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Black and Brown Students' Mathematics Anxiety in Elementary School:
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A master's thesis submitted to the Graduate Faculty in Liberal Studies in partial fulfillment of
the requirements for the degree of Master of Arts, The City University of New York

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by

Mariana Edyn Winnik

This manuscript has been read and accepted for the Graduate Faculty in Liberal Studies in satisfaction of the thesis requirement for the degree of Master of Arts.

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ABSTRACT

Black and Brown Students' Mathematics Anxiety in Elementary School:
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by

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Children navigate their world and are constantly making meaning of their experiences. Through this meaning making, children are also constructing their identities. Black and Brown children have an added layer of identity construction compared to their White peers. Black and Brown students develop their racial identity in conjunction with multiple other identities. This paper focuses specifically on how Black and Brown students construct a "mathematics identity" that is meaningful to their racial identity in order to help lessen their mathematics anxiety. I argue that the use of Restorative Justice Circles (RJC) in classrooms will allow for students to bring their own identity into the communal space of the classroom while also fostering the construction of a mathematics identity. Through the use of critical concepts of care, educators can create a more reciprocal relationship with their students. RJC allow students to better understand who they are, what they identify with, what that means for them in the world, and how they view themselves in relation to math content learning. Black and brown students need more spaces in school where they are able to talk about their identity, including their identity in relation to mathematics learning. A proposal is offered to use these concepts to improve their relationships and levels of trust with their teacher and peers and to help them feel intrinsically connected with their mathematics work. I believe that RJC, critical concepts of care, and providing students with tools to address their anxiety is the biggest precursor to Black and Brown students feeling success in the mathematics classroom.

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Learning occurs without any intention. It is a process in which individuals are constantly making sense of what they see, hear, smell, taste, and feel around us. The senses inform our thinking, which in turn informs our decision-making and sense of belonging. However, our sense of belonging shifts with each experience we have. Lived experiences of students inform their identity development. As Black and Brown students progress through childhood and adolescence, they begin to question who they are and what they aspire to be. It can be argued that all students are faced with challenges as they progress through school and must navigate their changing bodies and minds to be able to continue to form an idea of who they are. However, not all students question who they are racially or ethnically. White students have the privilege of only having to consider who they are in relation to the world and not to any particular racial group.

One challenge that affects students of all demographic groups is mathematics anxiety. This type of anxiety is specifically related to math learning. It affects how students approach math tasks, think about math, and view themselves as “doers” of mathematics. Mathematics anxiety is an under-researched facet of general anxieties that students experience that requires more attention from educators in order to ensure that students are not deterred from learning mathematics and have the potential to pursue careers in STEM in their future. Although, mathematics anxiety affects a wide range of students of diverse backgrounds, I argue that the mathematics anxiety of Black and Brown students is especially important to address. Black and Brown students face adverse challenges in school and that they constantly renegotiating intersecting racial, ethnic, and academic identities. Thus, Black and Brown students specifically must be provided a way for them to construct a mathematics identity to feel that their math learning is a part of their inherent identity.

Educators must be equipped with the appropriate tools to be able to help Black and Brown students feel connected to the learning they are doing and their own intersecting identities. I argue that the understanding, adoption, and consistent use of critical concepts of care, hope, and love aid Black and Brown students in building a reciprocal, caring, and hopeful relationship with their teacher. Through using these concepts, teachers show their students that they continue to have high, yet attainable, expectations for their learning, believe in their abilities no matter what behaviors are exhibited, and that no matter what, the teacher is there to support them and help them feel successful. But how do educators build in time into their busy teaching schedules to ensure students have an opportunity to discuss their feelings in relation to mathematics to aid them in constructing a mathematics identity? I propose that one tool teachers can use in their classrooms is Restorative Justice Circles.

Restorative Justice Circles (RJC) is a culturally responsive community building and learning structure. RJC have been used in multiple forms to address punitive measures to manage misbehaviors. Punishment in the traditional sense requires identifying the wrongdoer and prosecuting them with some form of punishment. RJC help create a shift in the way that educators “punish” their students. By using RJC, educators and students are equipped with the tools to create a space for students to be able to recognize undesirable behaviors and address any harm that may have been caused by a student. The goal of this paper is to explore the possibilities and practices of Restorative Justice to foster a safe space for community identity, racial identity, and mathematics identity to aid Black and Brown students in their journey through school, specifically in mathematics classrooms. I believe that helping students construct a mathematics identity is an imperative precursor to their success in mathematics. In the last later section of this paper I present this as a proposal for addressing math anxiety but it is first

necessary to review the state of our knowledge on identify formation in children and mathematics anxiety.

Identity Construction of Black and Brown Students in Schools

United States' society and its institutions are still structured to favor White students. White students have more positive role models, mirrors, and affirmations to identity with, whereas Black and Brown students must constantly face challenges to find positive role models who are praised in society. The way society views Black and Brown adolescents as members of a community affect the way they view themselves. "Black [and Brown] children are exposed to and absorb many of the beliefs and values of dominant White culture, including the idea that Whites are the preferred group in US society. The stereotypes, omissions, and distortions that reinforce notions of White superiority are breathed in by Black [and Brown] children as well as White [children]" (Tatum, 2017). This is detrimental to Black and Brown adolescents' identity construction. Black and Brown children must constantly toggle with messages of beauty standards, intellect, and experiences of White people and struggle to connect to the symbolic representation of how "people" should be. However, this symbolic representation often lacks that of Black and Brown people.

In my own life, as a Puerto-Rican woman of color, I've struggled with my own identity construction due to others' perceptions of myself. For example, I have naturally curly hair, and, as an adult, I've realized that when my hair is straight, I am treated differently than when it is curly. Differently in this example is synonymous with more positively. The majority of the comments I've received seem to be coming from a good place, however many of them end up being microaggressions against me. When White people ask me, "Why do you look so pretty today?" when my hair is straight, it makes me question where the comment is really coming

from. It is easy to internalize these comments as, “You’re only pretty when your hair is straight.” No matter how much confidence and awareness of my identity I have, these comments start to chip away and leave me to question my own ideas of beauty standards. The answer to the question, however, is I look so pretty because those who see me and treat me differently when my hair is straight have been socialized to absorb Eurocentric values including the idea that beauty is based on Eurocentric values of beauty.

These types of comments occur very often against Black and Brown people and exhibit a more indirect form of racism. Lopez (2003a), as quoted in Rolón-Dow (2005), outlines how “modern-day race and racism operate in such subtle ways that we often fail to see how racialized practices and beliefs influence institutions and relationships”. This “modern-day racism” manifests in different ways towards Black and Brown people. It is common that comments and interactions between White and Black and Brown people result in microaggressions. Microaggressions are defined as “brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color” (Sue et al, 2007). These comments tend to be well intentioned by the person saying them, but usually are loaded with underlying racial slights. For example, simply asking a Person of Color “where are you from?” can be considered a microaggression because the person asking assumes that they are a foreigner because of their skin color, and not American. Another example also includes people who claim, “I don’t see color” when talking to a Person of Color. In making this statement, it gives a message that the Person of Color isn’t seen for their true identity and therefore the person making the comment cannot be racist because they do not see color.

This study included diverse participants of color to determine how they felt after a microaggression and how the conversation was handled with professors to address it. The authors of this study found that:

Our participants believed that whether the difficult dialogue was facilitated or hindered seemed to depend upon the racial awareness, knowledge, and skills of the instructor. When the instructor seemed comfortable with addressing race issues, validated feelings experienced by students of color, legitimized a different racial reality, and exhibited good communication and facilitation skills, difficult dialogues proved a valuable learning experience (Sue et al, 2007).

This is important to consider when thinking about how Black and Brown students are affected by their teacher's lack skills and communication around issues of race. How can we expect educators to address microaggressions in the classroom setting when educators themselves exhibit them and lack basic knowledge on how to conduct difficult conversations around race and racism? The authors of this study argue that educators must be provided explicit training in their education programs to be better able to address such situations in the classroom. This is imperative for educators who will employ RJC as a tool to help students construct an intersecting mathematics identity (MI) with students' diverse racial, cultural, and ethnic identities.

Sadly, it is not only White people who are socialized to believe these things. Many Black and Brown people subsequently are influenced and exposed to these ideas of dominant White culture. Comments like these have many implications on Black and Brown people and stem from systemic issues that are difficult to fix on a local level. We are constantly constructing and reconstructing our identities through making meaning from our daily experiences. If I struggle with microaggressions on a regular basis, it is clear that Black and Brown youths' perceptions of themselves are affected by the ways in which society views them.

This struggle for identity construction (racial, academic, or otherwise) occurs much sooner than the adolescent years. Students as young as 5 and 6 years old become increasingly

aware or societal, racial, and gender norms that affect the way they see themselves as individuals and members of other identifying groups. For example, Martin & Ruble (2010) studied gender-development in young children and found an increasing awareness of status differences and discrimination with age. As early as 6 years old, children associate higher status jobs with being male and lower status jobs with being female. Research has shown that there are three different ways that children in Kindergarten respond to gender norm violations: correction, ridicule, and identity negation. This could include children shaming others for using a toy that is normally associated with the opposite gender, or simply telling a boy, for example, that he shouldn't play with dolls because they are "meant for girls". Although, various studies show that, as children get older, gender prejudices and discrimination vary across development. However, children are constant observers who are continually making meaning of others' actions. They internalize such meanings and construct their own ideas about themselves and the world accordingly. This example only addresses one facet of identity construction, however, it highlights the awareness of young children's' association with others that they view within or outside of the group in which they identify.

At the same time that Black and Brown students are constructing their identity, they are also constructing multiple other intersecting identities. Verales, Martin & Kane (2013) created a framework (CLIC) that considers "learning as a process involving Content Learning (CL) and Identity Construction (IC)". They describe IC as the ways in which students "see one's self in relation to communities, and for CL, it centers on the development of disciplinary concepts, processes, tools, language, discourse, and norms within practices". They conceptualize three intersecting identities of Black and Brown students within science and mathematics classrooms: disciplinary (DI), racial (RI) and academic identity (AI). This framework is used as a tool in

understanding how Black and Brown students see themselves as individuals as well as in relation to mathematics education. Martin (2007) and Kane, Martin & Verales (2013) suggest that mathematics literacy in the Black [and Brown] student population is linked to identity construction at the intersection of their racial identity (Black) and mathematics identity (i.e. becoming a ‘doer’ of mathematics)”. Black and Brown students must be given a space for them to fully understand themselves as “doers” of specific content and discipline, in this case, mathematics. But, how can elementary students be provided a space to construct their DI, RI, and AI, when educators are constantly under pressure to keep the pace of their curriculum and show academic progress? One possibility is for educators to explore the use of Restorative Justice Circles within their classrooms to enhance students’ sense of self and sense of self in relation to mathematics.

The State of Relevant Theory And Research

There are many factors that contribute to students’ mathematics anxiety. Social, cognitive, and academic factors affect students’ perception of their mathematics abilities. When considering the social factors, teachers must always keep in mind that gender, race, socioeconomic status, parent mathematics anxiety, and much more affect how students interact with their teacher and the academic discipline. Cognitive factors are particularly salient with students who may not be neurotypical. This may include students diagnosed with dyscalculia, the cousin of dyslexia, or any other cognitive deficit a student may have that affects their working memory and creates a barrier for their academic success, although, it is possible for cognitive factors to also affect students who are neurotypical. Students who continue to receive poor mathematics instruction are subject to heightened anxiety because their low perception of their mathematics skills leads to students avoiding mathematics courses and practicing skills when

their potential to learn such things is typical of students at the age. Of course, there are also academic factors that contribute directly to mathematics anxiety. These factors include the traditional mathematics curriculum, ineffective teaching styles, and teachers who themselves are math anxious. In the following section I will explain in more depth how these factors contribute to a cycle of continued anxiety, which is sometimes sustained by the educators teaching the content.

Social Factors

Many students lacking confidence in mathematics concepts, are influenced by their peers' ideas of them, or are implicitly affected by stereotype threat. These are some examples of social factors that students face and contribute to their anxiety. Richardson and Suinn define mathematics anxiety as “feelings of tension and anxiety that interfere with the manipulation of numbers and solving of mathematical problems in a wide variety of ordinary life and academic solutions” (Gresham, 2007). Some research suggests that math anxiety is linked to negative attitudes towards math, poor academic outcomes in math, and low confidence regarding their ability to learn the subject at all. Many students of varying ages, demographic, and socioeconomic status feel that mathematics is a difficult subject to study. Some say it is boring, impractical, too abstract, and requires a special ability to learn that not all people possess.

Studies have shown a “consistent but small” correlation between high math anxiety and low math performance (Gresham, 2007). Although the correlation may be small, it is still important to note and impacts the decisions and attitudes of individuals towards mathematics. For instance, an individual may choose to not take math courses in college if they are not mandatory due to their high levels of math anxiety. If these anxieties are not addressed at an early age, it becomes much more difficult to reverse the mindset that these courses are too hard.

The STEM fields are in the majority made up of White men. However, it is not only White men who are successful in STEM subjects. If students are given opportunities to build a strong MI, then more students of color would have the resources to pursue STEM fields as a career.

Stereotype threat is being at risk of confirming, as a self-characteristic, a negative stereotype about one's social group (Steele & Aronson, 1995). For example, as quoted in Young & Young (2016), “historically, compared with their peers, children of color educated in urban schools disproportionately struggle with mathematics” (Elias, White, & Stepney, 2014; Kellow & Jones, 2005, 2008). This stereotype exists, and when this stereotype is known to students in that demographic, it can affect their performance in that academic area, whether they believe the stereotype is true or not. Many students have negative performance in mathematics because a negative stereotype acts as an implicit bias towards those students. If teachers implicitly believe this stereotype, it can be detrimental to academic performance and math-self concept.

Considering what this research indicates, it is important to note that this is not due to deficits in intelligence. This is due to inequitable systemic problems that reinforce There are many socioeconomic factors that can lead to students being more math anxious. White students disproportionately have more access to resources that contribute to their success. For example, time and money to be able to hire a private tutor to help their child succeed in math.

The authors used K-8 national longitudinal data to investigate boys and girls' achievement in math and reading and where gender gaps first appear. They examine whether the gaps were due to the metric used and at what point are the gaps most prevalent. There were no math gender gaps found in kindergarten children. However, some research has shown that teachers consistently rate girls' higher in reading and math than boys, even when cognitive assessments done by researchers suggest, “males have an advantage”. “Males score lower in

elementary reading assessments, tend to get worse grades, and are less likely to complete high school and attend college than females” (Riordan, 1999; Sommers, 2000, as quoted in, Robinson & Lubienski, 2011). However, “over the past decade, results from the Main NAEP (which is more responsive to curricular trends than the LTT) have shown small but persistent math gender disparities favoring males at fourth, eighth, and twelfth grades” (Robinson & Lubienski, 2011). A more recent study, Penner and Paret (2008) examined the development of gender gaps in math achievement from kindergarten through fifth grade. They found that gender gaps begin as early as kindergarten in the top of the achievement distribution and then appear throughout the rest of the distribution by third grade.

Teachers’ expectations can alter the way that teachers ultimately treat their students. Studies have shown that teachers have higher expectations of students with higher achievement and treat them with more respect (Good, 1987). In a review of teacher expectations and beliefs about math and gender, Li (1999) concluded that teachers tend to view math as a male domain and also tend to have higher expectations for, and better attitudes toward, their male students (Robinson & Lubienski, 2011). Similarly, in a study of 38 first-grade teachers, Fennema, Peterson, Carpenter, and Lubinski (1990) found that teachers’ beliefs about females and males differed, with teachers more often naming males as the “best math students” and attributing males’ success to ability and females’ success to their effort.”

Much of the mathematics anxiety research has focused on gender differences and not on racial differences. This is a limitation in the research, and I argue that that Black and Brown students have similar mathematics anxiety compared to their White peers, however with added societal pressure to conform to Eurocentric norms and values, Black and Brown students face obstacles that their White students do not face, which contributes to the anxiety. For example,

considering stereotype threat research, if teachers implicitly believe that their Black and Brown students are underperforming compared to their White peers, regardless of actual performance on assessments, then Black and Brown students are at a disadvantage to their White peers. Many White students are given the benefit of the doubt, or multiple chances to perform well whereas Black and Brown students are hindered because of the color of their skin and are not afforded the same opportunities as White students.

Studies have also shown that placing a child in a higher ability group is positively related to learning behaviors and achievement (Tach and Farkas, 2006). This aspect of informed teaching is imperative to creating an equitable space for all students. In my own practice, I constantly have to informally and formally assess my students' abilities in math and must make a judgment based on my findings in order to justify the reasons for grouping students. For example, it is a popular practice for teachers to give a pre-assessment at the beginning of a new math unit. This is to gauge what prior knowledge students have coming into a new unit. It is imperative to assess before a unit to ensure that teachers are meeting students where they're at. For example, if starting a multiplication unit, a pre-assessment will include tasks involving different models, equations, and word problems. If students come in with multiplication knowledge, then teachers can alter their curriculum based on the needs of the students. Especially if students have insufficient knowledge to start a new unit, it informs teachers' planning and decisions for instruction. Teachers then examine the work of their students and must then group them accordingly. Three groups seem to be a standard for many teachers. I believe this is because of logistical reasons. For example, teachers who are the only educators in a room with 25-plus students must consider the logistics of students rotating through station work in math in order to increase the amount of small-group instruction the students receive.

However, teachers typically think in “low, medium, and high ability”. Within the scope of time that teachers have to plan and then teach, this process is the easiest. However, I argue that this type of grouping could be problematic because teachers’ perceptions of their students’ abilities affect how they proceed in teaching those students. Just as stated above, teachers have higher expectations for students that they believe have a higher chance of achievement and many teachers attribute male students’ math achievement to ability and female students’ achievement to effort.

I think the most effective ways to group students in mathematics is based on 1. Strategies the students choose to use for the given task and 2. Their attitudes when completing math tasks in general. To elaborate, if students are working on a multiplication unit, The Big Dinner, created by Metamorphosis, students will use a variety of strategies and models depending on their conceptual understanding of multiplication such as, adjusting, skip-counting, picture models, ratio tables, and using an expression to represent the context of the problem. For example, the pre-assessment task for this unit, Appendix A, asked students to find the cost of 17 pounds of green beans if the cost per pound is \$1.98. This is a difficult task and is meant to push students to find more efficient ways to find the total cost instead of adding 17 groups of \$1.98. I surely would make a computational error if I tried to add \$1.98 17 times. The goal is for students to notice that \$1.98 is 2 cents away from \$2.00. If students notice this, then they can multiply 17 pounds \times \$2.00 = \$34.00. Then students must be able to represent that they added an extra 2 cents per pound and must subtract 2 cents \times 17 pounds = 34 cents. The final step is students subtracting the 34 cents from the \$34.00 for a total of \$33.66. This strategy is called adjusting because you adjust the numbers to be easier to work with and then adjust accordingly. THIS IS SO HARD!! Students need a certain level of organizational skills and conceptual understanding

in multiplication and subtraction in order to keep track of all of this information. Using this pre-assessment as an example of how teachers can then be informed to make appropriate groupings of their students, it is imperative that their performance on this one task is not the sole reasoning for grouping students accordingly. I argue that it is important to consider the strategies the students used as a basis for their resulted grouping. This is because, for example, some students who may have added 17 groups of \$1.98 accurately should not be grouped with students who also got the correct answer, but used a much more efficient strategy. Many teachers think “Oh well if they were able to get the correct answer, then they understand the problem.” I would agree that a student who did this understood the context of the problem, however, they used a strategy that creates more room for error than, for example, using adjusting. I would group students into groups according to the particular strategy they attempted to use, even if their answer was incorrect. This is because those students who represented their thinking using similar strategies show that they think about the context in similar ways. Then, planning for instruction of small-groups is more focused on the strategies they have shown they know how to use rather than focusing on the rote procedure of how to get the correct answer.

It is also important to consider students’ overall attitudes and perceptions of their mathematical abilities and group students based on their level of perceived mathematics anxiety. Much of the literature on math self-concept and stereotype threat is focused on gender differences. Girls tend to perceive their math ability to be less than their male counterparts. As early as first grade, students rate their math abilities on self-reports lower than boys (Fredericks and Eccles, 2002, as quoted in Cvencek et. al., 2011). Math self-concept is the association between self and math. There are cultural, societal, and gender implications for this biased self-concept of girls learning math. It stems from these embedded contexts, which play a role in child

development. Children as young as 3 years old self-categorize themselves into social groups to which they belong, for example gender and ethnic identity, which can affect their perception of self in relation to their mathematics ability (Martin and Ruble, 2010).

Studies have used implicit measures such as Implicit Association Tests (IAT) to assess whether students' associations of math and gender are stereotype congruent or incongruent. One study by Cvencek, Meltzoff, & Greenwald (2011) measured this through two IAT tasks and self-reports. The first IAT task pairs gendered male names with math related terms such as "numbers" or "graph" and also paired gendered female names with reading related terms such as "letters" or "spelling". This first task is the stereotype congruent task. The second task paired gendered male names with reading related terms and paired gendered female names with math related terms. This is the stereotype incongruent task. It is hypothesized that students who possess the math-gender stereotype will associate the terms with gender more quickly in the first task than the second task. The results showed that boys associated themselves with math more than girls in this study, which resembles results of adults using the same measures.

This research makes me question the math-self concept of Black and Brown girls in mathematics classrooms. The research clearly shows that girls can be influenced by the negative stereotype that "girls aren't good at math". In one study conducted by Aronson and Steele, they presented Black and White students with a test and told the "students [that] the test diagnosed intellectual ability, thus potentially eliciting the stereotype that Blacks are less intelligent than Whites" This negatively affected girls' performance, specifically Black girls performance on sample GRE verbal question. Stereotype threat can have much influence on members of certain groups, even when that individual does not believe the stereotype. This is very harmful to Black and Brown students and educators must be aware of their implicit biases.

Cognitive Factors

When people experience any form of anxiety, it causes a barrier in the prefrontal cortex that inevitably interferes with their working memory. Working memory is the system in the brain that keeps information in the mind while performing complex tasks, such as reasoning, comprehension, and learning (Baddeley, 2010). Our working memory becomes increasingly more important to be able to complete math tasks as we progress through elementary school. In 4th grade in particular, there is an increased demand on the working memory because the concepts taught start to become more abstract. Students begin to learn about fractions concepts in 3rd grade, however in 4th grade the conceptual understanding must be solid in order to be successful. For example, a 3rd grade student would be asked to identify the fraction of the shaded area of a partitioned shape. If 2 out of the 3 equally sized boxes were shaded, then the fraction of the shaded area would be $\frac{2}{3}$. This type of question is visually accessible to students and allows them to reason with the image. They can clearly see that there are 3 equally sized pieces and that 2 out of the 3 are shaded. However, in 4th grade, students are asked to reason whether $\frac{3}{8}$ or $\frac{4}{7}$ is greater and why. The 3rd grade problem is more accessible to students because it involves a visual component that requires you to notice how many are shaded out of how many are there in whole, whereas the 4th grade problem requires much more reasoning for the student to be able to understand. They must understand the big idea that “the whole matters”, meaning that both fractions must be represented with the same size model in order to compare them at all. After all, you can’t compare half an apple and half a sandwich. They are different sizes, so the fractions are not equivalent. In order for a 4th grader to successfully access this problem, they must mentally visualize two models of the same shape, partition each accordingly, and compare which models has more area shaded within it. Without the visual representation or

understanding of how to represent a fraction with a model, students then have less access to this type of problem.

Students who rely heavily on their working memory are the most affected by math anxiety and those with a higher level of anxiety do worse on tasks that require working memory capacity (Ashcraft, 2002). 4th grade is the beginning of the first age of onset, which is directly linked to the content being taught which demands an increase in abstract thinking and working memory. Working memory is the system in brain that keeps information in our short term while performing complex tasks including reasoning, comprehension, decision-making, and learning (Baddeley, 2010). This term is used within the fields of cognitive psychology, neuroscience, and neuropsychology. The working memory is taxed by mental arithmetic like carrying and borrowing. When students experience anxiety, the working memory is compromised and has a more difficult time holding onto important information. Every time a student experiences anxiety around mathematics, it's as if there is a wall that erects in their brain that blocks the working memory from being able to function. Students do not understand or know how their anxiety affects their ability to process mathematical thinking. However, if students were more informed with strategies to combat anxiety, then students will be more aware and able to notice when the anxiety is about to affect them, and how to diminish the symptoms of anxiety.

It is necessary for educators to provide students who exhibit anxious behavior specific tools, strategies, and mechanisms to cope with their anxiety in the moment they are experiencing it. Compass et al (2017) conducted a study of the use of various strategies for children to cope with anxiety and found that “when the subjects used adaptive strategies, like looking at a problem in a different way, engaging in problem solving or pursuing constructive communication, they were better able to manage the adverse effects of stress.” Adaptive

strategies include: interfering on negative self-talk, meditation, deep breathing, and more. Adaptive strategies help students continue to function even if the anxiety still exists, whereas maladaptive strategies, which may provide short-term relief of the anxiety, end up prolonging confrontation of the anxiety which can negatively affect the student. For example, a maladaptive strategy may include avoidance. A student who is experiencing mathematics anxiety may try to avoid mathematics learning in general, which may lessen their anxiety in the moment, however, avoidance of the negative feelings of anxiety do not allow students to effectively address and cope with the anxiety. This student conditions him or herself to avoid mathematics because it eliminates the negative emotions associated with it. Students must be provided with clear, adaptive strategies to be able to recognize the anxiety, confront the negative emotions attached, and practice coping with anxiety in a productive way.

It takes high-anxious students about three times longer to solve a problem involving carrying than a low-anxious student. Under time pressure, anxious students will sacrifice accuracy for speed and answer basic arithmetic questions incorrectly. One study showed that giving college students simple whole number addition problems to solve in untimed, low stress conditions found no difference between low and high anxious learners, but giving the same problems under time pressure showed worsened performance in the high anxious group (Faust, 1996). This finding is important in understanding different facets of mathematics anxiety. For example, teachers in elementary school can begin to take some of the anxiety out of the equation when planning for math activities and tasks. Teachers who foster a sense of competitiveness and value of speed actually help to contribute to the anxiety even more. Students who are more anxious will perform worse than their less anxious peers. When considering the education system as a whole, speed is valued in many ways. New York State exams for 3rd-8th grade students

used to be a timed test. In recent years, the test is untimed and students can take as long as the entire school day to complete their exams.

People with high levels of stress and anxiety don't perform as well on tasks that require working memory capacity compared to people with lower levels of anxiety (Ashcraft, 2002). This cognitive system is responsible for temporarily holding information available for further processing, which is sometimes referred to as short-term memory but some theorists say they are distinct. Working memory allows for manipulation of stored information and short-term-memory only refers to storage of information that does not make it to the long-term-memory.

Anxiety is a participatory emotion that focuses on the uncertainty of achieving a particular outcome. Emotions have 2 underlying components in the classroom 1. Students value what they are learning and 2. Students feel they have control over a task. For example: enjoyment (emotion) is the product of student highly valuing what they're doing in conjunction with feeling a high level of control over a task. Neuroscience research supports this. A study using functional magnetic resonance imaging (fmri) of brain found neurological evidence of anxiety negatively impacting on math performance prior to completion of math task, when students anticipate task ahead (Lyons & Beilock, 2011). Anxiety is a background emotion, which we exhibit unconsciously through body posture and movements, minimal changes in amount and speed of eye movements, and the degree of contraction of facial muscles (Damasio, 1999).

Academic Factors

Students' lack of confidence can stem from a variety of factors. For example, a lack of pre-service teacher training can negatively affect teachers' ability to communicate mathematics concepts in a developmentally appropriate way, which can inhibit these teachers from fully understanding the concepts. If teachers aren't appropriately trained in not only the content

specific to the age in which they will teach, but also the social emotional piece, then teachers are not taking a holistic approach to teach the whole child. This is often left out of pre-service teacher curriculum. I argue that not only is it important for pre-service teachers to obtain an education that dives deep into mathematical concepts, but also to obtain an education directly examining the social emotional aspect and concepts of critical care that should be embedded in all mathematics learning.

Many teachers themselves are nervous/anxious about teaching math, mostly elementary school teachers. However, most middle or high school teachers specifically choose to teach math because they have felt successful in that subject and have a deeper conceptual understanding of mathematics. Some teachers exhibit anxious behavior when talking about math or during math instruction. For example, the language teachers use when speaking about mathematics often displays their negative feelings towards math, how difficult it is for them, and how their academic identity is more tailored to other subjects like reading, writing, or social studies. This can have a negative impact of students' perceptions of the value of math learning. In many schools, an initiative for fluent readers and writers is valued and tracked with multiple types of data including: reading assessments, guided reading groups, and independent reading. When schools do not show a shared value of all subjects, students begin to internalize what is important to learn, and what is not. When educators have math anxiety the result is that they ultimately spend less time preparing for math lessons and less time teaching it.

Studies show that 72% of the negative math experiences that arise in early-middle primary school are attributable to the teacher, rather than math content, family attitudes, or peers (Uusimaki & Nason, 2004). Unfortunately, many teachers also face mathematics anxiety and can inevitably pass that anxiety along to their students subconsciously. This idea is alarming and

must be addressed. Pre-service teachers “can successfully pursue a career as an elementary school teacher even if they have a propensity to avoid math. Interestingly, elementary education majors are largely female and have the highest levels of math anxiety of any college major” (Beilock et al, 2010). Pre-service teachers must be given the opportunity within their teaching curriculum to have explicit training in mathematics concepts that the students they teach will need understanding in to help lessen the anxiety that teachers themselves have. One of the most common ways for math anxiety to develop in the elementary or middle school classroom is by teacher modeling of math anxious behaviors (Gresham, 2007).

Children pick up on and react to these gestures, creating a learning environment where math is depicted as a subject to be avoided at all costs (Brady & Bowd, 2005). Even if educators have math anxiety, it is important for them to be aware of how their anxieties can be transferred to their students. I’ve observed in my own practice when teachers are not entirely confident in the concepts that are being taught and teachers create surface level lessons to attempt to meet standard goals. This lack of conceptual understanding of teachers also affects the way that teachers perceive their students math abilities in general. If educators lack the conceptual understanding, then it is difficult for them to recognize if their students have mastered a concept or have just memorized a rote procedure, for example, finding two equivalent fractions.

Considering when students begin to learn about fractions in 3rd grade, there is a huge shift from concrete concepts to abstract concepts. For example, all of the number sense conceptual work that students learn prior to 3rd grade is around whole numbers. This is the first time they are introduced to numbers that are less than one (except for money amounts of less than a dollar). When students are introduced to fractions, they are shown how to find the fraction out of a set. For example, there is a picture of 4 stars and 2 hearts. Students are asked how many

hearts there are out of all the images. This starts to get students to recognize the part-whole relationship. They must know there are 6 objects in the set and the 2 out of 6 of them ($\frac{2}{6}$) are hearts. This representation of a fraction is not less than one. Which is different than asking a student to partition a number line and show that Bobby walked $\frac{2}{6}$ of a mile and to mark on the number line where Bobby stopped. This distinction is difficult for students who do not have a solid understanding of number relationships and numerical magnitude and can increase frustration levels even in students who are neurotypical. This continued frustration could lead to mathematics anxiety if the students are not taught the underlying conceptual foundation needed to continue a successful mathematics education.

An example of a rote procedure or skill that math anxious teachers will teach with a lack of conceptual understanding is finding equivalent fractions. A trick that many adults know and use is to take any fraction and multiply the numerator and denominator by the same number, which will result in an equivalent fraction. For example, to find an equivalent fraction of $\frac{1}{2}$, multiply the fraction by $\frac{2}{2}$ and result in $\frac{2}{4}$. Now, this is certainly a useful and efficient trick to finding equivalent fractions, however, do you know why this trick works? Most teachers who teach their students this trick don't know why and neither do their students. If teachers understood the underlying big idea and concept for why this works and can teach it to their students, then it would be a much more effective trick. The underlying big idea is that the size of the fraction matters. When you take a model and partition it into 2 equal parts with one shaded in, it represents $\frac{1}{2}$. When you take that same model and multiply the numerator and denominator by $\frac{2}{2}$, it is equivalent because you double the amount of pieces within the same model. Now the model is partitioned in half with 4 equal boxes in which 2 are shaded. When students lack this understanding of the representation on modeling of equivalent fractions, then they are

complacently completing steps to get a correct answer but have no understanding of why it works. “Instead, it focuses on [the] acquisition of superficial knowledge of basic computational skills and math operations. The students lack the ability to understand the ‘why’ of mathematics and instead regurgitate facts” (Boes & Ruff, 2014). This causes students to forget the concepts taught previously and as the concepts become increasingly harder, students have less of a conceptual foundation to build off of and can cause an increase in their anxiety.

When this occurs there begins a vicious cycle of poor instruction, which leads to poor learning, and heightened anxiety. Educators need a more in depth conceptual understanding. This is a systemic problem within teacher education programs. Many of the requirements for elementary educators do not include intensive mathematics instruction. If you are an English concentrate, for example, getting an elementary education degree, you are only required to take one mathematics course and another mathematics course related to mathematics. This is something that must change in order for teachers to fully understand the concepts they will end up teaching their students.

Another contributing academic factor to math anxiety is that math-anxious teachers tend to focus on teaching skills, rather than concepts (Norwood, 1994), an important part of teaching for understanding. This problem is widely spread across many schools and educators. When educators are unable to address their own mathematics anxieties, they are less likely to address the anxieties their students possess. I argue that educators must be given an opportunity in their pre-service teacher education curriculums to be able to dive deep into the concepts of mathematics that they will need to teach their students. Many of the teacher preparation programs provide some mathematics courses that are rooted in what they will actually be able to teach, however, in my own teacher education program, I was only required to take one

mathematics course rooted in education. I was a mathematics concentrate so I was required to take higher-level mathematics courses. This higher-level education allowed me to fully understand mathematics concepts that allowed me to be able to better teach them to my students. One mathematics education course is not sufficient for educators who will have to teach mathematics to all of their students. There is a high demand for literate mathematics educators at the college level to ensure that pre-service teachers are prepared for not only teaching mathematics content but also to conceptualize how mathematics anxiety affects them and their future students.

Strategy Instruction

Math tends to be at the top of the anxiety list. Research shows that there are 3 stages of onset of math anxiety: 4th-6th grade, 9th-10th, and college. 93% of American adults self-identify as being “bad at math” or disliking it (Hembree, 1990). This percentage is alarming and gives much insight into Americans perceptions’ of their own mathematical ability. The first stage starts in 4th grade due to the increase of abstractness being introduced in the math curriculum. However, the shift in abstractness of math concepts is also occurring in many 3rd grade concepts being taught, such as fractions concepts. It is abstract because students must understand concepts of fractional notation (which contradicts notions of our base 10 number system), part-whole relationship, and equivalency in order to successfully approach this problem. Their conceptual understanding in 3rd grade affects their performance in 4th grade, and this is why it is important to examine students’ math self-concept prior to the first age of onset. This can also be done with the use of RJC. Teachers can have check-ins with students at the beginning, during, and at the end of a mathematical unit to be able to informally gauge students’ math-self concept. A question that could be posed to explore this idea is: How do you feel when we do multiplication?

Name a time during this unit you felt successful? These questions will give educators much insight into how students are viewing themselves as mathematicians.

At each stage of onset, students are introduced to more difficult abstract concepts, and without a strong foundation of mathematical computation, expressions, fundamentals, and earlier concepts, then students begin to feel anxious about learning math. In addition to the increase in abstract concepts, students are also becoming increasingly aware of who they are as well as who they are in relation to their peers. The first age of onset is 4th grade, when students are typically 8 or 9 years old. This is a pivotal time in their development. Ethnically diverse students have an increased awareness of their own identity in relation to their white peers due to the institutionalized issues students of color face.

Teachers can provide alternate models for students to apply abstract concepts in concrete examples, such as using various types of manipulatives. Research on the use of manipulatives in math instruction varies depending on the age of the students and the abstractness of the concept being measured. For example, Suh and Moyer (2007) as quoted in Carbonneau, Marley, & Selig (2013) measured the retention of fractions concepts after instruction using manipulatives after 20 days of intervention. They found that students who were taught explicitly how to use manipulatives to learn fractions performed higher on the post-assessment than other students.

However, strategy instruction cannot be the sole intervention to enhance students' math self-concept by explicitly teaching abstract mathematics concepts, especially if students are of diverse backgrounds. In order to achieve culturally responsive teaching, "explicit cultural knowledge must be taught in schools" (Gay, 2002). Often, there isn't a space given in the classroom to explicitly explore students' cultural knowledge. Curriculum is fast-paced and teachers face pressures to move through it and feel like they have no time or the resources to do

this work. Sharing narratives through RJC is one important way to begin to explicitly show students that each person has unique experiences and narratives that are culturally influenced and shape who they are.

An Example of the Use of Teacher Strategies in a 3rd Grade Mathematics Lesson

I have created this 3rd grade fractions lesson in order to demonstrate some of the strategies a teacher can use to interact with students in a way that helps to lessen their mathematics anxiety. The concepts outlined in this lesson could be applied to mathematics lessons for other concepts or grades. For this lesson, I planned to work with a small group of students of similar ability in regards to fractions conceptual understanding. A teacher could choose to group students according to their mathematics abilities, attitudes toward math, or another method that suits the makeup of the class. This lesson would come toward the middle of the fractions unit and studied in conjunction with division. Students are exploring when a fraction is less than one, equal to one, and greater than one. The use of big ideas and conjectures to drive student learning is useful for students to have a solid foundation in fractions concepts. For example, one big idea in fractions learning is: in order to compare two fractions, the wholes must be the same size (the whole matters). This understanding of the big idea allows students to not only respond to a rote procedure of finding which fraction is bigger, $\frac{1}{2}$ or $\frac{1}{4}$, but provides them the conceptual understanding that it is only possible to be able to compare these because their wholes are the same size.

The use of number strings in conjunction help students to reinforce the big ideas and for students to be able to find patterns, generalizations, and conjectures within operations. For example:

$$\begin{aligned}6 \div 6 &= 1 \\12 \div 6 &= 2 \\24 \div 6 &= 4\end{aligned}$$

This number string would help students to notice a pattern. We ask the students, “what do you notice about this string? What is staying the same? What is changing?” This allows for a rich discussion by simply asking a low risk question of what they see. Students should notice that the Dividend (the number you divide into) is doubling, i.e. $6 \times 2 = 12$, and the Divisor (the number you divide by) is staying the same, and that the Quotient (answer in a division problem) is getting cut in half. This conjecture helps students to solve other division problems in a more efficient way and better helps the student understand why certain things always happen in division/fractions.

In this lesson, the students explored different equations, without solving them, and I asked them if they could find any relationships between them. I gave them no further directions. The three main types of equations I provided were ones with a quotient less than, more than, or equal to one. I anticipated that some students would notice the equations where the quotient is less than one. This allowed for a rich discussion about what that means in terms of fractions and division.

It is always important when planning math lessons or activities that I am aware of any negative emotion or frustration that may arise due to the complexity or difficulty of the task. I don't want the lessons to be easy, but I also don't want them to be so hard that the frustration level occurs too soon. Planning for students who have mathematics anxiety is imperative to be able to control the behavior within the lesson. A quick chat with a student right before a lesson can let a teacher know that they are counting on them for their participation and that they look forward to hearing their ideas. My goal is for the students to feel like they learned something while also feeling confident about their mathematics abilities.

Personal Reflections as a Math Teacher: Critical Concepts of Care, Hope, & Love

As an educator, I've noticed many patterns around students' behaviors. These behaviors can present as straightforward whereas others can be complex and difficult to name and fully understand, for both the teacher and the student. Many of these behaviors are positive; whether it's a moment of pride a student shows after finishing a piece of published work, a moment of persistence with a tricky word problem, or a moment of patience a student shows to another during a group project. Some of the most interesting behaviors I observe, however, are negative and during specific learning environments. Many of the negative behaviors I observe are during math instruction and independent work time. These behaviors include: lack of eye contact during lessons, negative self-talk, avoidance, and lack of motivation to complete math work. All of these behaviors are linked to anxiety around math. These behaviors are especially intriguing to note because they do not typically occur during other subject work times including reading, writing, and social studies. Why is it that students have increased anxiety about learning math? Does this anxiety shape the way students approach, think about, or stay away from math?

The biggest challenge when considering the anxiety that some students may have towards math is how to lessen this anxiety while still teaching students relevant and necessary skills. It may seem obvious, but "caring teachers and school environments provide students with academic rigor while supporting them emotionally" (Rivera-McCutchen, 2012, p.653). Caring may seem innate to teaching, but educators must consciously be aware of how their actions make students feel about their abilities. There is often a disconnect between how much care a student feels from a teacher compared to how much care the teacher feels they have for the child. I argue that critical concepts of care, hope, and love can help to combat student math anxiety.

These concepts help educators think about the interactions they have with their students during the math period, and the impact of their actions on students' emotions. Teachers must have high expectations for all students. When they do not, teachers tend to not push students to their fullest potential and are not providing an academically rigorous curriculum due to preconceived notions of the student which alters their expectations. By enacting concepts of critical care, hope, and love educators can attempt to enhance students' math abilities, attitudes, and self-concept and reduce mathematics anxiety. It is my goal to analyze how critical concepts of care, hope, and love can help to combat students' mathematics anxiety.

Scholars engaged in this work have begun to explore several important, but understudied, areas related to Black children's mathematics learning and development, including: (1) the racialized nature of students' mathematical experiences in school and non-school settings, (2) *students' beliefs about their ability to participate meaningfully in mathematical contexts based on their socializing experiences*, (3) their resulting motivations and rationales for learning and doing mathematics, and (4) the co-construction of mathematics identities and other social identities that are important to these students (Martin, 2012) *italics my own*.

Scholars have pointed out important understudied facets of mathematics education of Black and Brown students. Number 2 focuses directly on Black and Brown students' self-concept in meaningful mathematics learning. This means their education must be reflective of their cultural and daily-lived experiences. The moment that students notice a disconnect from the content that is being instructed and their personal identity, students lose hope in the education they are receiving and the educators who are instructing it. Why should Black and Brown students trust their teachers when they feel that their teachers are not making an effort to make their education relevant to them? As adults, we appreciate interactions with others that show that they value some part of our identity or us. The same goes for children. They constantly search for validation.

My goal is to center this research in Black and Brown children, and not their White counterparts. Majority of the research in the field is centered on White children's achievements and the disparities between standardized test scores of Black and Brown children and White children. However, it is important not to focus on the disparity itself, but the reason for such disparity. Contrary to historical stereotypes of Black and Brown people, there is no gap in intellectual capacity for math. Similarly to the stereotype threat of girls learning mathematics, just the idea that this stereotype exists can negatively impact the self-concept of girls or Black and Brown students, regardless of whether they believe the stereotype to be true. This belief is important to understand in order to fully realize the impact on the curriculum.

Many scholars including Ladson -Billings and Martin argue for more attention to Black and Brown youth in mathematics research. There have been some studies of K-12 Black students, but the research is definitely lacking. Some studies have included a very small sample size ranging from individual case studies and samples including a diverse group, however the Black and Brown students represented only make up a small percentage of the sample. Although these studies provide some insight into the mathematics attitudes and abilities of Black and Brown students, there is a limitation within the existing research and the need for more work in the field is imperative.

Duncan-Andrade explains "material hope" as hope that comes from the control students feel they have over the resources and material being taught and implemented in their classroom. If students do not feel that what they are learning is relevant to their lives, then they are much less hopeful to have an educational experience that appeals to them and ultimately, these students end up becoming hopeless (Duncan-Andrade, 2009). This type of control allows students to feel that they are in control of their success, not just the teacher. It is necessary for "teachers who

want to build material hope [to] understand that quality teaching is the most significant ‘material’ resource they have to offer youth” (Duncan-Andrade, 2009).

It is not enough to just care about our students, because “caring without high expectations can turn dangerously into paternalism in which teachers feel sorry for underprivileged youth but never challenge them academically” (Katz, 1999, as quoted in Rivera-McCutchen, 2012). I argue that teachers and school leaders not only feel sorry for students, but also lose motivation to push them because of the negative experiences they have with their students, which in turn lowers their expectations for these students. By showing students that we believe in them, show them that our expectations are still high, and that although anxiety creates a border in a student’s mind that tells him they cannot do it, we can work through this negative emotion and figure out ways to diminish or eliminate that feeling. “Daniels (2012) argue[s] [that armed love] is an extension of caring; it is a fierce and unequivocal love for students and their communities, coupled with an unwavering belief in their potential to achieve the highest levels of success, despite structural and institutional impediments” (as quoted in Rivera-McCutchen, 2018). This type of persistence in a student shows them how much you care and love them without ever having to tell them.

Students implicitly notice when their teachers have lower expectations of them. If they sense this, it is very difficult to change the mindset of this student. Often times there is a disconnect between students’ perceptions of how much their teachers care about them and how their teachers perceive they care about their students. Rolón-Dow (2005) conducted an ethnographic study of Puerto-Rican high school girls, considering their racial and ethnic intersection, to understand why there are such divergent perspectives of caring of teachers and students. Narratives were collected of teachers and students to determine how students felt they were being cared for by their teachers as well as how teachers felt they cared for their students.

She found that the historical background of Latino/a/x students affects the ways in which others implicitly interact with them, which can affect the reciprocity a student feels with their teacher. Reciprocity is imperative when considering critical concepts of care with students, specifically with students of diverse backgrounds. If students do not feel a reciprocal relationship with their teacher, it is difficult for that student to feel cared for in the classroom setting. This research is very important when considering the implications of teacher actions towards Black and Brown students.

If teachers allow students to complacently remain in a lesson without coaxing anxious students to share their thinking, we send messages to our students that we don't really care or honor what they have to say. In turn, this perpetuates a behavior that most educators do not want to see in their classroom. However, there are times that teachers choose this path because dealing with an emotional outburst will not only negatively affect that student and their learning, but also every student participating in that lesson. This becomes a tricky line that must be tread. Math anxious students need to know that no matter how they are feeling emotionally, we are there to support them, and also teach them.

To put these concepts into the perspective of the mathematics classroom, consider the fictitious student, Javier. These traits attributed to Javier are comprised of a multitude of observable behaviors I have witnessed in my experience as an elementary school teacher. Javier is one of those children who is very bright and has so much potential, but his emotional profile inhibits him from completing work independently. Although he does not produce much written work, Javier is willing to share during group discussions and in partnerships. At the beginning of the year, this would not have happened. It is important to celebrate the small victories and to also be transparent with students about these small victories. It is important for educators to consider

positive communication with families to highlight positives of the students so that not all communication with home is in a deficit way. This also allows for students to feel respected by their teacher because regardless of the negative behaviors seen in the classroom, positive communication with their family shows that we do not only see the negatives in their behaviors. This is important too for the families to see because otherwise, they believe that their child is only exhibiting negative behaviors.

I think it is important to always focus on the skills that students are using and able to access. It is easy to lose sight of what our students are great at when we are constantly assessing what they are not able to do. “It’s much easier to say what kids are deficient in than to figure out what they’re great at and work hard to build upon their abilities” (Young, as quoted in Lopez, 2016). Although Javier does not produce much written work during the math period, his verbal skills are that of a 3rd grader or higher. He is able to reason and use logic to explain his thinking.

“A caring education provides students who have a history of poor academic outcomes with an environment that is both emotionally nurturing and academically rigorous. When students are sufficiently cared for, there can be a significant interruption of failure, and students can be *empowered* to become academically successful” (Rivera-McCutchen, 2012). The italics were added by me to reinforce how students feel in the classroom when they feel they are cared for. Creating mathematics lessons with students with mathematics anxiety in mind allows teachers to better be able to address the anxiety when it arises during instruction. Javier is a student who exhibits negative-self talk when he feels anxious about the task at hand. For a student like Javier, it is important to ensure the content and instruction is accessible to him in order to alleviate some of his anxious feelings. A main goal for Javier, during mathematics

lessons, is for him to feel good about his mathematics abilities so that the anxiety begins to lessen as each time he enters the classroom.

The Potential of Restorative Justice Circles

The first goal of RJC is to build community within whatever space these circles are taking place. For the purpose of this paper, I will only address the use of RJC in elementary school classrooms with the goal of guiding students to construct an intersecting mathematics identity, however, these practices can be implemented in any community where members have a responsibility to each other and some type of harm has occurred. RJC attempt to address harm in spaces where community members can hold each other accountable to the groups' values. "They provide specific pathways to repair harms by bringing together those who are affected by misbehavior in a dialogue to address concerns, achieve understanding, and come to an agreement about setting things right" (Teaching Restorative Practices, n.d.). In order to address some type of harm, classroom teachers and students must first decide on agreements, values, and tools to be able to effectively discuss these harmful situations in a way that each community member can reflect and purposefully move toward a more inclusive environment. The practices of these circles are obviously dependent on the make-up of the students who are participating.

Throughout this process of creating core values and agreements, students of different ethnic, racial, and cultural backgrounds are able to bring their personal identity into the space. This creates a way for students to develop their own identity, as well as share their racial, ethnic, and cultural identity to create a more inclusive space where students from diverse backgrounds can recognize the nuances and differences of each other's cultures and create an awareness and acceptance of others. This type of space isn't always provided for students and often times, students of diverse backgrounds aren't able to share their unique narratives and lived experiences

that inform their everyday lives. Providing and fostering this type of space is imperative for students of color, specifically Black and Brown students, who live in a racialized, Eurocentric reality, constantly comparing their own identity to those who may never face issues of discrimination and racism. RJC is one way for students to understand and develop their identity with a collective group who cherish and share their same values.

Through this work, educators can begin to create RJC that are in response to activities, concepts, situations, or academic disciplines occurring in the classroom to enhance students' academic identity in conjunction with their personal identity. To my knowledge there has not to date been any account of elementary school teachers specifically incorporating the fostering of mathematics identity in classrooms through RJC spaces. . Returning to the work of Kane, Verales, and Martin (2013), the CLIC framework is used to understand Black and Brown students' intersecting identities through the lens of math and science classrooms. This suggests that providing a space like RJC for students to talk about their RI, AI, and DI would enhance Black and Brown students' awareness of their mathematics identity (MI).

Many students face mathematics anxiety because they either lack confidence in mathematics concepts or they are implicitly affected by stereotype threat. Stereotype threat is being at risk of confirming, as a self-characteristic, a negative stereotype about one's social group (Steele & Aronson, 1995). For example, as quoted in Young & Young (2016), "historically, compared with their peers, children of color educated in urban schools disproportionately struggle with mathematics" (Elias, White, & Stepney, 2014; Kellow & Jones, 2005, 2008). This stereotype exists, and when this stereotype is known to students in that demographic, it can affect their performance in that academic area, whether they believe the stereotype is true or not. Many students have negative performance in mathematics because a negative stereotype acts as an

implicit bias towards those students. If teachers implicitly believe this stereotype, it can be detrimental to academic performance and math-self concept. The goal of this paper is to explore the possibilities and practices of Restorative Justice to foster a safe space for community identity, racial identity, and mathematics identity to aid Black and Brown students in their journey through school, specifically in the mathematics classrooms.

A Proposal for Addressing Math Anxiety Through Restorative Circles

“Restorative justice is not conceived as a disciplinary model but an approach to creating the conditions of relational spaces wherein individuals and communities flourish” (Kim et al, 2016). As noted in the previous section, RJC aim to build a sense of community in spaces where some type of harm has occurred and needs to be addressed. “Building on social identity theory, cooperative relations in school are a function of individuals feeling a high level of pride in their group and a high level of respect within the group. All members of school communities need to experience both respect and pride to feel they belong” (McClelland et al, 2007). The purpose is to shift from punitive measures to a more holistic understanding of why an action or behavior is undesirable or harmful to other members of the community, and to hold other community members accountable for their actions and their subsequent feelings. It is important, however, for educators to consider the purpose for bringing RJC into their classroom. Some questions to consider when implementing RJC are outlined in Figure 1. RJC has a specific protocol that ensures effectiveness in various spaces. No matter the space in which these circles occur, the following should remain constant: integration into routine, co-created community norms, shape of the circle, talking piece, and pose a question.

To what end are we implementing restorative justice in schools?

- To whom does the circle belong? How do we encourage a circle process built from diverse, multi-cultural histories?
- In what ways are we implementing a practice that is rooted in histories we fail to explore or understand?
- In what ways can a circle practice expand and redistribute ownership in a school setting?
 - What kind of community are we restoring?
 - To what culture are we responsive?
 - Whose values are being reinforced?
 - How do race, power, and privilege impact how responsive we are to diverse students?**

Figure 1. Questions to consider when implementing Restorative Justice Circles in classrooms (CCER, 2018)

Integrated Into Routine

In order to ensure that RJC are seen as an imperative part of learning, they must be integrated into the existing routine in which the circles will take place. This also helps to create a structure for the students to feel accountable for. If RJC begins to be seen by educators and students as something that just “needs to get done” or that happens very minimally, then the desired results will not be seen. All students must feel that RJC are occurring at appropriate times in response to harm, but also when members of the community want to check in with each other about a situation. When members of the community begin to ask to do RJC, that means something is working. However, it is also important for the educator to assess the emotions of the group to better understand the goal for the circle. For example, if a math task were given to the group and math anxious behaviors are observed, this would be a great opportunity for the teacher to call for circle time. Allowing students to talk through their frustrations and share how they felt while completing the task helps students to recognize that they are not the only ones who feel these emotions, and are more inclined to take risks during math that do not affect their sense of status in the group. Students, as well as adults, are constantly negotiating their status in

comparison to others. If students do not feel safe in the group to share their thinking, and are nervous about what others will think of them, then this too can exacerbate the feeling of anxiety around math. For elementary school teachers, this can happen during an extended morning meeting time, after lunch and recess when many conflicts with students arise, or during mathematics periods to center the circle in developing awareness of students' mathematics identity.

Although much of the research for RJC is in response to some type of harm, they also have the potential to be used as a preventative measure for students with mathematics anxiety. Students must be provided a space to be able to share their feelings towards math in a risk-free way. This only comes with time, as students are not going to instantly trust the process, their peers, or even their teacher. Teachers must use critical concepts of care in their daily practice and interactions in order for students to begin developing trusting relationships with students. If they do not feel a certain level of trust, safety, and value, then this model will not benefit students effectively.

Co-Created Community Norms

Prior to starting circles in classrooms, educators must explain the purpose and uses for circles in that space. One of the most important pieces of RJC is the co-created community norms. This aspect is so important because the values in Western classrooms are often different from the values of Non-Western cultures. For example, when using social skills as a measure of social competence, the main issue is deciding which skills are indicative of social competence. Social values have been used as a baseline to target specific behaviors students should exhibit in order to be considered competent in the classroom setting. However, selecting social values is not as normative as some may think. Social values are culturally applicable, and people of other

cultures may, not value a skill that one culture may value. Some behaviors may include: helpfulness, compliance, and self-assertiveness. All three of these behaviors are valued in American classrooms, but not necessarily by other cultures. Assertiveness can be seen as students advocating for themselves and exhibiting agency, however in other cultures, being assertive with an authority figure, like a teacher, can be seen as rude and disrespectful (Rose-Krasnor, 1997). Creating values as a collective ensures that students “create a sense of shared responsibility for the classroom at all times (not just during circles)” (Bucci, Cannon, & Ramkarran, 2017). When the norms are co-created by the group involved, each student feel responsible and accountable to the expectations of the group. This creates a shared sense of value where everyone's voice is heard and matters.

Shape of the Circle

The shape of the circle is an integral and symbolic part of Restorative Justice practices. By sitting in a circle, every member of the community is seen by each other member. This creates a sense of equity, solely by the way each member is positioned. Everyone in the circle has the opportunity to share or pass, whatever is most comfortable for them. In providing a physical space for students to be seen by each other creates a sense of belonging and accountability to each other. In creating a circle, there is inevitably an empty space in the middle. It can be left clear, or an object or something meaningful can be placed in the middle to center the focus of the circle. For example, if implementing a circle during a math content period, then objects related to the activity can be placed in the center and can be the topic of conversation. (“Teaching Restorative Practices”, n.d.).

Talking Piece

Many indigenous cultures have been conducting talking circles similar to the structure of

RJC. The RJC practices “most closely reflects the talking Circle process practiced by the Plains Peoples of North America. In these traditions, Circles are far more than a technique; they are a way of life. Circles embody a philosophy, principles, and values that apply” (“Living Justice Press,” n.d.). Adapting and using circles in classrooms based on indigenous cultures will also show students who are from indigenous cultures that their identity is being recognized in the classroom. The talking piece is different each week and is brought in by one student who will be leading the circle for that day. Students can volunteer ahead of time or may come prepared for a circle on any given day. The talking piece is meant to represent one speaker at a time, to ensure that all members of the community are actively listening to whoever is sharing. The student who brings in the talking piece starts off the circle by introducing the talking piece and it’s meaning to that individual. This also fosters identity development because students are given a space to share something that is a part of who they are. The talking piece provides a way for students to bring in a piece of their own lives and cultures into the classroom, which is an opportunity not always provided to students. Specifically for Black and Brown students, they are afforded an opportunity to bring in an object that is significant to them and in turn give their peers an opportunity to better understand their cultural background.

Pose a Question

There are two types of circles: community building and restorative. The practice is the same but the intention is different. With community building circles, the goal is to get to know the members of the community better in an attempt to gain more trust and understanding of the other members. The questions that are posed in community building circles should aim to be low-risk so that each student can access the question and has the opportunity to share as much or as little as they feel comfortable. A few examples of questions for “Getting Acquainted” can be

found in Figure 2. In holding these types of circles, students have the opportunity to find a connectedness to others in the group. A possible community building question could be, “If you could be any superhero, who would you be and why?” Students can copy others’ answers or share something new. The idea is to honor what each student shares by actively listening and allowing the speaker to share their voice to the center of the circle. Figure 2 outlines possible circle starters that teachers can use with their students. This figure was adapted from the works of Cole and Dedinsky (n.d.) and outline different goals for circle time. The italicized questions “Related to Mathematics” were created by me to highlight how circle time can reflect a way to provide students an opportunity to talk about how they feel when doing mathematics. This time can help students to create their own identity in relation to mathematics. If Black and Brown students do not have an opportunity to express their feelings, actions, abilities in relation to their Racial Identity (RI), then students will have a more difficult time constructing a Mathematics Identity (MI). Providing this space is imperative for students to construct an identity they feel represents them as doers of mathematics while always considering their RI as well.

- ❖ Getting Acquainted
 - How would your best friend describe you?
 - If you were an animal, what animal would you be and why?
 - What would you not want to change about your life?
- ❖ Exploring Values
 - What is something you are passionate about?
 - What change would you like to see in your community? What can you do to promote that change?
 - What demonstrates respect?
- ❖ Storytelling (Who we are and what has shaped us)
 - Share a time that you were out of your comfort zone
 - Share a time you felt a feeling you did not expect
 - I feel scared when...
- ❖ *Related to Mathematics*
 - *These math problems make me feel...*
 - *When I picture myself taking a math test I...*
 - *I am a mathematician because...*

Figure 2. Questions to guide different types of RJC (Cole and Dedinsky, n.d.)

Other times, circles will be in direct response to something that happened either with or to any members of the group. After the 2016 Presidential election, many NYC public school students wanted a space to talk about what was going on in the world. Many teachers, especially elementary school teachers, had difficulty deciding upon the most appropriate ways to speak to their students. RJC would be a perfect practice to call students together to check in with them when something in the world could be affecting them. More commonly, conflicts will arise between students in the class and the RJC becomes a way to be able to respond to these conflicts. The goal of the facilitator of the circle is to pose a deep inquiry question where students can respond in meaningful ways. For example, to begin the circle, the facilitator might want the students to have a space to tell their side of a situation that happened prior: “What happened and what were you thinking when it happened?” If all the students who wanted to share have had an opportunity to do so, the facilitator may ask a question to guide students toward creating a resolution: “What do you think needs to be done to make things as right as possible?” The circle is never meant to be a time to “fix” student behaviors. That is a desired outcome, but it naturally happens through the process of the circle. In gaining trust with other members of the group, each member must respect what the other says by actively listening and not interrupting, adding on, giving an anecdote, or anything. The space is meant for everyone to be truly heard and that through the process of authentically sharing, the truth will be found in the center.

Although there are two main themes of RJC, there are endless possibilities for ways to lead effective RJC with the intention or goal of a specific outcome. I believe through RJC that students can be provided an opportunity to explore their own identity in different social and academic contexts. When adults reflect on themselves as learners, more than likely you will hear comments such as: “I loved English class”, “I was really good at debating”, or “Science was my

thing!” These comments are elements of their academic identity. We all have an association to a specific subject because of how well we performed or how smart we felt when being able to do the work. Students have the same associations. They say they love math only when they feel emotionally safe within math classrooms, perform well, and feel respected, acknowledged, and valued by their peers and teachers. If students do not have these positive associations with themselves as “doers” of mathematics, then they will never have a positive mathematics identity. Circle facilitators must gauge their class at what pace to move the circles. Some groups may take more time to build a strong sense of trust and openness. Based on students’ level of participation sharing in the circle and whether answers seem to be superficial or authentic, the facilitator can choose to dive deeper into students’ identity. Students must not only understand their identity, but also what their identity means in the context of being a mathematician. Many students are not given the space to reflect on *how they feel* performing math tasks or *what they feel* when told they must complete a math test. Are students nervous? Do they pretend to not be so other members of the group do not make fun of them? Would students show their true feelings towards math if they felt more emotionally safe within the space of the classroom? These are all questions to consider when implementing circles for the purpose of uncovering a mathematical identity. According to Martin (2009), a mathematics identity:

Refers to the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity encompasses a person’s self-understanding and how others see him or her in the context of doing mathematics. Typically, a mathematics identity is expressed in narrative form as a negotiated self and results from the ongoing negotiation of our own assertions and the external ascriptions of others.

Students must be given the opportunity to express, understand, and reflect on their dispositions and beliefs about how they see themselves as doers of mathematics. Through experience,

students are constantly negotiating their mathematics identity, which in turn is a process of learning. As students see themselves as central members of a mathematics community, students are demonstrating learning of skills, engagement, and participation. Identity shifts are where much learning and realization of self happens. Much evidence supports that Black and Brown students' mathematics identity is a reliable predictor of short and long term mathematics success (Martin, 2007).

All students deserve an opportunity to feel like they are capable of reaching their full potential as a person and a learner. White students inherently are privileged by the fact that others view them as capable compared to their peers of color. Whether implicit or not, rhetoric around "achievement gap" literature is problematic for students of color (Kane, Martin, & Verales, 2013). Many educators "strive to close the achievement gap", however, the achievement gap is not a true indicator of ability and success. Black and Brown students are constantly compared to their White peers, as if White achievement is the standard. Whereas, Black and Brown students should strive for excellence, not the excellence of a certain group of people. Educators must buy into this notion that the achievement gap is not real, and that our ideas of students' abilities are based off socially constructed ideologies to hinder the success of Black and Brown students. Through RJC, educators make a commitment to their students and themselves, to continue to be critical of our education system, achievement gap rhetoric, and the social constructs that implicitly guide our life. Through this work, the goal is for Black and Brown students to find their place in mathematics spaces in order for grander opportunities for their mathematics future.

Observable Anxious Behaviors and Strategies to Alleviate Math Anxiety

This list is created as a tool for educators to use to identify students who may exhibit observable anxious behaviors. It is based on a synthesis of my own personal teaching experiences alongside relevant research. I provide tips, techniques, and strategies educators can use with elementary students to help alleviate their students' anxiety. However, all of these strategies can be differentiated to be developmentally appropriate for all students. These behaviors may be present when a student experiences anxiety and are important to be aware of in order to address anxious behavior with the student and communicating these findings with families:

1. Sense of panic or frustration during assessment, when called to share, or during independent work

Some students experience anxiety when they know an assessment is coming. Students who have a fear of failure may experience anxiety before an assessment. If teachers notice this pattern of behavior with a student, there are a few things educators can do to prevent the heightened anxiety before the assessment begins. It is imperative for educators to model and emphasize that making mistakes (especially in math) is a major part of learning. Educators who do not model this thinking risk students assuming perfection is what makes them successful. Students with anxiety around assessments can be invited to have a conversation with the teacher prior to giving the assessment. Educators can speak to this student about the importance of trying their best and offer strategies the student can use independently to manage their anxiety. For example, teachers can co-create a list of adaptive strategies such as: taking 5 deep breaths, getting a drink of water, and/or creating a list of things they feel they are successful at before beginning the assessment. This will allow the student to recognize if they are feeling anxious and choose an appropriate

strategy to use to alleviate the symptoms. This also provides students with a sense of choice and ownership over their decisions.

For students who experience anxiety when sharing with the group or during independent work, there are a few options for teachers to help them alleviate their anxiety. Similarly to the strategies provided for students with anxiety during an assessment, educators can help students who experience the anxiety during the independent task by co-creating a list of strategies with the student that they can use on their own. The student may need a reminder to choose a strategy to use when you notice their behavior change. It is also important for the educator to consider whether the task is accessible to the student at that moment. Sometimes the anxiety starts because the student feels the task is too difficult. At times, this is just the anxiety “tricking their brain” to think they can’t do it. Other times, the task is actually too difficult and the anxiety will continue until the student can feel successful. If the task may be too hard, offer the student a differentiated task that consists of the same concepts, but uses applications that are more accessible for the student.

When students show anxious behavior when called to share with the group, educators can consider preventative measures for this as well. Students who have difficulty articulating their ideas can be encouraged to use a notebook, mini-whiteboard, or equivalent material to jot down their idea before sharing with the group. Educators should speak with the student prior to a mathematics lesson so they are aware of how to use the material effectively to help the student form their ideas prior to sharing. It is also helpful for the student to be given a heads-up during the lesson or discussion of when they will be called on. From personal experience, I have found that when I let students know when I will be calling on them, they have time to prepare their idea in their head or on paper, and feel more successful when sharing.

2. Lack of motivation

When students exhibit a lack of motivation to complete work or participate during math lessons, educators can consider the following to help them become intrinsically motivated to continue working. A lack of motivation for some students is related to a sense of helplessness. Learned helplessness is defined as a sense of defeat or helplessness someone experiences when they believe they cannot do something. It can be reinforced by the actions of others towards the student who experiences learned helplessness. If a student has felt disappointed by the way a teacher reacts to their mistakes, displays frustration, or interacts with that student, they may be discouraged to continue trying.

Positive reinforcement works well with students who lack motivation or experience learned helplessness. For these students, offering some type of choice or variation of structure, when appropriate, can change their mindset. For example, if students must complete an independent activity related to the lesson, educators can offer students a choice of three different activities that are related but vary in structure. One option could be to work independently if you know the student prefers to work alone, work with a partner on the activity, or have students create a game related to the concepts that they can teach the class and play during independent work time. Another option is to vary the structure of the math lesson itself. If a teacher notices that many of their lessons include lecture style and independent work, they can try to differentiate the structure that they use. They can consider using stations with students 1-2 times a week. For classrooms with only one teacher, they can consider creating a routine for 3 stations consisting of: lesson instruction, math games with a partner, and independent or partner work. This does take a bit more preparation, but once students are familiar with the routine, they will be able to move through the stations lasting 15-20 minutes each while also experiencing 3 different tasks.

This form of variety can act as a motivator for students who lack motivation during the mathematics period.

3. Avoidance

Avoidance is a difficult behavior to analyze in relation to mathematics anxiety. Some educators who notice their students are avoiding work may categorize them as lazy or unmotivated; however, avoidance can be a major indicator of anxiety. Students with anxiety who avoid work do so to be able to relieve themselves of the negative emotions attached to the anxiety. This is a maladaptive behavior that allows the student to feel a short-term sense of relief of those negative emotions (Compas, 2017). However, in the long-term, this is very harmful to students because they never have to deal or cope with the anxiety directly. Prolonged use of maladaptive strategies can be damaging to students and can potentially lead to an inevitable meltdown, violent or emotional outburst, and/or other related health concerns. Students must be appropriately taught how to address their anxiety in order to be able to face it and move on from it.

Teachers should have open conversations with their students who avoid work to be able to uncover the true reasons for the avoidance. If they suspect it is due to anxiety, they can offer the student an opportunity to create some sort of scale of how intense their feelings are during the math period. This can be done in different formats, but the end goal is for students to be able to rate how high their anxiety is in that moment, and based off the intensity they choose, they can pick an appropriate strategy they can use to help alleviate some of those feelings. It is very important for students to be able to identify and address the emotions they feel, whether good or bad. One tool that could be used is the Zones of Regulation. The Zones of Regulation are used as a way to help students identify their feelings in order to better regulate them and was originally

designed for students with Autism Spectrum Disorder to contribute to their emotional intelligence (Kuypers, 2011). The Zones include four color-coded sections (blue, green, yellow, red) that categorize different feelings people experience based on a scale of alertness and level of emotions felt. For example, the blue zone is categorized as low level of alertness and negative feelings students feel such as being: tired, sad, sick, bored. The green zone is the most desired zone for ideal learning to occur. Students in this zone may be characterized as focused, peaceful, content, or happy. The yellow zone is a high level of alertness and heightened emotions including feeling: silly, anxious, excited, nervous, or frustrated (Kuypers, 2011). Most of the students who experience math anxiety will typically feel that they are in the yellow or red zones when experiencing the anxiety. If teachers can help students to recognize when they are feeling a certain emotion in a specific zone, then they can more accurately be provided with tools to help them get back to the green zone. There are many resources for teachers on how to implement the instruction of The Zones of Regulation with their students and many tools teachers can offer their students. The Zones help students take ownership over their emotions and encourage students to regulate their emotions by using appropriate strategies to decrease their anxiety.

Boes & Ruff (2014) outline a range of adaptive strategies students with anxiety can use including: “identifying and expressing feelings, positive and negative self-talk, changing negative thought patterns, stress reduction and relaxation exercises, self-advocacy-knowing when and how to ask for help, goal setting, accepting mistakes as a part of learning, celebrating success, specific math study skills, journaling, self-evaluation, and termination.” Similarly to Boes & Ruff, I believe students who exhibit anxious behaviors should be provided a variety of tools, strategies, and anecdotes for the student to be able to use on their own.

It is important for teachers to know that they alone cannot take students anxiety away. Students must actively be a part of the process of finding a solution or solutions that work best for them. The strategies I outline are only some of the many strategies and resources teachers can use when helping their students cope with their anxiety. These strategies may not work for every child who has mathematics anxiety; however, they can be used as a baseline to assess what would work best for the student. Figure 3 summarizes the strategies outlined above in order to provide educators with a quick list of potential strategies to use with students to help alleviate their mathematics anxiety.

- Model positive attitude towards math
- Emphasize and model that everyone makes mistakes, it's okay to fail, we learn most from our mistakes
- Use various types of assessments and not too often
- Try methods that are fun, to foster positive emotion: games, stories, partner work, hands-on projects
- Provide clear goals and feedback
- Offer choice when appropriate
- Scaffold challenges with appropriate tools to boost confidence
- Cooperative NOT competitive social interactions in math

Figure 3. Strategies to Alleviate Mathematics Anxiety

Conclusion

In this paper I have argued that it is not only imperative for Black and Brown students to be given the space in school to be able to construct their own identity, but also, specifically, their identity in relation to mathematics. Through a critical review of the literature, I concluded that identity construction occurs when an individual makes sense of the members of groups in which they believe they belong. It is constructed through narratives and lived experiences of the individual. Black and Brown students need more spaces in school where they are able to talk about their identity as well as their identity in relation to mathematics learning. Many times

students of color are not afforded the opportunity to be able to discuss their identity in relation to specific academic disciplines. When students are provided a space to toggle with their idea of themselves in relation to mathematics, then they are more able to construct an identity that is particular to the experiences that they live on a day-to-day basis.

Mathematics anxiety is most easily combatted when students believe in a mindset that is not fixed. When students believe that they have the ability to learn new skills, apply them to further concepts, and feel confident discussing mathematics concepts with their peers, students have less anxiety revolving around getting a correct answer, fear of failure, or assessments. The anxieties associated with these ideas begin to diminish and students have the opportunity to feel more successful in mathematics. Students must be provided specific tools to help them recognize, address, and regulate their anxiety. I've outlined potential observable behaviors that educators can use to help them notice when students may be developing mathematics anxiety, as well as strategies teachers can use and provide to their students who have mathematics anxiety.

Educators should strive for every student to love learning and feel a sense of belonging as a member of the classroom community. All students are capable of excellence, especially Black and Brown students. Our students need to know we believe in them and support who they are as a whole person. Educators must employ critical concepts of care, hope, and love to in order to build reciprocal relationships with students, show students they have high expectations for them, and successfully alter the mindset of math anxious students. We must build caring relationships with our students so that we are able to teach the whole child.

Based on this critical review I then outlined a proposal for the use of RJC spaces in classrooms that will allow students to better understand who they are, what they identify with, what that means for themselves in the world, and how they view themselves in relation to math

content learning. I hope that this will set the stage for the next task of introducing an experimental use of RJC with a sample of schools as a way of testing its effectiveness.

Appendix

Name: _____

Date: ____ / ____ / ____

The teachers are hosting a big dinner and we need your help! One of the things we need to cook is green beans.

At the supermarket, green beans are \$1.98 per pound. We need to prepare 17 pounds. How much would 17 pounds of green beans cost? Remember to show your thinking!

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