). These strategies included math anxiety, academic efficacy, and math value. (Watkins, 2019). Preliminary findings from another study at Virginia State University found that

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internalized messages influence Black American students' academic achievement. Messages such as "I don't belong" are a response to culturally disseminated stereotypes of people of color and "I don't care" is an attitude cultivated early in the educational experience to protect from a sense of failure (Talley, Fife, Harris, & Hill, 2015).

Common Maladaptive Academic Strategies

Impulsivity

Impulsivity has been defined as swift action without forethought or conscious judgement, behavior without adequate thought, and the tendency to act with less forethought than most individuals with equal ability and knowledge (Hinslie & Shatzky, 1940; Smith, 1952; Dickman, 1993; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Multiple studies have found that students with greater impulsivity have lower academic achievement than their peers (Frazier, Youngstrom, Glutting, & Watkins, 2007). Impulsivity can be very helpful when a quick response is necessary, can contribute to resiliency, and willingness to engage in new stimuli (Valiente, Eisenberg, Spinrad, Haugen, Thompson, & Kupfer, 2013). This same impulsivity can also be negative when unnecessary or inappropriate impulsive responses occur (Dickman, 1993). Children with high levels of impulsivity are often diagnosed with ADHD, and can be quickly placed on a special education track, even when they may be able to be in general or even high achieving academic classrooms. (Romano, Babchishin, Pagani, Kohen, 2010).

Math Anxiety

Math anxiety is defined as feelings of tension and apprehension surrounding the manipulation of numbers and the solving of mathematical problems in academic, private, and social settings (Richardson & Suinn, 1972). More recently, Vahedi & Farrokhi (2011) defined math anxiety as negative cognitions, avoidance behaviors, and feeling pressured and inadequate

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in a performance that when combined interfere with solving math-related problems in both general life and academic situations. Powell (1990) stated that as a cultural group, Black American's do not have the expectation to perform well in mathematics, and subsequently give up on trying to succeed in mathematics if they perform poorly. Rech (1994) found that even students that have high math computation abilities have higher math anxiety than White students that have high math computation abilities, and are more likely to have negative attitudes towards math and be deterred from enrolling in higher-level math courses as they continue in their educational career.

Anxiety

Anxiety is defined as the response to prolonged, unpredictable threat, which encompasses physiological, affective, and cognitive changes (Davis, Walker, Milles, & Grillion, 2010). This means that anxiety is conceptualized as a state in which an individual is unable to instigate a clear pattern of behavior to remove or alter the event, object, or interpretation that is threatening an existing goal (Power & Dalgleish, 1999). Anxiety has been shown to be associated with increased interference from distractors in search tasks, poorer performance on measures of reading comprehension, poorer performance on mathematical problem solving, and lower scores on standardized tests of intelligence and general aptitude (Moran, 2016; Bar-Haim, Lamy, Pergamin, Batermans-Kranenburg, & van IJzendoorn, 2007; Moser, Becker, & Moran, 2012; Ashcraft & Kirk, 2001). National studies have shown that individuals with anxiety disorders are 1.4 times more likely to drop out of high school and that subclinical anxiety negatively impacts academic performance (Kessler, Foster, Saunders, & Stang, 1995; Crozier & Hostettler, 2003). Van Ameringen, Mancini, and Farvolden (2003) found that around half of 201 adult patients

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with an anxiety disorder stated that they had left school prematurely and in 24% of those patients, anxiety was given as the primary reason for leaving.

Self-Handicapping

Academic self-handicapping refers to the strategies that students use so that if they perform low in school, those circumstances, rather than their ability, are seen as the cause. (Midgley, Maehr, Hruda, Anderman, Anderman, Freeman. . . & Urdan, 2000). Schwinger et al (2014) found that the best way to improve academic performance across age groups was to focus on preventing self-handicapping. Many students try to blame the circumstances around them, especially their teachers or peers, so as not to deal with the fact that their own lack of ability caused them to do poorly on a test. This kind of thinking often encourages students to give up before they even try, so that they are able to say that their poor performance is due to the lack of studying rather than their lack of knowledge.

Avoiding Novelty

Avoiding novelty refers to a student's preference for avoiding unfamiliar or new work (Midgley et al, 2000). Often children who are not confident in their academic abilities will avoid work or learning new things because they are unsure of their ability to learn new things. These students struggle with continuing to add to what they already know due to their insecurity of not knowing if they will understand the new material. Many of these students also struggle with learning new lessons due to their unstable grasp of the previously learned lessons.

Self-Presentation

Self-presentation is also referred to as self-presentation of low achievement. This refers to a student's preference to keep peers from knowing how well they are achieving in school (Midgely, et al 2000). These students may know the information, but will not volunteer to

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answer a question because they do not want their peers to know they are smart or understand. They will often avoid participating in class if it means that other students would discover that they know a lot of information.

Adaptive Academic Strategies

Academic-Efficacy

Academic efficacy is a students' perception of their competence to do their class work (Midgley et al, 2000). Students with high academic-efficacy feel secure that they are able to learn and that they can grasp the material even if it is harder than what they are used to. These students believe that they are able to master the school work if they continue to work hard. Students with high academic efficacy are often thought to be resilient, as they do not see difficulty as a negative obstacle.

Procedural Metacognition

Procedural knowledge metacognition is the application of knowledge for the purposes of completing a procedure or process (Schraw & Dennison, 1994).. Students with high procedural knowledge can show comprehension of newly learned material by applying what they have learned to applicable circumstances. This type of student can learn through discovery, problem solving, and cooperative learning. Students with procedural knowledge know what a process is and then how to apply it to actual situations. This is especially important for understanding math, as students often have a difficult time understanding how math could be used in the real world and not just their textbooks.

Comprehension Monitoring Metacognition

Students with high levels of comprehension monitoring metacognition are able to assess their own learning or strategy use (Schraw & Dennison, 1994). These students are able to set

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goals for themselves, and then determine if they are meeting those goals. They try to adopt and apply study strategies and make sure that they are useful strategies that will help them in the long term. Comprehension monitoring is especially helpful for Black American students that are often placed in classrooms where they may not be given the opportunity to ask many questions or are assumed not to know the answer. These students are able to establish if they need more help or if they are able to continue with a teacher or school that does not have many supports for them.

Debugging Metacognition

Students that are able to think about themselves and how they learn are then able to use debugging strategies. These debugging strategies help students correct comprehension and performance errors (Schraw & Dennison, 1994). Debugging strategies include being able to and feeling comfortable asking others for help when they don't understand, as well as taking the time to review the material so that they can identify what they don't understand in order to better articulate what they need when they ask for help.

Planning Metacognition

Students that have concrete goals and look toward the future tend to have high planning abilities. These students are able to plan, set goals, and allocate resources before they begin to learn (Schraw & Dennison, 1994). This might mean thinking of multiple solutions to a problem and determining the best one, organizing their time correctly so that they are able to complete work in a timely manner, pacing themselves in order to learn and complete work, and setting specific goals before they begin a task.

Evaluation Metacognition

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A student that has high evaluation metacognitive abilities is able to gauge themselves and understand how well they might have done on an assessment (Schraw & Dennison, 1994). They tend to test themselves with review questions to make sure that they truly understand a concept.

Significance of Study

Mathematics as Resiliency

Failure is the most commonly assumed outcome for Black American students studying math, which does not leave much room for understanding how Black American students do succeed in mathematics (McGee, 2015). Powell (1990) stated that as a cultural group, Black American's do not have the expectation to perform well on mathematics, and subsequently give up on trying to succeed in mathematics if they perform poorly. This lack of research on Black American students' success in mathematics creates a belief and stereotype that Black students are unable to achieve such. Rech (1994) found that even Black American students that have high math computation abilities have higher math anxiety than White students with high math computation abilities, and are more likely to have negative attitudes towards math and be deterred from enrolling in higher level math courses as they continue their educational career.

Studies suggest that mathematics literacy in Black American students is linked to identity construction at the intersection of their racial identity and their mathematics identity (Martin, 2007). It is important for Black American students to be encouraged to pursue science, technology, engineering, and math (STEM) based courses and careers. Mathematics performance of United States elementary and secondary students lags in comparison to many other nations (Provasnik, Kastberg, Ferraro, Lemanski, Roey, & Jenkins, 2012). According to the United States Department of Labor, Black American youth were the least likely racial group to enter the field of technology (U.S. Department of Education, 2016). This is not due to students not having

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the “innate math ability” but due to continued unequal learning opportunities, lack of understanding of the risk factors surrounding Black American children, and being more likely to have inexperienced teachers (Shaw & Barbuti, 2010). Inexperienced teachers are more likely to interpret students lack of understanding as ineptitude and are often less likely to provide additional resources for students to continue to learn (Martin, 2012) In many situations, this, however, is not the case. The very act of Black American students performing mathematics is an act of resiliency.

Hypotheses

- 1) It is hypothesized that there are underlying adaptive and maladaptive coping strategies related to mathematics performance in our sample of Black American students.
- 2) Based on the literature, it is hypothesized that students with higher maladaptive coping strategies will have higher reaction times and lower accuracy on math computation than students with less maladaptive coping strategies.
- 3) A model will be generated and tested that illustrates causal pathways to mathematics performance.

Chapter 3

Methodology

Participants

Participants were from students at a Historically Black College and University in Virginia. One hundred and fifty-seven participants for this study were recruited from two different sources. There were a total of 146 participants that had complete cases. Students recruited were enrolled in the Introductory to Biology classes and all other students enrolled in classes in the psychology department. The participants in this population were between age 18 to 43 years old ($M = 20.98$, $SD = 4.01$). There were a total of 73.3% female participants ($n = 107$) and the remaining 26.7% were males ($n = 39$). The majority of participants, 91.1%, identified as being Black/African American/Caribbean ($n = 141$), 1.4% of the population identified as White, and 2.1% identified as other. Participants were given extra credit for their participation in the study.

Materials and Procedure

Survey and Computer Task

The survey was collected by the use of Qualtrics, a survey hosting website. The link was provided through text messages to participants that had signed up for the study and told to complete the survey before they did the computer task portion. Demographic information, such as the participant's age, ethnicity, and gender were collected in the survey as well.

The computer task was given in person to participants. The computer task consisted of a math task and a computer task. Participants were given instructions and explained how the

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computer task was to be answered. Participants were given 16 sample problems to practice how to answer the questions and understand the instructions.

Survey

Abbreviated Math Anxiety Scale

The Abbreviated Math Anxiety Scale is derived from factor analytical studies of the Math Anxiety Scale-Revised (Hopko, Mahadevan, Bare, & Hunt, 2003). The Abbreviated Math Anxiety Scale is a 9-item Likert-type scale from 1 (low anxiety) to 5 (high anxiety). An example of a good question to assess a participants math anxiety is “Taking an examination in a math course.” (See Appendix A for scale)

Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory is a 21-item 4-point Likert type self-report measure of anxiety (Beck, Epstein, Brown, & Steer, 1988). Sample scale statements include “numbness or tingling” and “feeling of choking.” (See Appendix B)

Barratt Impulsiveness Scale-11

The Barratt Impulsiveness Scale-11 is a 30 item 4-point Likert type self-report measure of the personality/behavioral construct of impulsiveness (Barratt, 1994). Sample scale statements include “I plan tasks carefully” and “ I don’t ‘pay attention’.” (See Appendix C)

Patterns of Adaptive Learning Scales (PALS)

(See Appendix D)

Subscales were used from the Patterns of Adaptive Learning Scales (PALS) (Midgley et al, 2000). The subscales all used a 5-point Likert scale ranging from 1= “not at all true,” to 5= “very true.”

Academic Self-Handicapping

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This refers to strategies used by students to buffer the effects of low performance by blaming the surrounding experiences than a students' lack of ability. Sample scale statements include "Some students fool around the night before a test, then if they don't do well they can say that is the reason."

Avoiding Novelty

This refers to the student's preference to avoid new or unfamiliar work. Sample statements include "I would choose classwork I knew I could do rather than work I haven't done before."

Self-Presentation

This refers to the student's preference to keep peers from knowing how well they are achieving in school. The sample statement included "I would avoid participating in class if it meant that other students would think I knew a lot."

Academic Efficacy

Five items were used to refer to a student's perception of their ability to complete their classwork. Sample scale statements include "I am certain I can master the skills taught in class this year."

Metacognitive Awareness Inventory (MAI)

(See Appendix E)

Subscales were used from the Metacognitive Awareness Inventory (Schraw & Dennison, 1994). The scales used a true or false scale.

Procedural Knowledge

Four items used to refer to the application of knowledge for the purposes of completing a procedure or process. Sample items include "I try to use strategies that have worked in the past."

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Comprehension Monitoring

Seven items were used to refer to the assessment of one's learning or strategy use.

Sample items included "I ask myself periodically if I am meeting my goals."

Debugging Strategies

Five items were used to refer to strategies used to correct comprehension and performance errors. Sample items included "I ask others for help when I don't understand something."

Planning

Seven items were used to refer to planning, goal setting, and allocating resources prior to learning. Sample items included "I pace myself while learning in order to have enough time."

Evaluation

Six items were used to refer to analysis of performance and strategy effectiveness after a learning episode. Sample items included "I summarize what I've learned after I finish."

Computer Task

Math Task and Word Task

The math task and word tasks were adapted from Lyons and Beilock (2012). Participants performed 2 different tasks (a math and a word task) in blocks. There were two levels of difficulty included for each task: hard and easy. A cue was given before each block of trials for 1500 milliseconds that indicated if the next set was a math or word task. This cue did not indicate task difficulty, but simply, using a blue or white square if the task would be math or word. Cues always preceded blocks of 4 trials each. After the cue was an 18-second interval. The 4 trials of each block were separated by a fixed interstimulus interval of 1500 milliseconds. Each trial had a 5.5-second cutoff. Participants completed 2 blocks of each task type after

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completing 16 practice trials of the easy math and word tasks. Participants pressed the letter M for correctness and the letter Z for incorrectness.

Participants verified whether math problems had been correctly solved. All math problems were in the form of $(a \times b) - c = d$; where a does not equal b , c is greater than 0 and d is greater than 0. For all easy math problems, 1 is less than or equal to a which is less than or equal to 9, 1 is less than or equal to b which is less than or equal to 9, and a times b is less than or equal to 10, and 0 is less than c which is less than or equal to 9. For example, an easy math problem might be $(3 \times 3) - 4 = 5$ (see Figure 3). For all hard math problems, 5 is less than or equal to a which is less than or equal to 9, 5 is less than or equal to b which is less than or equal to 9, and a times b is greater than or equal to 30, and 15 is less than c which is less than or equal to 19. For example, a hard problem might be $(5 \times 9) - 18 = 27$ (see Figure 4). Participants pressed M if the problem had been solved correctly and Z if the problem had been solved incorrectly.

Figure 3. Easy Math Task

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Figure 4. Hard Math Task

Participants verified whether a reversed word spelled an actual English word. For half of the words, 2 internally adjacent letters were switched so that reversing the letters would result in a nonword. For easy word problems, letter strings were always 4 letters in length. For example, if the participant saw the word *eirw*, reversing this string of letters would be *wrie*, which is not an English word and the correct response would be to press Z (see Figure 5). For hard word problems, the letter strings were always 7 letters in length. For example, if the participant saw the word *rethona*, reversing this string of letters would be another (see Figure 6). Because the letters *t* and *h* have been switched, this is not an English word and the correct response would be to press Z. Participants also pressed M if the string of letters was correct and Z if the string of letters was incorrect.

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Figure 5. Easy Word Task

Figure 6. Hard Word Task

The word task was a control task that was nonmathematical in nature, but similar to the math task in terms of how to respond and general task-set properties, as both were forced-choice verification tasks. The control task was developed to be as difficult as the hard math-task in the lower math anxiety group.

Statistical Analysis

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Descriptive analysis, discriminant analysis, and linear regression were conducted using SPSS.24.0 for Macintosh. Microsoft Excel was used for data screening and cleaning.

A discriminant analysis was used to determine if there were math computation differences amongst the psychosocial variables and agreed with the predicted groupings for maladaptive and adaptive coping strategies. Discriminant analysis predicts group membership in a categorical outcome variable (Warner, 2013). For reaction time, 3 categorical groups were created from dividing the reaction time into thirds, and they were fastest, slower, and slowest with two discriminant functions to predict group member outcome. For accuracy, 2 categorical groups were created from using a median split, and they were more and less accurate, with one discriminant function to predict group member outcome.

Chapter 4

Results

Data Screening

Data Screening (Warner, 2013)

Discriminant Analysis- Preliminary screening indicated that scores on all 12 variables were approximately normally distributed. Group membership was assumed to be mutually exclusive. A pooled within-groups matrix was calculated to assess whether there was multicollinearity among these predictor variables. No correlation exceeded .7 in absolute value, with the exception of metacognitive factors procedural, comprehension, debugging, planning, and evaluation. Box's M test for possible violation of the homogeneity of within-group variance/covariance matrix was judged as nonsignificant.

Linear Regression - Prior to conducting the linear regression, Pearson correlations were performed on all psychosocial variables in order to test the assumption that the dependent variables would be correlated with each other in the moderate range. Linear regression was performed to evaluate how well planning and comprehension could predict academic efficacy and impulsivity.

Descriptive Statistics

Descriptive Statistics, including means and standard deviations of the measures, are shown in Table 1.

Table 1. Means and Standard Deviations of Predictor Variables

	Mean	SD
Debug	4.78	1.02
Planning	4.53	1.12
Evaluation	4.45	1.16
Efficacy	3.66	0.98
Procedural	4.66	1.11
Comprehension	4.52	1.13
Math Anxiety	2.66	1.00
Anxiety	1.65	0.06
Impulsivity	2.13	0.33
Self-Presentation	2.02	0.99
Avoiding Novelty	2.99	0.92
Self-Handicapping	3.13	0.86

Discriminant Analysis

A discriminant analysis was performed to determine if there are math computation differences amongst the psychosocial variables. The discriminant analysis was used to determine which psychosocial variables were able to successfully predict how quickly or the reaction time on the math task, and the relative contribution of each of these correlates.

Easy Math Reaction Time

Because there were three categorical groups, fastest, slower, and slowest, two discriminant functions were created. Discriminant function 1 had a canonical correlation of .303; thus it was weakly related to group membership. The chi-square for discriminant function 1 was not statistically significant; $\chi^2(24)=21.50$, $p=.61$. Discriminant function 2 had a canonical correlation of .224 and was also not significantly significant; $\chi^2(11)=8.37$, $p=.68$. Overall 47.6% of participants were correctly classified. Specifically, with the slowest reaction time participants being correctly classified at 54.2%, slower reaction time being correctly classified at 51.0%, and the fastest reaction time being classified at 37.5%. While neither of the discriminant functions were significant, based on an arbitrary cutoff of .50, the nature of the patterns from Table 2

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suggests that evaluation has a large enough coefficient to contribute to the scoring on function 1, and evaluation and comprehension have large enough coefficients to contribute to the scoring on function 2.

Table 2. Discriminant Functions of Easy Math Reaction Time

Variable	Function 1	Function 2	Univariate F	P Values for Univariate F
Math Anxiety	.175	-.486	1.09	.339
Impulsivity	.466	-.081	2.69	.071
Anxiety	-.239	.026	.07	.936
Self-Handicapping	-.238	.026	.11	.893
Avoiding Novelty	.160	.469	.99	.37
Self-Presentation	.019	-.184	.82	.44
Academic Efficacy	-.118	.235	1.70	.187
Procedural	-.368	.229	1.26	.286
Comprehension	-.296	-1.69	.88	.42
Debugging	-.361	.433	1.78	.173
Planning	-.499	.276	1.91	.307
Evaluation	1.39	.829	.32	.724

Hard Math Reaction Time

Because there were three categorical groups, fastest, slower, and slowest, two discriminant functions were created. Discriminant function 1 had a canonical correlation of .352; thus it was weakly related to group membership. The chi-square for discriminant function 1 was not statistically significant; $\chi^2(24)=30.41$, $p=.17$. Discriminant function 2 had a canonical correlation of .244 and was also not significantly significant; $\chi^2(11)=12.17$, $p=.35$. Overall

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47.6% of participants were correctly classified. Specifically, with the slowest reaction time participants being correctly classified at 50.0%, slower reaction time being correctly classified at 60.0%, and the fastest reaction time being classified at 47.9%. While neither of the discriminant functions were significant, based on an arbitrary cutoff of .50, the nature of the patterns from Table 3 suggests that procedural, comprehension, and evaluation has a large enough coefficient to contribute to the scoring on function 1, and evaluation, planning, debugging, and comprehension have large enough coefficients to contribute to the scoring on function 2.

Table 3. Discriminant Functions Hard Math Reaction Time

Variable	Function 1	Function 2	Univariate F	P Values for Univariate F
Math Anxiety	.042	-.240	.55	.576
Impulsivity	.294	.217	.16	.851
Anxiety	.413	-.151	1.61	.204
Self-Handicapping	.239	.108	.03	.967
Avoiding Novelty	-.350	.471	.90	.408
Self-Presentation	-.324	-.304	1.20	.304
Academic Efficacy	-.375	.273	.89	.413
Procedural	1.758	.075	.436	.648
Comprehension	-.835	.992	.07	.931
Debugging	.098	.760	.26	.768
Planning	.153	-1.038	.39	.678
Evaluation	-.942	-.953	.64	.527

Easy Math Accuracy

Because there were two categorical groups, more and less, one discriminant function was created. Discriminant function 1 had a canonical correlation of .257, thus it was weakly related to

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group membership. The chi-square for discriminant function 1 was not significantly significant; $\chi^2(12)=9.47$, $p=.66$. Overall, 58.9% of participants were correctly classified. Specifically, the scores with more accuracy were predicted at 60.8% and less accuracy predicted at 58.9%. While the discriminant function was not significant, based on an arbitrary cutoff of .50, the nature of the patterns from Table 4 suggests that math anxiety, planning, and evaluation contribute to the scoring on function 1.

Table 4. Discriminant Analysis Easy Math Accuracy

Variable	Function 1	Univariate F	P Values for Univariate F
Math Anxiety	.891	6.93	.009
Impulsivity	.198	1.31	.254
Anxiety	.055	.82	.367
Self-Handicapping	-.221	.08	.779
Avoiding Novelty	-.120	.10	.747
Self-Presentation	-.046	.05	.823
Academic Efficacy	.127	.30	.584
Procedural	-.055	.46	.499
Comprehension	.342	.24	.622
Debugging	-.310	.91	.341
Planning	-.710	.75	.388
Evaluation	.573	.07	.792

Hard Math Accuracy

Because there were two categorical groups, more and less, one discriminant function was created. Discriminant function 1 had a canonical correlation of .288, thus it was weakly related to group membership. The chi-square for discriminant function 1 was not significantly significant; $\chi^2(12)=11.95$, $p=.45$. Overall, 66.4% of participants were correctly classified. Specifically, the scores with more accuracy were predicted at 85.2% and less accuracy predicted at 37.9%. While the discriminant function was not significant, based on an arbitrary cutoff of .50, the nature of the patterns from Table 5 suggests that math anxiety contributes to the scoring on function 1.

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Table 5. Discriminant Analysis Hard Math Accuracy

Variable	Function 1	Univariate F	P Values for Univariate F
Math Anxiety	.814	4.16	.043
Impulsivity	-.387	2.01	.159
Anxiety	.118	.05	.829
Self-Handicapping	-.318	.59	.442
Avoiding Novelty	-.177	.80	.372
Self-Presentation	-.228	2.68	.104
Academic Efficacy	.468	1.67	.198
Procedural	-.390	.13	.719
Comprehension	-.098	.09	.768
Debugging	.103	.35	.553
Planning	-.070	.21	.652
Evaluation	.354	.14	.705

Data Exploration

Although all the initial hypotheses were not supported, further exploration of the data was conducted. Specifically, a Pearson correlation was conducted and indicated a significant relationship between academic efficacy and planning, $r(144)=.349$, $p=.000$. A linear regression was performed to evaluate how well academic efficacy could be predicted from planning. Findings indicated that planning significantly predicted academic efficacy, $F(1,144)=19.991$, $p=.000$. The regression equation for planning predicting academic efficacy was $Y'=2.28+.30 \times X$. The r^2 for this equation was .122; that is 12.2% of the variance in academic efficacy was predicted by planning. The significant regression still shows that planning was significantly predictive of academic efficacy in our population. The positive strength of the b coefficient in the regression equation shows that academic efficacy has a positive strength on planning, meaning that the higher planning the higher academic efficacy will be. The 95% CI for the slope to predict planning score in academic efficacy score ranged from .224 to .578. A scatter plot of the data with a 95% CI around the fitted regression line is in Figure 7.

Figure 7.

Another Pearson correlation was conducted and indicated a significant relationship between academic efficacy and comprehension, $r(144)=.383, p=.000$. A linear regression was performed to evaluate how well academic efficacy could be predicted from comprehension. Findings indicated that comprehension significantly predicted academic efficacy, $F(1,144)=24.751, p=.000$. The regression equation for comprehension predicting academic efficacy was $Y'=2.16+.33 \times X$. The r^2 for this equation was .147, showing a 14.7% variance in

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academic efficacy predicted by comprehension. This significant regression still shows that comprehension was significantly predictive of academic efficacy in our population. The positive strength of the b coefficient in the regression equation shows that academic efficacy has a positive strength on comprehension, meaning that the higher academic efficacy, the higher comprehension is likely to be. The 95% CI for the slope to predict comprehension score in academic efficacy score ranged from .266 to .618. A scatter plot of the data with a 95% CI around the fitted regression line is in Figure 8.

Figure 8.

Additionally, another Pearson correlation was conducted and indicated a significant relationship between impulsivity and planning, $r(144)=-.305, p=.000$. A linear regression was

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performed to evaluate how well impulsivity could be predicted from planning. Findings indicated that planning significantly predicted impulsivity, $F(1,144)=14.749$, $p=.000$. The regression equation for planning predicting impulsivity was $Y'=6.707 -1.025 \times X$. The r^2 for this equation was .093, showing that 9.3% of the variance in impulsivity was predicted by planning. The negative strength of the b coefficient in the regression equation shows that impulsivity has a negative impact on planning, meaning that the higher the impulsivity score, the lower the planning score will be. The 95% CI for the slope to predict planning score in impulsivity score ranged from -1.552 to -.497. A scatter plot of the data with a 95% CI around the fitted regression line is in Figure 9.

Figure 9.

Finally, a Pearson correlation was conducted and indicated a significant relationship between impulsivity and comprehension, $r(144)=-.281$, $p<.001$. A linear regression was performed to evaluate how well impulsivity could be predicted from comprehension. Findings

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indicated that comprehension significantly predicted impulsivity, $F(1,144)=12.316$, $p=.001$. The regression equation for comprehension predicting impulsivity was $Y'=6.539 - .949 \times X$. The r^2 for this equation was .079, showing that 7.9% of the variance in impulsivity was predicted by comprehension. The negative strength of the b coefficient in the regression equation shows that impulsivity has a negative impact on comprehension, meaning that the higher the impulsivity score, the lower the comprehension score will be. The 95% CI for the slope to predict comprehension score in impulsivity score ranged from -1.483 to -.414. A scatter plot of the data with a 95% CI around the fitted regression line is in Figure 10.

Figure 10.

Chapter 5

Discussion

This study sought to examine math computation, as a factor of resiliency, through the understanding of academic coping responses in Black American students.

Hypotheses

It was hypothesized that there were underlying adaptive and maladaptive coping strategies related to mathematics performance in our sample of Black American students. In the sample, results revealed that our adaptive and maladaptive coping strategies were not able to predict the math task performance. These adaptive and maladaptive coping strategies have been revealed to be significant and explored in the literature and consistent with the reactive coping strategies in research supporting PVEST (Spencer, 2006; Watkins, 2019). The PVEST framework is not one that is traditionally used for outcome factors and focuses more on the identity of the person or learner and how they apply their adaptive skills to stressors in their life (Spencer, 1997; 2008). Previous research has also been done to examine how these different factors affect emotional development and using self-regulation skills within the STEM context (Talley, Fife, Harris, & Hill, 2015; Tope-Banjoko, Davis, Morrison, Fife, Hill, & Talley, 2020). This study sought to determine if PVEST could be used to interpret math task performance through academic adaptive and maladaptive coping skills.

As PVEST is not traditionally used as a framework in which there is a defined outcome, it is not unexpected that the adaptive and maladaptive coping strategies were not able to predict the mathematics performance groupings in our sample of Black American students. PVEST has

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been used to predict academic performance in high school students as defined by GPA but included other factors such as parental involvement and attitudes towards math (Watkins, 2019; Upton Patton, Woolley, & Hong, 2012; McDermott, Umana-Taylor, Martinez-Fuentes, 2018). PVEST has also been used to predict academic future outcomes and general future outcomes based on coping skills, but it has not been used to predict specific outcomes on computation (Cunningham, Hurley, Foney, & Hayes, 2002; Cunningham, Corprew, & Becker, 2008).

While the results of the discriminant analysis did not show that the academic coping skills were able to predict the math performance, the metacognitive factors related to the understanding of one's own abilities were heavily weighted in the prediction of reaction time. Students who are able to understand how to quickly apply their learning skills and how to think about solving a math problem they have not encountered may have a stronger math identity.

Due to the first hypothesis not being supported in this study, the following hypotheses were not able to be supported. Previous research has also shown that students with higher math anxiety have faster response times and lower accuracy on a math task than those students who have lower math anxiety (Kendall Brooks, 2019). While the study was not able to support the hypothesis that students with higher maladaptive coping strategies would have higher reaction time and lower accuracy on math computation than students with less maladaptive coping strategies, previous research supports that this may be true for some coping strategies. A model was not able to be generated and tested to illustrate causal pathways to math performance due to the first hypothesis not being supported.

Exploratory Analysis

Although results from the current study were not supported by the hypothesis, significant predictive findings occurred with comprehension, planning, academic efficacy, and impulsivity.

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The current study found that comprehension and planning both significantly predicted academic efficacy. Students with high levels of comprehension are able to understand their own ability to learn and students with high levels of planning are able to plan, set goals, and allocate necessary resources before they begin to learn or. Students with high levels of academic efficacy believe that they are able to learn the material even if the material is harder than what they are used to. Similar to previous findings, students who understand how they learn and execute those abilities are more likely to persist and find value in the future success of the task they are performing (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2019).

The current study also found that comprehension and planning both significantly predicted impulsivity. Students with high levels of comprehension and planning both had a negative relationship with impulsivity. Students with high levels of comprehension are able to understand how best they learn and with high levels of planning are able to plan and set goals for their learning and application of learning, while students with high levels of impulsivity act rashly and quickly, not taking the time to best understand how to solve a problem accurately. Similar to previous findings and observations of the study, those students are less likely to persist and just guess quickly to get the task over with (Morgan, Farkas, Tufis, & Sperling, 2008).

These findings support the use of using predictions in addition to explanations in the field of psychology. The debate that psychology must focus on explanatory goals and not predictive goals gives way to understanding the value in both (Shmueli, 2010; Yarkoni & Westfall, 2017). While the study initially set out to understand how academic coping skills could predict math computation, the PVEST framework led to another prediction and understanding of the metacognitive factors comprehension and planning and the behavioral factors of impulsivity and academic efficacy.

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Limitations

The current study attempted to use discriminant analysis to predict math computation outcomes based on adaptive and maladaptive coping skills. According to Zavorka and Perrett (2011), the minimum sample size for discriminant analysis with 12 predictors would be 360 participants. Due to COVID-19, data collection was cut short, and less than half of the recommended sample size was used. Because a portion of this study was in person, data collection was unable to be continued.

Another limitation was the completion and explaining of the math task. While there was a standardized script and protocol to explain to participants how to complete the math tasks, some of the researchers did not use the script if not being monitored and participants might not have understood the instructions even after completing the practice problems. Having at least two researchers to help explain and read the script for explaining the instructions might have improved participants' understanding of how to complete the math task.

Participants completed the survey, through a Qualtrics link, before they came for the in-person portion of the study. Due to the amount of coping skills measured, the survey should have taken participants approximately 20 minutes to complete, but this survey was often completed in less than 10 minutes. The inability to assure that participants were not just clicking random buttons to complete the survey as quickly as possible may have impacted the accuracy and reliability of the participant's responses, as previous research has found that the length of the survey can cause reliability issues (Kost & Correa da Rosa, 2018).

Future Directions and Conclusions

While the results of the study did give some predictive outcomes, it did not achieve the original goal, of using PVEST as a framework to determine if academic coping skills would

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predict the outcome of a math computation test. Continuing this study in person when it is safe to do so, or modifying it so that the math-task can be done virtually would allow for the sample size to better be used for predictions. Also, looking at less predictor coping skills might have participants better and more accurately complete the survey if it is less than 10 minutes. Using the same PVEST framework can also be used to look at these same academic coping skills, but looking at more nuanced outcomes, such as overall student GPA upon graduation or job placement after one year. Looking at lifestyle outcomes and if these academic coping skills are able to predict future productive life stage outcomes can help better understand what coping skills students are using to have successful lives. Black American children and adolescents experience many risk contributors during their formative years, and the identity developed through stress engagement and reactive coping greatly decides their life outcomes. This research could be used to help future children develop academic adaptive coping mechanisms and have improved life outcomes and resiliency.

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Reference

- Ashcraft, M., & Kirk, E. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology*, 130(2), 224-237.
- Bar-Haim, Y., Lamy, D., Pergamin, L., Bakersman-Kranenburg, M., van Ijzendoorn, M. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*, 133, 1-24.
- Barratt, E. (1994). Impulsiveness and aggression. In J. Monahan & H.J. Steadman (Eds.), *The John D. and Catherine T. MacArthur Foundation series on mental health and development. Violence and mental disorder: Developments in risk assessment* (p.61-79). University of Chicago Press.
- Battey, D., Leyva, L., Williams, I., Belizario, V., Greco, R., & Shah, R. (2018). Racial (mis)match in middle school mathematics classrooms: Relational interactions as a racialized mechanism. *Harvard Educational Review*, 88(4), 455-482.
- Beck, A., Epstein, N., Brown, G., & Steer, R. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, 56(6), 893-897.
- Bourdieu, P., Passeron, J., & Nice, R. (1977). Education, society, and culture. *Trans. Richard Nice*. London. SAGE Pub.
- Bradley, D. (2019). We gotta work with what we got: School and community factors that contribute to educational resilience among African American students. *Electronic Theses and Dissertations*. 1556.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32(7), 513-531.

EXAMINING ACADEMIC COPING STRATEGIES

- Bronfenbrenner, U. (1994). Ecological models of human development. In *International Encyclopedia of Education, Vol 3, 2nd Ed.* Oxford: Elsevier.
- Calhoun, Y., Snodgrass Rangel, V., & Coulson, H. (2019). Educational resilience at risk? The challenges of attending an early college high school. *The Urban Review, 51*, 301-325.
- Carter, P. (2005). *Keepin' it real: School success beyond Black and White.* Oxford University Press.
- Claessens, A., & Engel, M. (2013). How important is where you start? Early mathematics knowledge and later school success. *Teachers College Record, 115*(6).
- Cross, C., Joseph Taylor, R., & Chatters, L. (2018). Family social support networks of African American and Black Caribbean adolescents. *Journal of Child and Family Studies 27*(9), 2757-2771.
- Crozier, W., & Hostettler, K. (2003). The influence of shyness on a children's test performance. *British Journal of Educational Psychology, 73*(3), 317-328.
- Cunningham, M., Hurley, M., Foney, D., & Hayes, D. (2002). Influence of perceived contextual stress on self-esteem and academic outcomes in African American adolescents. *Journal of Black Psychology, 28*(3), 215-233.
- Cunningham, M., Corprew, C., & Becker, J. (2008). Associations of future expectations, negative friends, and academic achievement in high-achieving African American adolescents. *Urban Education, 44*(3), 280-296.
- Cunningham, M., & Phillips Swanson, D. (2010). Educational resilience in African American adolescents. *The Journal of Negro Education, 79*(4), 473-487.
- Cyders, M., Littlefield, A., Coffey, S., & Karyadi, K. (2014). Examination of a short version of the UPPS-P Impulsive Behavior Scale. *Addictive Behaviors, 39*(9).

EXAMINING ACADEMIC COPING STRATEGIES

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2019).

Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97-140.

Davis, M., Walker, D., Miles, L., & Grillon, C. (2010). Phasic vs sustained fear in rats and humans: role of the extended amygdala in fear vs anxiety.

Neuropsychopharmacology, 35(1), 105-135.

Dickman, S. (1993). Impulsivity and information processing in the impulsive client. In W.G.

McCown, J.L. Johnson, & M.B. Shure (Eds.), *The Impulsive Client: Theory, Research, and Treatment*. (pp. 151-184). Washington, DC, American Psychological Association.

English-Clarke, T., Slaughter-Defoe, D., & Martin, D. (2012). "What does race have to do with math?" Relationships between racial-mathematical socialization, mathematical identity, and racial identity. *Contributions to Human Development*, 25, 57-79.

Fitz-Gerald, S. (2017). Stress, coping, and academic self-efficacy in first-generation college students. (Doctoral Dissertation). Retrieved from

https://digitalcommons.pcom.edu/cgi/viewcontent.cgi?article=1424&context=psychology_dissertations

Frazier, T., Youngstrom, E., Glutting, J., & Watkins, M. (2007). ADHD and achievement: Meta-analysis of the child, adolescent, and adult literatures and a concomitant study with college students. *Journal of Learning Disabilities*, 40, 49-65.

Garmezy, N., Masten, A., & Tellegen, A. (1984). The study of stress and competence in children: A building block for developmental psychopathology. *Child Development*, 55(1), 91-111.

EXAMINING ACADEMIC COPING STRATEGIES

- Gershenson, S., Holt, S., & Papageorge, N. (2015). Who believes in me? The effect of student-Teacher demographic match on teacher expectations. *Upjohn Institute Working Paper*, 15-231.
- Gutman, L., Sameroff, A., & Eccles, J. (2002). The academic achievement of African American students during early adolescence: An examination of multiple risk, promotive, and protective factors. *American Journal of Community Psychology*, 30(3), 367-399.
- Hill, O., Serpell, Z., & Faison, M. (2016). The efficacy of the LearningRx cognitive training program: Modality and transfer effects. *Learning, Instruction, and Cognition*, 84(3), 600-620.
- Hill, O., Serpell, Z., & Faison, M. (2016). Improving minority student mathematics performance through cognitive training. In L.A. Flowers, J. Moore, & L.O. Flowers (Eds.), *The Evolution of Learning: Science, Technology, Engineering, and Mathematics Education at Historically Black Colleges and Universities*, University Press of America.
- Hill Morton, C. (2014). A story of African American students as mathematics learners. *International Journal of Education in Mathematics*, 2(4), 234-245.
- Hinslie, L., & Shatzky, J. (1940). *Psychiatric Dictionary*, Oxford University Press. Google Scholar.
- Hoggard, L., Byrd, C., & Sellers, R. (2012). Comparison of African American college students' coping with racially and nonracially stressful events. *Cultural Diversity and Ethnic Minority Psychology*, 18(4), 329-339.
- Ingram, M., Wolfe, R., & Lieberman, J. (2007). The role of parents in high-achieving schools serving low-income, at-risk populations. *Education and Urban Society*, 39(4), 479-497.

EXAMINING ACADEMIC COPING STRATEGIES

- Johnson, S. (2019). A study of the disproportionality of African American males' math achievement and discipline in middle school. (Doctoral Dissertation). Retrieved from https://www.cn.edu/libraries/tiny_mce/tiny_mce/plugins/filemanager/files/Dissertations/Dissertations2019/Sonya_V_Johnson.pdf
- Jordan, A., Glenn, C., & McGhie-Richmond, D. (2010). The Supporting Effective Teaching (SET) project: The relationship of inclusive teaching practices to teachers' beliefs about disability and ability, and about their roles as teachers. *Teacher and Teacher Education*, 26(2), 259-266.
- Kajander, A., Zuke, C., Walton, G. (2008). Teaching unheard voices: Students at-risk in mathematics. *Canadian Journal of Education*, 31(4), 1039-1064.
- Kendall Brooks, L. (2019). Separating math from anxiety: The influence of math anxiety on math computation in majority African American college students. [Masters Thesis].
- Kessler, R., Foster, C., Saunders, W., & Stang, P. (1995). Social consequences of psychiatric disorders I: Educational attainment. *American Journal of Psychiatry*, 152(7), 1026-1032.
- Kost, R., & Correa da Rosa, J. (2018). Impact of survey length and compensation and validity, reliability, and sample characteristics for ultrashort, short, and long research participant perception surveys. *Journal of Clinical and Translational Science*, 2(1). 31-37.
- Lewin, K. (1935). *A dynamic theory of personality*. New York: McGraw-Hill
- Luthar, S. (2006). Resilience in development: A synthesis of research across five decades. In D. Cicchetti & D.J. Cohen (Eds.), *Developmental psychopathology: Risk, disorder, and adaptation* (p.739-795). John Wiley & Sons, Inc.
- Luthar, S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, 71(3), 543-562.

EXAMINING ACADEMIC COPING STRATEGIES

- Lyons, I., & Beilock, S. (2012). Mathematics anxiety: Separating math from the anxiety. *Cerebral Cortex*, 22(9), 2102-2110.
- Mamolo, A., & Pinto, L.E. (2015). "Risks worth taking? Social risks and the mathematics teacher. *The Mathematics Enthusiast*, 12(1).
- Mapp, K. (2003). Having their say: Parents describe why and how they are engaged in their children's learning. *School Community Learning*, 13(1), 35.
- Martin, D. (2007). Beyond missionaries or cannibals: Who should teach mathematics to African American children? *The High School Journal*, 9(1), 6-28.
- Martin, D. (2012). Learning mathematics while Black. *Educational Foundations*, 26, 47-66.
- McDermott, E., Umana-Taylor, A., & Martinez-Fuentes, S. (2018). Family ethnic socialization predicts better academic outcomes via proactive coping with discrimination and increased self-efficacy. *Journal of Adolescence*, 65, 189-195.
- McGee, E. (2015). Robust and fragile mathematical identities: A framework for exploring racialized experiences and high achievement among black college students. *Journal for Research in Mathematics Education*, 46(5), 599-625.
- McGee, E., & Martin, D. (2011). "You would not believe what I have to go through to prove my intellectual value!" Stereotype management among academically successful mathematics and engineering students. *American Educational Research Journal*, 48(6), 1347-1389.
- McGee, E.O., & Spencer, M.B. (2013). The development of coping skills for science, technology, engineering, and mathematics students: Transitioning from minority to majority environments. In C. C. Yeakey, Thompson, V.S., & Wells, A. (Eds.), *Urban ills: Post recession complexities of urban living in the twenty first century*. (pp. 351-378). Lanham, MD: Lexington Books.

EXAMINING ACADEMIC COPING STRATEGIES

- Midgley, C., Arunkumar, R., Urdan, T. (1996). "If I don't do well tomorrow, there's a reason": Predictors of adolescents' use of academic self-handicapping strategies. *Journal of Educational Psychology*, 88(3), 423-434.
- Midgley, C., Maehr, M., Hruda, L., Anderman, E., Anderman, L., Freeman, K., & Urdan, T. (2000). Manual for patterns of adaptive learning scales. Ann Arbor: University of Michigan.
- Moeller, F., Barratt, E., Dougherty, D., Schmitz, J., & Swann, A. (2001). Psychiatric aspects of impulsivity. *The American Journal of Psychiatry*, 158(11), 1783-1793.
- Moran, T. (2016). Anxiety and working memory capacity: A meta-analysis and narrative review. *Psychological Bulletin*, 142(8), 831-864.
- Morgan, P., Farkas, G., Tufis, P., Sperling, R. (2008). Are reading and behavior problems risk factors for each other? *Journal of Learning Disabilities* 41(5), 417-436.
- Morrison Gutman, L., & Midgley, C. (2000). The role of protective factors in supporting the academic achievement of poor African American students during the middle school transition. *Journal of Youth and Adolescence*, 29, 223-249.
- Moser, J. Becker, M., & Moran, T. (2012). Enhanced attentional capture in trait anxiety. *Emotion*, 12(2), 213-216.
- O'Day, J., & Smith, M. (2016). Quality and equality in American education: Systemic problems, systemic solutions. In I Kirsch. & H. Braun (Eds), *The Dynamics of Opportunity in America*.(pp. 297-358). Springer, Cham.
- Perron, N. (2017). Brofenbrenner's Ecological Systems Theory. In W. Killiam & S. Degges-White (Eds.), *College Student Development* (pp.197-210).

EXAMINING ACADEMIC COPING STRATEGIES

- Pizzo, B. (2015). Problematizing resilience: Implications for planning theory and practice. *Cities*, 43, 133-140.
- Powell, L. (1990). Factors associated with the underrepresentation of African-American's in mathematics and science. *Journal of Negro Education*, 59(3), 292-297.
- Power, M., & Dalgleish, T. (1999). Two routes to emotion: Some implications of multi-level theories of emotion for therapeutic practice. *Behavioral and Cognitive Psychotherapy*, 27(2), 129-141.
- Provasnik, S., Kastberg, D., Ferraro, D., Lemanski, N., Roey, S., & Jenkins, F. (2012). Highlights from TIMSS 2011: Mathematics and science achievement of US fourth-and-eighth-grade students in an international context. NCES 2013-009. *National Center for Education Statistics*.
- Reardon, S., Weathers, E., Fahle, E., Jang, H., & Kalogrides, D. (2019). Is separate still unequal? New evidence on school segregation and racial academic achievement gaps (CEPA Working Paper No. 19-06). Retrieved from Stanford Center for Education Policy Analysis: <http://cepa.stanford.edu/wp19-06>
- Rech, J. (1994). A comparison of the mathematics attitudes of Black students according to grade level, gender, and academic achievement. *The Journal of Negro Education*, 63(2), 212-220.
- Richardson, F., & Suinn, R. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counseling Psychology*, 19(6), 551.
- Romano, E., Babchishin, L., Pagani, L., & Kohen, D. (2010). School readiness and later achievement: replication and extension using a nationwide Canadian survey. *Developmental Psychology*, 46(5), 995.

EXAMINING ACADEMIC COPING STRATEGIES

- Roska, J., & Kinsley, P. (2019). The role of family support in facilitating academic success of low-income students. *Research in Higher Education, 60*(4), 415-436.
- Ryan, D.P.J. (2001). Bronfenbrenner's ecological systems theory. Retrieved May 11, 2020.
- Schmitt, M., Branscombe, N., Postmes, T., Garcia, A. (2014). The consequences of perceived discrimination for psychological well-being: A meta-analytic review. *Psychological Bulletin, 140*(4), 921.
- Schraw, G., & Dennison, R. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*(4), 460-475.
- Shaw, E., & Barbuti, S. (2010). Patterns of persistence in intended college major with a focus on STEM majors. *NACADA Journal, 30*(2), 19-34.
- Shmueli, G. (2010). To explain or predict? *Statistical Science, 25*(3), 289-310.
- Skinner, E., Pitzer, J., & Steele, J. (2013). Coping as a part of motivational resilience in school: A multidimensional measure of families, allocations, and profiles of academic coping. *Educational and Psychological Measurement, 73*(5), 803-835.
- Slaughter-Defoe, D. T. (1995). Revisiting the concept of socialization: Caregiving and teaching in the 90s-A personal perspective. *American Psychologist, 50*(4), 276-286.
- Smith, A., Black, S., & Hooper, L. (2017). Metacognitive knowledge, skills, and awareness: A possible solution to enhancing academic achievement in African American adolescents. *Urban Education, 00*(0), 1-15.
- Smith, L. (1952). *A Dictionary of Psychiatry for the Layman*, London, Maxwell.
- Smith, S. (2017). Supporting math anxiety and resilience together: An evaluation of a program Targeting math learning disabilities and math anxiety. *Learning Disabilities Association of Niagara Region, Spring 2017*.

EXAMINING ACADEMIC COPING STRATEGIES

- Spence, D., & Usher, E. (2007). Engagement with mathematics courseware in traditional and online remedial learning environments: Relationship to self-efficacy and achievement. *Journal of Educational Computing Research*
- Spencer, M.B. (1995). Old issues and new theorizing about African-American youth: a phenomenological variant of ecological systems theory. In R. L. Taylor (Ed.), *Black youth: Perspectives on their status in the United States* (pp. 37-69). Westport, CT: Praeger.
- Spencer, M.B. (2006). Phenomenology and ecological systems theory: Development of diverse Groups. In R.M. Lerner & W. Damon (Eds.), *Handbook of child psychology, vol. 1: Theoretical models of human development, 6th ed.* (pp. 829-893). New York: Wiley Publishers.
- Spencer, M.B. (2008). What does 'acting white' really mean? Racial identity, adolescent development, and academic achievement among African American youth. In J. Ogbu (Ed), *Minority Status, Oppositional Culture, and Schooling*, 222-239. New York: Routledge.
- Spencer, M.B. (2011). American identity: Impact of youths' differential experiences in society on their attachment to American ideals. *Applied Developmental Science* 15(2), 61-69.
- Spencer, M.B., Dupree, D., & Hartmann, T. (1997). A Phenomenological Variant of Ecological Systems Theory (PVEST): A self-organization perspective in context. *Development and Psychopathology*, 9, 817-833.
- Swanson, D.P., Spencer, M.B., Harpalani, V., Dupree, D., & Noll, E. (2003). Psychosocial development in racially and ethnically diverse youth: Conceptual and methodological challenges in the 21st century. Retrieved from http://repository.upenn.edu/gse_pubs/2

EXAMINING ACADEMIC COPING STRATEGIES

- Talley, C., Fife, J., Harris, T., & Hill, O. (2015). Increasing achievement by strengthening resilience: An ecologically-based intervention for African American students. In L. Drakeford (Ed), *The Race Controversy in American Education*, Prager Publishing.
- Taylor, S. (2006). Tend and befriend: Biobehavioral bases of affiliation under stress. *Current Directions in Psychological Science*, 15, 273-277.
- The Nation's Report Card. (2019). National Results Overview. *The Nation's Report Card*
https://www.nationsreportcard.gov/reading_math_g12_2015/#mathematics
- Tope-Banjoko, T., Davis, V., Morrison, K., Fife, J., Hill, O., & Talley, C. (2020). Academic resilience in college students: Relationship between coping and GPA. *Anatolian Journal of Education*, 5(2), 109-120.
- Tsoi-A-Fatt Bryant, R. (2015). College preparation for African American students: Gaps in the high school educational experience. *CLASP*.
- Upton Patton, D., Woolley, M., & Hong, J. H. (2012). Exposure to violence, student fear, and low academic achievement: African American males in the critical transition to high school. *Children and Youth Services Review*, 34(2), 388-395.
- US Department of Education Office for Civil Rights. (2014). Civil rights data collection data Snapshot: College and career readiness. *Department of Education Data Snapshot*, 3.
- Vahedi, S., & Farrokhi, F. (2011). A confirmatory factor analysis of the structure of abbreviated math anxiety scale. *Iranian Journal of Psychiatry*, 6(2), 47.
- Valiente, C., Eisenberg, N., Spinrad, T., Haugen, R., Thompson, M., & Kupfer, A. (2013). Effortful control and impulsivity as concurrent and longitudinal predictors of academic achievement. *The Journal of Early Adolescence*, 33(7), 946-972.

EXAMINING ACADEMIC COPING STRATEGIES

- Van Amerigan, M., Mancini, C., & Farvolden, P. (2003). The impact of anxiety disorders on educational achievement. *Journal of Anxiety Disorders*, 17(5), 561-571\
- Warner, R. (2013). Applied statistics: from bivariate through multivariate techniques. Sage Publications, Inc.
- Watkins, B. (2019). A model of academic resilience: Examining academic coping responses among African American students between gender and across development. (Doctoral Dissertation).
- Watkins, B., Kendall Brooks, L., JohnFinn, S., Clemons, K., Talley, C., & Hopkins, R. (2020). More than just math: The challenges and benefits of intervention in under resourced school districts utilizing the Southern Initiative of the Algebra Project approach. [In submission].
- Wilder, S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review*, 66(3), 377-397.
- Williams, D., Priest, N., & Anderson, N. (2016). Understanding associations between race, socioeconomic status and health: Patterns and prospects. *Health Psychology*, 35(4), 407-411.
- Williams, J., & Bryan, J. (2012). Overcoming adversity: High-achieving African American youth's perspectives on educational resilience. *Journal of Counseling and Development*, 91(3), 291-300.
- Yarkoni, T., & Westfall, J. (2017). Choosing prediction over explanation in psychology: Lessons from machine learning. *Perspectives on Psychological Science*, 12(6), 1100-1122.
- Zavorka, S., & Perrett, J. (2011). Minimum sample size considerations for two-group linear and quadratic discriminant analysis with rare populations. *Communications in Statistics-Stimulation and Computation*, 43(7), 1726-1739.

EXAMINING ACADEMIC COPING STRATEGIES

Zorrilla, E., & Koob, G. (2019). Impulsivity derived from the dark side: Neurocircuits that contribute to negative urgency. *Frontiers of Behavioral Neuroscience*.

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Appendix A

Abbreviated Math Anxiety Scale

Please click on the circle with the answer that best describes how anxious you would feel in each situation described below.

	1=Low Anxiety	2=Some Anxiety	3=Moderate Anxiety	4=A lot of Anxiety	5=High Anxiety
1. Having to use the tables in the back of a math book	☐	☐	☐	☐	☐
2. Thinking about an upcoming math test one day before.	☐	☐	☐	☐	☐
3. Watching a teacher work an algebraic equation on the blackboard.	☐	☐	☐	☐	☐
4. Taking an examination in a math course	☐	☐	☐	☐	☐
5. Being given a homework assignment of many difficult problems which is due the next class meeting.	☐	☐	☐	☐	☐
6. Listening to a lecture in math class	☐	☐	☐	☐	☐
7. Listening to another student explain a math formula	☐	☐	☐	☐	☐
8. Being given a "pop" quiz in a math class.	☐	☐	☐	☐	☐
9. Starting a new chapter in a math book.	☐	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Appendix B

Beck Anxiety Inventory (BAI)

Read each statement and select the response that best fits you.

	Not at all	Mildly	Moderately	Severely
Difficulty breathing	☐	☐	☐	☐
Difficulty sleeping at night	☐	☐	☐	☐
Dizzy or lightheaded	☐	☐	☐	☐
Face flushed	☐	☐	☐	☐
Faint	☐	☐	☐	☐
Fear of dying	☐	☐	☐	☐
Fear of losing control	☐	☐	☐	☐
Fear of the worst happening	☐	☐	☐	☐
Feeling hot	☐	☐	☐	☐
Feelings of choking	☐	☐	☐	☐
Hands trembling	☐	☐	☐	☐
Heart pounding or racing	☐	☐	☐	☐
Indigestion or discomfort in abdomen	☐	☐	☐	☐
Nervous	☐	☐	☐	☐
Numbness or tingling	☐	☐	☐	☐
On edge	☐	☐	☐	☐
Racing thoughts	☐	☐	☐	☐
Shaky	☐	☐	☐	☐
Sweating (not due to heat)	☐	☐	☐	☐
Terrified	☐	☐	☐	☐
Unable to relax	☐	☐	☐	☐
Unsteady	☐	☐	☐	☐
Wobbliness in legs	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Appendix C

Barratt Impulsiveness Scale-11

	Rarely/Never	Occassionally	Often	Always/Always
I plan tasks carefully	☐	☐	☐	☐
I do thinks without thinking	☐	☐	☐	☐
I make-up my mind quickly	☐	☐	☐	☐
I am happy-go-lucky	☐	☐	☐	☐
I don't "pay attention"	☐	☐	☐	☐
I have "racing thoughts"	☐	☐	☐	☐
I plan trips well ahead of time	☐	☐	☐	☐
I am self controlled	☐	☐	☐	☐
I concentrate easily	☐	☐	☐	☐
I save regularly	☐	☐	☐	☐
I "squirm" at plays or lectures	☐	☐	☐	☐
I am a careful thinker	☐	☐	☐	☐
I plan for job security	☐	☐	☐	☐
I say things without thinking	☐	☐	☐	☐
I like to think about complex problems	☐	☐	☐	☐
I change jobs	☐	☐	☐	☐
I act on"impulse"	☐	☐	☐	☐
I get easily bored when solving thought problems	☐	☐	☐	☐
I act on the spur of the moment	☐	☐	☐	☐
I am a steady thinker	☐	☐	☐	☐
I change residences	☐	☐	☐	☐
I buy things on impulse	☐	☐	☐	☐
I can only think about one think at a time	☐	☐	☐	☐
I change hobbies	☐	☐	☐	☐
I spend or charge more than I earn	☐	☐	☐	☐
I often have extraneous thoughts when thinking	☐	☐	☐	☐
I am more interested in the present than the future	☐	☐	☐	☐
I am restless at the theatre or lectures	☐	☐	☐	☐
I like puzzles	☐	☐	☐	☐
I am future oriented	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Appendix D

Patterns of Adaptive Learning

Avoiding Novelty

The following questions are about the work you do in class. Please select the answer that best describes how you feel.

	1 Not at all True	2	3 Somewhat True	4	5 Very True
7. I would prefer to do class work that is familiar to me, rather than work I would have to learn how to do.	☐	☐	☐	☐	☐
20. I don't like to learn a lot of new concepts in class.	☐	☐	☐	☐	☐
23. I prefer to do work as I have always done, rather than those I haven't thought about before.	☐	☐	☐	☐	☐
35. I like academic concepts that are familiar to me, rather than those I haven't thought about before.	☐	☐	☐	☐	☐
40. I would choose class work I knew I could do, rather than work I haven't done before.	☐	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Self-Presentation

The following questions are about the work you do in class. Please select the answer that best describes how you feel.

	1 Not At All	2	3 Somewhat True	4	5 Very True
2. I would avoid participating in class if it meant that other students would think I know a lot.	☐	☐	☐	☐	☐
5. If other students found out I did well on a test, I would tell them it was just luck even if it wasn't the case.	☐	☐	☐	☐	☐
21. If I wouldn't volunteer to answer a question in class if I thought other students would think I was smart.	☐	☐	☐	☐	☐
24. If I did well on a school assignment, I wouldn't want other students to see my grade.	☐	☐	☐	☐	☐
27. If I were good at class work, I would try to do my work in a way that didn't show it.	☐	☐	☐	☐	☐
46. One of my goals in class is to avoid looking smarter than other kids.	☐	☐	☐	☐	☐
37. One of my goals in class is to avoid looking smarter than other kids.	☐	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Academic Efficacy

Please select the answer that best describes how true each statement is for you.

	1 Not At All	2	3 Somewhat True	4	5 Very True
1. I'm certain I can master the skills taught in class this year.	☐	☐	☐	☐	☐
11. I'm certain I can figure out how to do the most difficult class work.	☐	☐	☐	☐	☐
52. I can do almost all the work in class if I don't give up.	☐	☐	☐	☐	☐
56. Even if the work is hard, I can learn it.	☐	☐	☐	☐	☐
58. I can do even the hardest work in this class if I try.	☐	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

Self-Handicapping

Please select the best answer that best describes how true each statement is for you.

	1 Not At All	2	3 Somewhat True	4	5 Very True
12. Some students fool around the night before a test. Then if they don't do well, they can say that is the reason.	☐	☐	☐	☐	☐
16. Some students purposely get involved in a lot of activities. Then if they don't do well on their classwork, they can say it is because they involved in other things.	☐	☐	☐	☐	☐
18. Some students look for reasons to keep them from studying (not feeling well, having to help their parents, etc). Then if they don't do well on their classwork they can say this is the reason.	☐	☐	☐	☐	☐
42. Some students let their friends keep them from paying attention in class or from doing their homework. Then if they don't do well, they can say their friends kept them from working.	☐	☐	☐	☐	☐
44. Some students purposely don't try hard in class. Then if they don't do well, they can say it is because they didn't try.	☐	☐	☐	☐	☐
47. Some students put off doing their classwork until the last minute. Then if they don't do well on their work, they can say that is the reason.	☐	☐	☐	☐	☐

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Appendix E

Metacognitive Awareness Inventory

Think of yourself as a learner. Read each statement carefully. Consider the statement as it generally applies to you when you are in the role of a learner (student, attending classes, university, etc).

	Never	Rarely	Sometimes	Often
2. I consider several alternatives to a problem before I answer.	☐	☐	☐	☐
3. I try to use strategies that have worked in the past.	☐	☐	☐	☐
4. I pace myself while learning in order to have enough time.	☐	☐	☐	☐
5. I understand my intellectual strengths and weaknesses.	☐	☐	☐	☐
6. I think about what I really need to learn before I begin a task.	☐	☐	☐	☐
7. I know how well I did once I finish a test.	☐	☐	☐	☐
8. I set specific goals before I begin a task.	☐	☐	☐	☐
9. I slow down when I encounter important information.	☐	☐	☐	☐
10. I know what kind of information is most important to learn.	☐	☐	☐	☐
11. I ask myself if I have considered all options when solving a problem.	☐	☐	☐	☐
12. I am good at organizing information.	☐	☐	☐	☐
13. I consciously focus my attention on important information.	☐	☐	☐	☐

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14. I have a specific purpose for each strategy I use.	☐	☐	☐	☐
15. I learn best when I know something about the topic.	☐	☐	☐	☐
16. I know what the teacher expects me to learn.	☐	☐	☐	☐
17. I am good at remembering information.	☐	☐	☐	☐
18. I use different learning strategies depending on the situation.	☐	☐	☐	☐
19. I ask myself if there was an easier way to do things after I finish a task.	☐	☐	☐	☐
20. I have control over how well I learn.	☐	☐	☐	☐
21. I periodically review to help me understand important relationships.	☐	☐	☐	☐
22. I ask myself questions about the material before I begin.	☐	☐	☐	☐
23. I think of several ways to solve a problem and choose the best one.	☐	☐	☐	☐
24. I summarize what I've learned after I finish.	☐	☐	☐	☐
25. I ask others for help when I don't understand something.	☐	☐	☐	☐
26. I can motivate myself to learn when I need to.	☐	☐	☐	☐
27. I am aware of what strategies I use when I study.	☐	☐	☐	☐
28. I find myself analyzing the usefulness of strategies while I study.	☐	☐	☐	☐
29. I use my intellectual strengths to compensate for my weaknesses.	☐	☐	☐	☐

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30. I focus on the meaning and significance of new information.	☐	☐	☐	☐
31. I create my own examples to make useful information more meaningful.	☐	☐	☐	☐
32. I am a good judge of how well I understand something.	☐	☐	☐	☐
33. I find myself using helpful learning strategies automatically.	☐	☐	☐	☐
34. I find myself pausing regularly to check my comprehension.	☐	☐	☐	☐
35. I know when each strategy I will use be most effective.	☐	☐	☐	☐
36. I ask myself how well I accomplish my goals once I'm finished.	☐	☐	☐	☐
37. I draw pictures or diagrams to help me understand while learning.	☐	☐	☐	☐
38. I ask myself if I have considered all options after I solve a problem.	☐	☐	☐	☐
39. I try to translate new information into my own work.	☐	☐	☐	☐
40. I change strategies when I fail to understand.	☐	☐	☐	☐
41. I use the organizational structure of the text to help me learn.	☐	☐	☐	☐
42. I read instructions carefully before I begin a task.	☐	☐	☐	☐
43. I ask myself if what I'm reading is related to what I already know.	☐	☐	☐	☐

EXAMINING ACADEMIC COPING STRATEGIES

44. I reevaluate my assumptions when I get confused.	☐	☐	☐	☐
45. I organize my time to best accomplish my goals.	☐	☐	☐	☐
46. I learn more when I am interested in the topic.	☐	☐	☐	☐
47. I try to break studying down into smaller steps.	☐	☐	☐	☐
48. I focus on overall meaning rather than specifics.	☐	☐	☐	☐
49. I ask myself questions about how well I am doing while I am learning something new.	☐	☐	☐	☐
50. I ask myself if I learned as much as I could have once I finish a task.	☐	☐	☐	☐
51. I stop and go back over new information that is not clear.	☐	☐	☐	☐
52. I stop and reread when I get confused.	☐	☐	☐	☐