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The Elephant in the Classroom: Understanding Teachers' Implicit Biases in Grading Student Work in a Mathematics Classroom

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The Elephant in the Classroom:
Understanding Teachers' Implicit Biases in Grading Student Work
in a Mathematics Classroom

by

Tina Marie Medina

A dissertation submitted to the faculty of Coastal Carolina University
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Education
with a specialization in Curriculum, Instruction, and Assessment

Education Sciences and Organizations

Coastal Carolina University

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Doctoral Committee

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ABSTRACT

This study focused on automaticity, or the choices we make without conscious thought. Specifically, the study examined how math teachers improved their understanding of the practice and evolution of culturally responsive teaching by analyzing the lived experiences and metacognition of practicing middle school teachers as they assess student work in mathematics. The potential impact of implicit stereotypes, instructor expectations, assessment design, cultural considerations, and other variables on the grading process was investigated. The purpose of this case study was to uncover teachers' implicit biases as it relates to grading student work in a middle school math class.

This qualitative study was conducted in a northeastern county in South Carolina. It involved three scheduled interviews and numerous voluntary observations with four middle school math teachers. All four teachers teach multiple levels of math classes; however, only general math classes were used for this study. The conceptual framework underpinning the study was Costa & Garmston's Cognitive Coaching (2016), and the Literature Review focused on implicit biases, gender and ethnicity in the STEM fields, biases in the mathematical classroom, culturally responsive teaching, grading biases, and consultation/coaching models.

All participants demonstrated implicit biases when evaluating student work in general education classrooms. A variety of formative and summative assignments were observed. As teachers graded, handwriting, achievement, and behavior biases were revealed. As participants grew increasingly aware and began to identify their personal biases, the researcher implemented the Cognitive Coaching framework to provide the support necessary to accept them and shift teachers' mindsets (Harris, 2023).

Keywords: **Implicit Bias, STEM, Mathematics, Grading Bias, Cognitive Coaching, Culturally Responsive Teaching**

DEDICATION

I dedicate this study to my wonderful son, Zeth, my cheerleader, and my amazing parents, Ed & Deb, for being my support system, ensuring I balance my time, giving me the courage to move forward, and encouraging me to accomplish this lifelong objective. I am indebted to them for the sacrifices they made for me and their patience throughout the many hours of study and classes while I completed this degree. I know Zeth is ready to have his mama back, and I am sure my parents are prepared to have their daughter back.

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CHAPTER 1: INTRODUCTION

In middle school math classrooms, educators undertake the crucial task of assessing student's mathematical understanding and growth. Students are growing up in a world where mathematics is everywhere. All technology utilized in offices, homes, and schools is based on mathematical concepts. High levels of mathematical proficiency are necessary for many educational options and desirable careers (Kilpatrick et al., 2013; National Research Council. 2001). It is an important subject that is essential for all students.

The kind of mathematics that today's children need to master differs from that of their parents and grandparents. 'Old Math' focused on rote memorization; rules would be followed without understanding the why, but points were given if the answer was correct. Within the past 20 years, 'New Math' has focused on creating problem-solving skills and allowing students to apply math concepts to real-world problems (Crow, 2022). School mathematics should aim to educate today's learners for the increasing demands for mathematical ability that they will face as adults. Furthermore, mathematics is no longer a field exclusive to a small group of people. The ability to think mathematically is a skill that all young people in the United States must develop (Kilpatrick et al., 2013; National Research Council. 2001).

Aspiring to teach all learners to think mathematically is a novel and challenging objective, but contemporary society must support it (Kilpatrick et al., 2013; National Research Council. 2001). All students must have equal access to mathematics to pursue educational and workforce opportunities. In a mathematics classroom, mathematical proficiency is utilized to engage learners in learning mathematics successfully (National Research Council. 2001). To develop mathematical proficiency, five strands (Kilpatrick et al., 2013) are interwoven through instruction to assist students in developing skills, confidence, and knowledge of mathematics.

Teachers do their best to help their students formulate, represent, and solve problems; explain and justify solutions; and have access to challenging, rigorous, as well as engage in meaningful math. Students in mathematics classes are encouraged to draw links between mathematical representations to enhance their comprehension of mathematical ideas and practices and use them as problem-solving tools.

By developing strong relationships with our students and having a profound daily impact on them, we can provide them with an educational experience that has the potential to transform their lives significantly: an awakening of their intellect, a better knowledge of themselves and their potential, the igniting of a passion, or the realization of their voice. Despite this, teaching has never been more challenging or burdensome. Our learners are becoming increasingly diverse; a higher proportion of them have households below the poverty line and whose first language is not English (Parrett & Budge, 2015).

Additionally, teachers must assess students and their proper proficiency in mathematics. Grades assigned to students reflect their academic achievements and influence their self-esteem, motivation, and future educational endeavors. However, under this objective grading process lies a complex and easily overlooked issue: grading biases. Raising serious concerns about how our grading systems represent students' abilities and potential, grading biases cast doubt on how fair and equitable assessments are made in our educational community.

Background of the Problem

History of Education Inequality

Historical educational inequities have resulted in a stubborn achievement gap in math and reading. Inequality in educational opportunities in the United States has a long history and has been influenced by several causes. During the colonial era, education was limited; wealthy

families could provide education, while those in a lower socio-economic class had little education (Najarro, 2023). As the 19th century emerged, America saw the rise of the Common School Movement. The Common School Movement worked to make public education available to all children. However, the establishment of common schools forced the relocation of Native Americans east of the Mississippi River. It coincided with the prohibition against enslaved Black Americans learning to read and write. Significant gaps persisted even after the Common School Movement, with Black segregated schools lacking government-provided resources and wealthy communities' schools having more excellent resources and qualified instructors (Najarro, 2023).

The 1920s saw the rise of neighborhood schools, which reinforced racial segregation and substantial differences in educational opportunities by situating schools in the middle of neighborhoods (Najarro, 2023). This idea inspired suburban neighborhood schools as education continued to expand and, therefore, resulted from the segregation of schools along racial lines, particularly in the Southern states. Generational disadvantages were prolonged since African American students were often compelled to attend inadequately funded, poor schools (Najarro, 2023).

The educational system has struggled with racial injustice (Neitzal, 2018). More than 60 years ago, the US Supreme Court declared in *Brown v. Board of Education* (1954) that racial segregation of students in public schools is illegal. This decision became one of the cornerstones of the civil rights movement. It established the precedent that "separate-but-equal" education and other services were not, in fact, equal at all (Brown V. Board of Education: Summary, Ruling & Impact, 2009; Cramer et al., 2018). Ever since this ruling, the United States has been struggling with the issues of equity and equality of all students; the educational system has struggled with racial injustice (Cramer et al., 2018; Neitzal, 2018). One would expect that in the 60 years after

this decision, America's educational system would work to guarantee that every student is educated in a setting that promotes more inclusivity or equality in education. Unfortunately, educational decisions and challenges are creating a more significant gap among students, especially those of brown and black skin (Futrell, 2004). Even while education has made some strides, our system still has a long way to go before achieving equity and equality.

Over time, curricula have also contributed to educational disparities. K-12 curriculum is embedded with biases that portray white people as heroic figures and all other races as inferior, unintelligent humans who are dependent on whites (Najarro, 2023). Before 1980, 35 states had enacted multicultural education reforms, but as pressure on schools to prioritize academics increased in the 1990s, money for these programs was either eliminated or never implemented (Najarro, 2023). This led to developing strategies and techniques, such as Culturally Responsive Teaching (CRT) and Culturally Relevant Pedagogy (CRP), that support teachers in utilizing students' life experiences and cultural identities as teaching resources in the classroom. These approaches enable all students, especially students of color, to develop into critical thinkers and lifelong learners (Will & Najarro, 2022).

Moreover, the education system needs help with equal access to quality education for all students. Achievement gaps in race, ethnicity, and socio-economic areas are systematic, preventing many students from achieving success (Cabral-Gouveia et al., 2023). Special Education and English Language Learners face challenges as they need more resources and support to succeed academically. Despite years of progress, significant inequalities still exist and demand ongoing attention and action (Cabral-Gouveia et al., 2023). The United States continues to struggle with addressing educational disparities. Increased financing for underprivileged schools, segregation-reduction policies, teacher cultural competency training,

and initiatives to close achievement gaps are all examples of efforts to advance equity. Ideas, perceptions, and educational laws must change to shift our education system so all students have equal access to resources and opportunities to succeed (Rynders, 2019).

Efforts to Close the Achievement Gap

Policy efforts, such as The No Child Left Behind (NCLB) Act (NCLB, 2002), aimed to close achievement gaps while holding schools responsible for students' performance. This act aimed to provide a better education and opportunities for students. It concentrated on kids who spoke little or no English, students of color, students in special education programs, and students living in poverty (Lee, 2023). The NCLB Act required schools to report on the learning and performance of their students. The act measured this data through school assessments, reports, improvement targets, and penalties for schools. Due to these changes, the NCLB Act became controversial for its narrowed focus on standardized testing and insufficient attention to systematic disparities, even while it compelled schools to concentrate on pupils from disadvantaged backgrounds (Lee, 2023).

The NCLB Act is no longer a law; the Every Student Succeeds Act (ESSA) replaced it. In 2015, President Obama approved ESSA, reauthorizing the federal education law to give all students equal access to education. This act was significant because it handed individual states back control over academic standards, in contrast to the NCLB Act, which granted the federal government the right to set national educational standards (Education Policy Issues in 2020 and Beyond, 2022). The ESSA is currently the education law for the public schools in the US. This law holds schools accountable for how students learn and achieve. Equal opportunity, including in special education, is the goal of ESSA for kids from disadvantaged backgrounds. Using this plan, every state develops an education plan that its schools must adhere to. This plan includes

state report cards, annual testing, accountability, standards, and goals for achievement. The goals of ESSA are to advance equity in K-12 schools, require high academic standards, improve parent-teacher communication, encourage local input, emphasize accountability, and increase school funding (Jones, 2024).

Additionally, ESSA funds literacy initiatives and promotes creative approaches to teaching students in schools (Lee, 2023). However, some disadvantages of ESSA are that success is measured by unreliable testing, it needs to address causes of inequality, it does not address school closings, and adequate yearly progress is no longer considered (Jones, 2024).

Education Inequality in Mathematics

Inequity, or equity, is still the core focus of current reform initiatives in mathematics education (National Council of Teachers of Mathematics [NCTM], 2000, 2008). Mathematical education inequality refers to discrepancies in student accomplishment across distinct demographic groups and gaps in access to high-quality math instruction. Socioeconomic status, race, gender, location, and the standard of educational resources are only a few variables that can impact these differences (*The Mathematics of Inequality*, 2018). Stereotypes and biases can impact a student's mathematical performance and image of themselves. Even the implicit biases in teachers can affect what they anticipate from and think of their students. Students are presented with an education that perpetuates the traditional idea of mathematics as culture-neutral, even though many bring a wide range of cultural and language abilities to the classroom. Additionally, students from underrepresented backgrounds may become disengaged by the lack of cultural relevance or inclusivity in math curricula and teaching materials (Abdulrahim & Orosco, 2020).

Most U.S. mathematics curricula, pedagogies, and assessments are standardized and based on something other than learners from varied cultural and language backgrounds. This one-size-fits-all method ignores students' cultural assets and learning experiences, impacting how they respond to math instruction (Abdulrahim & Orosco, 2020). A multimodal strategy is needed to address math education inequity, including fair funding for schools, teacher professional development, inclusive curriculum design, and initiatives to combat preconceptions and biases. NCTM created five process standards: problem-solving, reasoning and proof, communication, connections, and representations. Using these process standards, teachers should develop mathematical practices for students to build math proficiency and feel successful in a mathematical classroom (National Council of Teachers of Mathematics [NCTM], 2000, 2008).

According to many studies, establishing learning environments that recognize and integrate the linguistic and cultural diversity of students, family, and community members into instruction fosters a connection between mathematics cognition and language. Therefore, fostering mathematical comprehension can be significantly aided by teaching and learning strategies that bridge students' real-world experiences and mathematical activity (Abdulrahim & Orosco, 2020). For achievement disparities to be closed and chances for future success in Science, Technology, Engineering, and Mathematics (STEM) disciplines and other fields to be fostered, it is crucial to promote equal access to high-quality math education for all students.

While math instruction may be resistant to the impact of cognitive biases, research has indicated it is not (Copur-Gencturk et al., 2022; Stephens et al., 2022; Feldman, 2018; Conaway & Bethune, 2015; Sprietsma, 2013) and, therefore should be studied to understand the biases that come with grading and math instruction. The specifics will be discussed more in-depth in the

literature review in Chapter 2. To comprehend the nature of the issue, it is essential to note that research has shown that cognitive biases affect how teachers assess students' thinking when they solve and explain mathematical problems, even in the subject of mathematics.

Problem Statement

Math achievement gaps that persist show that teachers need assistance in implementing practices that will enhance student learning for all learners. Formal and informal assessments of student work, including homework, projects, quizzes, tests, and student engagement, have historically been utilized to observe student growth. Tests and quizzes are straightforward because there are several ways to evaluate students learning. Either the final response is right or wrong. Other grading categories become subjective regarding assignments, projects, and different methods of gathering information and assigning grades. Opinions, biases, and perspectives emerge when instructors use these learning resources, and personal presumptions change the grading process.

Continued achievement gaps in math indicate the need to support teachers in strategies that will improve student learning for all students. This study explores how math teachers respond to consultations focusing on implicit bias in math grading.

Purpose of the Study

Traditionally, student work has been assessed using formative and summative assessments, such as classwork, student participation, homework, projects, quizzes, and tests. With the multiple avenues for evaluating students and their learning, quizzes, and tests are straightforward; the answer is either correct or incorrect. However, these categories become subjective with class work, projects, and other ways to gather data and collect grades. When educators assess these forms of learning, opinions, biases, and beliefs start to form, and

individual assumptions begin to alter the grading process. (Terrier, 2020). Particularly in a math class, answers are usually black and white. However, when a teacher looks at how a student got their final answer to a math problem, what is the correct way to grade? Is there a correct way to grade? How much work must a student show for the teacher to access their learning? Grading has become a subjective lens for math educators. The problem with subjective grading is it leaves the door open for one's own bias to factor in the assessment process (Silverstein, 2022).

Students who struggle academically are frequently less inclined to seek aid and support (*Awareness of Implicit Biases*, 2021; Staats et al., 2016). Instructors may presume that students are aware of how to get help when they are having difficulties, when in actuality, many students may need help finding support when required. Teachers may believe that students from particular social or economic groups have different intellectual aptitudes or aspirations. For instance, a teacher may think that a child from a specific background, like minorities, will be content with lower achievement levels (*Awareness of Implicit Biases*, 2021; Quereshi, 2017). Negative perceptions may lead to unequal treatment of students (Quereshi, 2017).

Perceptions, whether held by teachers or students, have been proven to correlate strongly with student accomplishment, with specific characteristics predicting favorable and unfavorable outcomes (Worrell, 2022; Peterson et al., 2016). Some researchers have explored teacher views, such as teacher expectations and implicit bias, while others have explored student perceptions of achievement, such as mindsets, hope, and time attitude (Worrell, 2022). Research on implicit bias shows that most of us have implicit biases in the form of stereotypes and prejudice against racial minorities (Desai, 2019). Differences in discipline have continued for several years, even though most educators and school personnel are dedicated to treating all pupils fairly and equally, regardless of race. Several researchers have conducted studies suggesting this paradox

may arise from the significance of "implicit bias" and related ideas in our lives (Quereshi, 2017). According to research, when people have a vague understanding of others, they are more prone to act in biased and stereotypical ways. Relying on a stereotype requires less mental effort than carefully considering the circumstances. Because of this, unless instructed otherwise, a teacher may instantly make assumptions about a new student of a different race based only on the student's conduct (Quereshi, 2017).

This study is focused on automaticity or the choices we make without conscious thought. Therefore, the researcher seeks to improve the current understanding of the practice and evolution of culturally responsive teaching by analyzing the lived experiences and metacognition of practicing middle school teachers as they assess student work in mathematics. Furthermore, this study on grading biases in middle school math classes explores the various manifestations of these biases and their effects on students. The researcher examines the potential impact of implicit stereotypes, instructor expectations, assessment design, cultural considerations, and other variables on the grading process.

Conceptual Framework

Cognitive Coaching

As a mentoring method, cognitive coaching effectively fosters teachers' feelings of efficacy development (Alicea, 2014; González Del Castillo, 2015; Maskey, 2009). Cognitive coaching has been shown to specifically (a) promote professional discourse, (b) boost teachers' sense of efficacy, (c) support any teaching-related innovation, and (d) promote job satisfaction (Brooks, 2000; Göker, 2006b; Maskey, 2009). Researchers in education have primarily focused on coaching and teacher efficacy, and they have all attempted to connect these two concepts to improving teaching practice and student achievement (Göker, 2020). According to many studies

(such as Göker, 2006b; Lumpe et al., 2012), teacher feeling of efficacy has typically been examined in conjunction with student accomplishment in various academic subjects and other teaching-related tasks. Scholars have demonstrated that teachers still need to make significant progress in their professional development. Peer coaching and teacher training support are alternatives to traditional methods of solving issues with teacher efficacy (Göker 2006b; Göker, 2020; Lumpe et al., 2012).

In addition, Clarke et al. (2013) presented the study of teachers' professional identities as a new area of study in educational contexts. Professional identity, as a newly emerging term, is an integrative construct that "represents the process by which the person seeks to integrate his various statuses and roles, as well as his diverse experiences, into a coherent image of self," according to Epstein (1978, p. 101). In this framework, identity is defined by Gee (2000) as an informed understanding of a teacher's professional identity. This definition is also considered in our study to determine how past experiences of teachers may impact the development of future teacher identities.

Along with these studies, the peer coaching model has also been cited as a successful strategy for boosting teacher efficacy and student progress. When inner and invisible cognitive habits are changed, cognitive coaching creates conditions where student teachers or early career educators can identify opportunities to change observable teaching behaviors. Therefore, coaching models or consulting strategies are essential to this study because they show the effect of a cognitive coaching model developed by the researcher on teacher biases in assessing student work in a mathematics classroom.

Research Questions

This case study aims to uncover teachers' implicit biases regarding grading student work.

The research questions to guide this study include:

RQ1: What implicit biases can be identified during consultation sessions with math teachers?

RQ2: How do participants react to the implicit bias consultation process?

RQ3: How does consultation affect detected implicit biases in math grading?

Significance of the Study

Teachers' perceptions of intellect have been linked to bias (Stephens et al., 2022). Some people believe that intellect is primarily fixed, meaning that people are born with a specific level of intelligence that cannot be altered. Others contend that intellect is more flexible and that individuals can enhance their intelligence with work and encouragement (Stephens et al., 2022). Teachers who have more rigid ideas about intelligence might be less inclined to act to slow down a student's academic advancement, which could cause them to give them less complicated assignments and stop giving them the support they need to perform at higher levels (Stephens et al., 2022).

Peterson et al. (2016) study showed that for students (grades 4-10) from the ethnic majority vs those from the ethnic minority, teachers' implicit biases led to differential mathematical success improvements equal to an entire academic year. Unlike explicit measures, which allow for thoughtful responses, implicit measures can be instrumental in evaluating sensitive issues among teachers, such as attitudes toward historically marginalized groups (Stephens et al., 2022). The study's authors hypothesized that this impact might have resulted from the instructors' implicit expectations being more subtly conveyed to students in mathematics due to the teachers' less prominent explicit expectations in that subject. This means

that teachers should have high standards for every student and implement strategies frequently used by high expectations, like flexible groupings rather than ability groups, which draw attention to various expectations for each student.

In another study by Stephens et al., 2022, they found that the highest reduction in implicit achievement bias was accompanied by a decrease in a fixed mindset and an elevation in a growth mindset. Conversely, those who made the most significant gains saw a rise in growth and fixed mindsets. Therefore, investigating implicit prejudice may be a helpful way to learn more about the unequal academic outcomes of students from minority groups. Because implicit measures are thought to be able to identify more automatic responses, such as non-verbal behavior that more accurately reflects the daily complexity of the classroom, than explicit measures, they may be able to provide a more accurate indicator of teacher attitudes and behavior (Glock & Kovacs, 2013; Stephens et al., 2022).

Integrating research on implicit racial associations and current understandings of racial inequalities in education can strengthen our knowledge in each arena and identify novel strategies for increasing the fairness and effectiveness of educational settings. Collaboration between social psychologists and education scholars provides essential insights into the relationship between individual mechanisms of racial bias, often implicit, and the structural and cultural forces shaping the lives of children.

Furthermore, our classrooms are becoming more diverse, so teachers must be ready to collaborate productively with students from various backgrounds, including cultural, linguistic, and national origin (Keengwe, 2010). Students who attend American schools today differ significantly from those who did so in the past. Over the past few decades, there has been a significant growth in the racial, ethnic, cultural, linguistic, and socioeconomic variety of students

in public schools (Bonner et al., 2018). Students bring their cultures, backgrounds, and unique personalities into the classroom. Each one stands out and is significant. Culturally competent teachers are involved in curriculum decision-making, showcasing that the curriculum is meaningful and relevant to students' lives (Gay, 2010). If district officials and teachers invested a small amount of time and training, students who have been historically underserved could be given educators who are devoted, sensitive, and competent to teach culturally and linguistically. As cultural organizers, teachers recognize that including students' cultural experiences during instruction promotes high academic achievement for all students, thus cultivating a classroom community in which students embrace and affirm their cultural differences and those of their peers (Johnson & Gonzalez, 2014). Teachers must constantly reflect on their views and biases to become more culturally aware and committed to supporting marginalized and diverse children. Students will then dedicate themselves to acquiring the skills required to become culturally competent and responsive (Gay, 2010; Milner, 2011). A vision for educational equity should result in more responsive teaching, classrooms, and schools for the students they serve.

Assumptions, Limitations, Delimitations

The following assumptions and limitations may affect this study:

The researcher assumes the participants may need to understand or acknowledge their biases regarding grading work entirely. The researcher expects to see the following biases: gender, social, economic status, and race. In the mathematics classroom, the researcher assumes that the teacher is looking to see if the answer is correct and assessing the students' process to show how they got it.

Limitations to this study are biases, time, location, and sample size. As this study focuses on the implicit biases that teachers showcase when grading student work, there may be

limitations on observing more biases than what has been specifically researched. The time of the study is another limitation. With only a few months to collect and analyze data, the short time frame may affect some of the study's findings. Lastly, the sample size for this study is small. Only four mathematics teachers will participate in this study.

Conclusion

In conclusion, integrating research on implicit racial, gender, socioeconomic, and sex-orientation bias associations and current understandings of racial inequalities in education can strengthen our knowledge in each arena and identify novel strategies for increasing the fairness and effectiveness of educational settings. Collaboration between social psychologists and education scholars provides essential insights into the relationship between individual mechanisms of racial bias, often implicit, and structural and cultural forces shaping the lives of children.

Many well-meaning people are sincerely devoted to seeing all children succeed in their education. Since they directly and indirectly affect many individuals, educators are uniquely positioned to understand the need to invest in young people's education, health, and general well-being for society's present and future. Education professionals should be aware of implicit bias, which refers to views or prejudices that unconsciously affect our knowledge, behaviors, and decisions.

Definition of Terms

1. *Biases are prejudices* of or against one thing, person, or group compared with another, usually in a way considered unfair (“Definition of Bias,” 2023).
2. *Explicit Biases* refer to our conscious attitudes and beliefs about a person or group (Copur-Gencturk et al., 2022).

3. *Implicit Bias*, also known as implicit prejudice or implicit attitude, is a negative attitude toward a specific social group of which one is unaware. It is thought to be shaped by experience and based on learned associations between particular qualities and social categories, including race and gender (*Awareness of Implicit Biases*, 2021).
4. *Culture* is more than a collection of common festivals, meals, or linguistic or religious practices; it is a lived experience unique to each individual (Gay, 2000).
5. *Diverse Learners*- children and students of all abilities from racially, ethnically, culturally, and linguistically diverse communities and backgrounds.
6. *Gender* is a social construct generally based on the norms, behaviors, and societal roles expected of individuals based primarily on their sex, not their gender identity itself.
7. *Race*- is an arbitrary classification of modern humans, sometimes based on a combination of various physical characteristics, such as skin color, facial form, or eye shape.
8. *Ethnicity*- a social group that shares a common and distinctive culture, religion, or language.
9. *Equity* provides different resources or accommodations to create just circumstances within a group. Equity is concerned with the concept of fairness.
10. *Equality* is the distribution of the same resources or accommodations within a group. *It* concerns the concept of sameness.
11. *Cultural Relevancy Teaching* is defined as culturally relevant pedagogy (or culturally relevant teaching) as a “theoretical model that not only addresses student achievement

but also helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools” (Gay, 1995, p. 469).

12. *Culture-responsive teaching* is a collection of pedagogical knowledge and skills that assist in creating successful outcomes for each student. It specifies the pedagogical skill sets required of teachers (Ladson-Billings, 1995).

CHAPTER 2: LITERATURE REVIEW

This chapter will explore the current literature related to the fundamental concepts for this study. The first section will examine the literature about implicit biases, including biases specific to STEM fields, including mathematics and the classroom. The second section will discuss current literature on Culturally Responsive Teaching in STEM fields and how biases are formed in this area. These sections will support strategies used during this study's consultations with math teachers. Following these sections, this chapter will look in depth at Cognitive Coaching, including studies indicating its effectiveness for K-12 teachers. Finally, this chapter will situate the present research in literature and demonstrate how it will contribute to the field.

Biases

According to Merriam-Webster Dictionary, biases are an inclination of emotion or outlook, especially a personal and sometimes unreasoned judgment (“Definition of Bias,” 2023). There are two types of biases: explicit and implicit. Explicit biases stem from intentional and conscious responses based on our preconceptions, judgments, and beliefs (Copur-Gencturk et al., 2022), something people are aware of and frequently observe in society regarding social groups and personal views. Explicit biases immediately and openly influence our beliefs and actions, yet they are also controllable (Banks et al., 2021; Holroyd et al., 2017) and can be altered as beliefs change (Copur-Gencturk et al., 2022). In contrast, implicit bias is the term used to describe unintended, automatic beliefs or preconceptions (*Awareness of Implicit Biases*, 2021) that affect our everyday decision-making, behavior, and perception. It uses easy, fast, and intuitive cognitive processing of the perceived world. Individuals with implicit bias do not intentionally behave in a biased manner (Copur-Gencturk et al., 2022) towards them or their beliefs, stereotypes, or prejudices. It results from an unconscious cognitive mechanism (Banks et al.,

2021; Chin et al., 2020). We are affected by biases in various ways, whether explicit (knowing) or implicit (unconscious). Because they are intentional, explicit prejudices are simple to spot. Implicit biases, on the other hand, are the attitudes or stereotypes that affect our understanding, actions, and decisions and have an unconscious impact on us (Stats, 2016; Stephens et al., 2022); therefore, it is more difficult to see them.

Teacher Biases

In the United States, educators' work in institutions and societies is significantly influenced by biases (Starck et al., 2020). Bias may come from our attitudes influencing our perceptions (Glock & Kovacs, 2013; Olson & Fazio, 2009) and our judgments and decisions (Daumeyer et al., 2019). People of all backgrounds encounter implicit biases, which are pervasive in all situations and could have adverse effects. Moreover, educators must understand how to identify when biases are seen, used, or felt through everyday schooling activities.

Implicit biases among teachers can affect both their behavior toward students and the effectiveness of their interactions with them (Rynders, 2019; Starck et al., 2020). The frequency and quality of these interactions are typically influenced by factors like a student's race, gender, socioeconomic background, and sexual orientation. Similar to how it can affect student expectations, bias can also affect how teachers evaluate students' academic performance (Papageorge et al., 2016; Rynders, 2019).

The unconscious views and feelings we have toward others based on their race, ethnicity, age, gender, and outward appearance start to form at a very young age as a result of direct and indirect messages. These attitudes and feelings are pliable and may be unlearned consciously (Blair et al., 2001 & Neitzel, 2018). These unconscious biases have an impact on people's actions and decisions, which may lead to outcomes that are unfair to various groups. For example, in

some areas, white, middle-class females hold the majority of leadership roles, including teachers as well as administration, in K–12 educational institutions, whereas poor, minority kids make up the majority of the student body (Zumwalt & Craig, 2005) and African American stereotypes are still pervasive, according to recent studies on implicit bias (Cunningham et al., 2004; Neitzel, 2018; Rynders, 2019). The fact that teachers bring formulated assumptions derived from previous experiences (Douglas et al., 2008) to their classroom is crucial to understand, as those norms can influence teachers' interactions with minority students.

Implicit biases work without teachers being aware and can affect students subtly but significantly (Calinger, 2020). Students from various racial and cultural backgrounds in the US experience alarming, ongoing success discrepancies (Calinger, 2020). For example, implicit bias frequently causes differing treatment and expectations in the classroom for Black girls (Sirrakos & Edmin, 2017). These stereotypical signals may be conveyed to students by various people, including their teachers, peers, and parents. However, teachers' unconscious prejudices, influenced by cultural stereotypes, significantly negatively impact their students' academic performance. People frequently exhibit unconscious prejudice when presented with confusing or insufficient information, time restrictions, or situations that impair cognitive control. People of all backgrounds encounter implicit biases, which are pervasive in all situations and can have adverse effects. Students can feel these biases and stereotypical signals that make them uncomfortable in the classroom.

Implicit biases can affect education, preventing some students from achieving their potential (Staats, 2016). Tenenbaum & Ruck's (2007) research demonstrates that teachers have various expectations for their students' performance depending on their ethnic background and that these expectations impact students' performance in multiple ways. First, teachers'

expectations of their students' abilities may cause them to make (unconscious) modifications in conduct that impact their students' actual performance. More recent research has shown unintentional variations in instructor behavior depending on the student's background (Copur-Gencturk et al., 2023). There is evidence that African-American students receive much less praise, fewer direct questions from teachers, and less feedback following errors than their counterparts from other ethnic backgrounds (Sprietsma, 2013). These children, who are frequently members of low-status minoritized groups, suffer from the short- and long-term effects of their professors' ingrained prejudices and attitudes, which are challenging to manage and widespread (DeCuir-Gunby & Bindra, 2022; Warikoo et al., 2016). Acknowledging personal biases, especially implicit biases, can strengthen student-teacher relationships, restore trust with all students, and improve achievement outcomes.

Biases in the STEM Field

Women are still underrepresented in STEM fields; from 2011 to 2021, men made up about 65% of STEM workers, while women made up roughly 35%. Minorities are still underrepresented as well. Black people hold 9% of STEM jobs and 11% of all jobs. Just 8% of STEM positions are held by Hispanics, who make up 17% of total workers. Only 20% of high school graduates are equipped for college-level coursework in STEM majors, suggesting we may need to catch up in STEM education (Smith, 2024).

Unfortunately, teachers themselves are entangled in a society where racial and gender stereotypes are ubiquitous and are not immune to bias. The racial and gender differences in teachers' assessments of students' mathematical proficiency (Copur-Gencturk et al., 2020) and performance (Wang & Hall, 2018) are reflected in the way they grade student work (Lavy & Sand, 2015), as well as recommend students for gifted and special education programs (Copur-

Gencturk et al., 2023; Morgan, 2020; U.S. Department of Education, 2021). Copur-Gencturk et al., 2023 study showed that prejudices among teachers can be seen in various contexts. This study found that teachers may exhibit unintentional biases that reflect those in a broader society, but findings can't support whether biases reflect teacher biases or actual differences. Therefore, they sought to create an experimental study to find these biases against gender and race, specifically women and people of color, in the STEM field. As a result, math teachers are especially well-positioned to form students' STEM intellectual self-concepts and assist them in overcoming stereotypes.

Racial Bias

Implicit racial bias refers to the unintentional socio-cognitive associations we have with particular racial groupings and is reinforced by inputs from our social settings (Tropp & Rucinski, 2022). Both within and outside of the classroom, racial bias is pervasive. Research has shown that educators make racially biased decisions that have a significant impact on student's lives and perpetuate racial disparities. Teachers also treat their students differently based on race, which leads to differences in academic performance and school climate (Starck et al., 2020; Warikoo et al., 2016). Racial biases, for example, among educators frequently impact the standards they set for their students, the overall quality of their instruction, and the decisions they make about how to operate their classrooms (Starck et al., 2020). Teachers may worry about coming across as racist, regardless of their implicit racial attitudes. They may feel uncomfortable discussing race and racism openly in the classroom due to the colorblind mentality that permeates American society (Pollock, 2004). They may fear that their intentions will be misinterpreted or that they will come out racially prejudiced by students or colleagues (Tropp & Rucinski, 2022).

The majority of the time, people are either unaware of their implicit associations or hesitant to support their prejudices toward minority groups. Due to this, racial biases affect these students in the classroom, specifically STEM classes. Biases specific to STEM fields can exist among educators. For instance, there are persistent misconceptions that men and White students are more naturally gifted in math and other subjects requiring a lot of math. In addition, women and people of color are regarded as being less capable than White men in terms of natural abilities (Lecklider, 2013), and this is especially true in the STEM fields. These prejudices can contribute to educational inequity, racial gaps continue despite sincere attempts, student achievements are likely to be impacted, which is associated with bad feelings and behavioral problems, and the pressures of working conditions can have an impact on the attitude and conduct of instructors (Warikoo et al., 2016). When faced with ambiguous or insufficient information, a time crunch, or conditions that may impair our cognitive control, unconscious bias is more likely to influence our decisions and actions (Staats, 2016; Kempf, 2022). Teachers' decisions, academic trajectories, and expectations of themselves can be influenced by teachers' conscious and unconscious expectations of their students.

Gender Bias

Explicit and implicit bias can also be seen among different genders. These biases mainly connect to gender and misbehaviors. According to a study, males are seen as more bothersome than females and engage in more disruptive behavior (Beaman et al., 2006). As a result, teachers discipline male students more frequently than female students, even though teachers compliment boys more frequently than girls (McClowry et al., 2013). The more negative behavioral expectations teachers have for male students lead to a biased perception of male students'

behavior, making teachers feel more stressed because they believe their students are acting out more frequently than they are (Glock & Kleen, 2017).

Since the early days of science, women have made significant contributions to the field. However, despite this progress, women continue to face gender barriers in STEM fields. Recent research found that women are underrepresented in positions of leadership in STEM fields, and they earn less than men for equivalent work. The declining development of women's engagement in STEM preparation has been compared to a leaky pipeline (Block et al., 2019). It has been shown that this decline is constant and progressive. There appears to be a broad consensus that women suffer particular difficulties as they advance in the STEM pipeline, including a lack of role models, gender stereotypes, a lack of opportunity to foster STEM interests early on, and poor experiences with gender socialization.

Nearly two-thirds (65%) of women working in STEM jobs in 2021 had at least a bachelor's degree education (Bloodhart et al. 2020), compared with less than half (43%) of men in STEM jobs (National Science Foundation, 2023). In 2020, women earned more bachelor's degrees but were underrepresented among degree recipients at all degree levels in physical and earth sciences, mathematics and computer sciences, and engineering (National Science Foundation, 2023). Furthermore, in the fields of STEM, women are still underrepresented, even though progress has been made in the last several years. In 2021, among people ages 18 to 74 years, women made up half (51%) of the total U.S. population and about a third (35%) of people employed in STEM occupations (National Science Foundation, 2023).

The gender difference begins in middle school (Elliot et al., 2020). This is a time when negative gender socialization experiences begin to occur, and therefore, young girls start to become self-critical, and perfectionism kicks in. Stereotypes are evident, leading to diminished

self-concept, self-interest, and lack of motivation (Almukhambettova et al., 2021). During these middle school years, girls may have “imposter syndrome,” more self-doubt, and fear of failure (Almukhambettova et al., 2021). Studies reveal that girls' interest in STEM fields dwindles in middle school and that at this time, their self-perceptions of their mathematical prowess relative to boys likewise drastically decline (Elliot et al., 2020). Females enjoy competition, but when they lose, they may blame themselves for not trying hard enough, which can cause self-doubt, fear of achievement, perfectionism, and loneliness, all of which prevent females from achieving success in STEM fields or achieving success in anything (Lin & Deemer, 2021). Additionally, women are driven to help humanity and propelled to interact with others; therefore, female students seek a more comprehensive range of job alternatives than male students but are still more interested in female-dominated occupations, which often have lower educational requirements and lesser status (Almukhambettova et al., 2021). As students enter high school, experiences, math competence, and societal opinions about scientists and engineers all influence how they perceive their academic and professional options; therefore, females believe they are incapable of success in STEM careers (Elliott et al., 2020).

Additionally, there is this stigma with STEM that it is a “dude” culture (Miller et al., 2021). It is a hidden bias that the American contemporary society has structured STEM careers as “cisheteropatriatchal” (Miller et al., 2021), meaning privileges for heterosexual men in this field, which leads to toxic masculinities. Due to this stigma, women are often unwelcomed in STEM learning environments and may be harassed, discriminated against, or, even worse, threatened (Block et al., 2019 & Miller et al., 2020). With the gender biases that are evident in STEM, women may experience a chain of psychological events because their abilities are unwelcoming even though they outnumber degrees compared to men (Bloodhart et al. 2020), and this can lead

to environmental threats. To overcome these barriers, organizations and individuals must work together to create an environment conducive to women's success in STEM. This can be done by encouraging girls to pursue a career in STEM, providing access to resources and training, and offering support from schools. We must create a culture that values diversity, inclusion, and innovation. These principles will help to break the gender barrier in STEM fields and allow women and minorities to achieve their full potential.

Classroom Biases

Teachers have preconceived beliefs about how students learn and their potential for academic success based on their identities and experiences. Scholars have focused on how an unconscious bias held by an educator can affect both the teacher's attitude toward students and the nature of their interactions with them (Rynders, 2019 & Starck et al., 2020). The frequency and quality of these interactions are typically influenced by factors like a student's race, gender, socioeconomic background, and sexual orientation (Banks et al., 2021). Similar to how it can affect student expectations, bias can also affect how teachers evaluate students' academic performance. Alarming, persistent success gaps exist amongst students from different racial and cultural origins in the US (Calinger, 2020; Williams et al., 2020). These beliefs could harm the students' growth (Awareness of Implicit Biases, 2021).

Numerous research has shown a correlation between attitudes and race/ethnicity. However, limited research has examined the impact of teacher prejudice on traditional educational settings (Conaway & Bethune, 2015). Ferguson's (2003) study on bias in the conventional classroom was examined, and the results showed that teachers are prejudiced and frequently have preconceived notions about certain pupils based on their status in certain groups, such as gender, race, or ethnicity. It was shown that teacher assumptions can significantly

impact students' performance and accomplishment. Names, stereotypes, and ethnicity are traits that affect how teachers shape their expectations. The ongoing discrepancy in test results between Black and White children was the main reason behind Ferguson's initial investigation. It was observed that teachers frequently asked white students to read aloud or respond to questions in class, but they rarely asked black students to participate. In the classroom, teachers are already laying the foundation for even white learners to believe they belong to a more intelligent race (Conaway & Bethune, 2015).

The Brain and Biases

According to psychologists, our brains can reportedly process about 11 million bits of information each second (Staats, 2016). Researchers have worked to grasp the subtleties of our cognitive functioning, considering the amount of information that inundates our brains at any given time. By dividing mental processing into two categories—System 1 and System 2—, Daniel Kahneman presents a widely used paradigm for explaining human cognitive performance in his 2011 book *Thinking, Fast and Slow*. System 1 is responsible for handling cognition that takes place subconsciously, such as stopping at a red light. In contrast, System 2 is a conscious process for mental tasks requiring concentration (Kahneman, 2011). Together, these two systems help us make sense of the world around us.

Most of our cognitive processing happens unconsciously from the millions of possible pieces of information we can process each second (Staats, 2016). Therefore, System 1 cognitive processing is significant because it clarifies how many implicit biases affect our perception and behavior. As a result, System 1 is to blame for the associations known as implicit biases. Implicit associations do not always correspond with our explicit views and expressed goals because they form outside of our awareness. This entails that even those who admit equal intentions and make

an effort to treat everyone reasonably may unintentionally behave in a way that reflects their implicit—as opposed to explicit—biases (Staats, 2016). Furthermore, we are unaware that implicit biases exist despite System 1's unconscious and involuntary activation of them, which can significantly negatively impact our ability to make decisions (Staats, 2016; Kahneman, 2011).

Culture and Diversity Biases

The foundation of inclusive education is the belief that all students should have access to the same learning environments and opportunities and that diversity among people should be valued and acknowledged in schools (Urbani et al., 2022; Division for Early Childhood & National Association for the Education of Young Children, 2009). In addition to access to quality education, economic problems, limited resources, and mental health issues, the school system is battling educational equality, hindering many students from succeeding (Lynch, 2023).

Experiences and situations in our lives define and mold who we are. All educators, from those new to the classroom to those with experience, have room to develop and improve. Students of color make up over half of the student body in public schools; however, the majority of schools are structured around the mainstream culture of white Americans. 80% of white teachers (National Center for Education Statistics, 2021; Starck et al., 2020) teach in the United States. To become better and more successful instructors, educators, and white teachers in particular, need to evaluate their prejudices and privileges critically (Miller, 2020), assumptions, worldviews, contradictions, racism, homophobia, sexism, and other forms of oppression.

Schools sometimes reflect the culture many children encounter at home and in their communities. With these struggles, teachers create relationships with their diverse students, sometimes coming across as superheroes for students who may look different from them (Will,

2020) and making assumptions about their learning, thus bringing biases into the classroom. These biases can negatively affect the natural world and keep some children from advancing academically. In some instances, student results are correlated with teachers' bias levels. For example, the more biased teachers are, the poorer the results are for the learners (Starck et al., 2020). Furthermore, a significant degree of bias is involved in how teachers view, assess, and handle children based on race (Starck et al., 2020; Will, 2020). These students, who commonly belong to low-status minoritized groups, suffer immediate and long-term repercussions since their teachers' implicit biases and attitudes are pervasive and resistant to change (DeCuir-Gunby & Bindra, 2022).

Society has this preconceived notion that children attending urban schools need assistance or are simply "bad" children. It has been said that "these perceptions get reinforced and affirmed by narratives constructed and shared by and through the spectacle, which trigger the negative perceptions of urban youth that we have all become too comfortable with" (Edmin, 2017, p. 78). We have failed these communities as a society because "The Spectacle" sheds light on them, allowing prejudice and intolerance to flourish. We have gradually diminished the value of minority communities because of these prejudices. According to Edmin's (2017) "The Spectacle," it is a derogatory belief that students and schools alike must adopt an "Americanized" mindset. As a result of their own experiences, instructors frequently enter the classroom with prejudices, assumptions, and biases to appear to their students as heroes. When students come from different backgrounds than their teacher, the teacher "sees the student as the other" (Edmin, 2017, p.78). instead of the world students live in, educators aim to shape students into "their world."

Teachers in public schools have underestimated the potential for academic success of children from diverse backgrounds by lowering expectations and viewing cultural differences as obstacles rather than growth opportunities (Will & Najarro, 2022). Consequently, educators developed asset-based pedagogies: culturally responsive teaching or culturally relevant pedagogy, which are teaching strategies that use students' life experiences and cultural identities as instructional tools in the classroom (Will & Najarro, 2020). The primary challenge of the American educational system is to prepare the best teachers and assist them in handling diversity in the school.

Grading Biases

Implicit biases can affect how students are graded (Quinn, 2020; Sprietsma, 2013), how they learn (Ferguson, 2003), and how they will do in future educational endeavors (Gershenson et al., 2015; DeCuir-Gunby & Bindra, 2022). Every classroom contains a diverse group of students. Student levels might range from poor to exceptional, depending on the school's socioeconomic situation and the surrounding community. It is the responsibility of the teacher to recognize the diversity in their class and know how to precisely meet each student's needs.

Grading practices have mostly stayed the same over the years. The primary performance and aptitude gauge teachers use to evaluate their students is grades. Grades are still utilized to compare students and as incentives and repercussions, and the scars of feeling inadequate are lifelong for those with the lowest grades. These scores can impact student accomplishment in the long term (Papay et al., 2011). One of the biggest problems facing public education today is that teachers are punishing our most marginalized learners with inequitable grading practices (Forster, 2023); it is very subjective (Sprietsma, 2013) and can negatively impact their educational experience (Conaway & Bethune, 2015). Students of color, disabled students,

LGBTQIA+ students, and particularly low-income students had two to five times higher high school dropout rates in the United States (Forster, 2023). Many studies have suggested that teachers have biases (Chin et al., 2020; Copur-Gencturk et al., 2022; Dennesen et al., 2022; Starck et al., 2020), and these stereotypes can affect teachers' evaluations and grades, but little research has been done on the effects of these biases (Copur-Gencturk, 2023; Terrier, 2020).

It is well-known that educators make biased judgments based on preconceptions, a range of stable personality traits, situational and personal experiences, and teachers' perceptions about their abilities (Copur-Gencturk et al., 2022; Graham & Williams, 2009). Additionally, teachers are said to make decisions and grade students' work differently depending on their race and gender (Graham, 2017) due to their personal attitudes, viewpoints, and life experiences. In a recent study (Quinn, 2020), grading scales with ambiguous or broad criteria may be more biased than those with precise criteria, which implies that carefully thought-out grading procedures could lessen biases. In this study, teachers gave a student writing sample a lower rating on an ambiguous grade-level assessment scale when it was arbitrarily indicated that the author was Black rather than White. However, racial bias was not shown when teachers utilized a rubric with more precisely defined evaluation criteria.

Grades can be used to correct or reward in-class behavior or to support students who are low on self-esteem. However, when assigning grades to students, teachers have been known to blame effort or ability for both successes and failures (Copur-Gencturk et al., 2022; Wang & Hall, 2018; Sprietsma, 2013). The primary purpose of teacher-assigned grades should be to inform students and parents about their academic progress. Yet, teachers consider student traits other than success when deciding on grades, such as the student's effort and demeanor in the

classroom (Westphal et al., 2016). Therefore, implicit biases related to gender, race, and socioeconomic status frequently influence traditional grading procedures (Feldman, 2018).

Grading is not covered in teacher preparation programs or professional development during the teaching career. Thus, teachers' grades are based entirely on personal experience, not research or best practices (Feldman, 2018). Therefore, when grading student work, teachers may show bias differently. Teachers have different expectations depending on a student's ethnic background, precisely African American students (Ferguson, 2003). Teacher expectations may affect student performance and how it is perceived (Sprietsma, 2013). Given the performance gaps and personalized learning to meet the needs of students, teachers can hold different expectations of average performance. They may show biases toward students who do not meet the average expectation. For example, a teacher may provide a higher score on written work for an English as a second language (ELL) student struggling with language barriers. On the other hand, teachers may provide a lower score to a student who shows excellence because the student may show more capabilities on the assignment. Because teachers' implicit biases and attitudes are ubiquitous and difficult to alter, these children, who frequently belong to low-status minoritized groups, suffer immediate and long-term effects (DeCuir-Gunby & Bindra, 2022).

Several unrelated factors can be misinterpreted for biases when grading assignments. According to psychological studies (Hoffman, 2005), teachers are more prone to look harder for proof of their expectations and exhibit implicit biases associated with explicit judgment, a factor in these inequity grading tendencies. Furthermore, biases can emerge when assigning names (Sprietsma, 2013). While teachers often evaluate student work using a set of predetermined evaluation criteria, various subjective judgments, such as biases and expectations (Sprietsma, 2013), may also be used to estimate the quality of student work. Studies, as shown in

Maloff 2008 (as cited in Conaway & Bethune, 2015), provided a plethora of examples of biased grading practices, including the use of a student's kindness, prior academic success, degree of interest in the subject, gender, looks, and the teacher-student relationship. Studies have also shown how preconceptions held by educators can result in students' lack of interest in a subject, stereotype threats, self-fulfilling prophecies, and decreased effort (Terrier, 2020). To minimize the evident biases, blind grading (Conaway & Bethune, 2015) is preferred wherever feasible.

Culturally Responsive Teaching & Culturally Relevant Teaching

The Diversity in a Mathematics Classroom

Today's educators frequently hear about educational inequalities, including achievement, financing, and school-readiness gaps. Yet another gap is the cultural gap between students and teachers, which remains largely unexplored (Culture in the Classroom, 2023). As the diversity of our classrooms increases, teachers must be prepared to work effectively with students from different cultural, linguistic, and national backgrounds (Keengwe, 2010). Ever-changing culture is influenced by a person's growth, experiences, and environment (La Salle et al., 2015).

Acknowledgment of diverse learners to where they are valued, seen, and heard opens the door for acceptance.

In the contemporary world, fostering children's intellectual development involves more than just functioning based on color blindness (Culture in the Classroom, 2023). If educators wish to engage students fully, we must reach out to them in appropriate ways that are culturally and linguistically sensitive, and we must consider the cultural assumptions and preconceptions we bring to the classroom that may hinder connection. Therefore, culturally sensitive teaching makes learning experiences more relevant and effective for ethnically diverse students by using

their cultural knowledge, prior experience, frames of reference, and performance styles (Gay, 2000).

Every educator should be aware of how to impart knowledge while concentrating on the diversity of their students. Teachers must examine their biases, develop empathy for others' differences, and be open to approaching education from a multicultural standpoint (Keengwe, 2010). Cultural awareness is more than just being aware of the presence of students from different ethnicities. Cultural competency is distinguishing between the differences in each child represented in the school, independent of race, ethnicity, or socioeconomic status. Teachers try to build relationships with their students while teaching the curriculum engagingly. Still, they may make assumptions or choose to pass judgment based on past experiences or stereotype a population of students that interferes with student learning and their capabilities (Staats et al., 2017). Unintentionally, teachers bring their implicit biases to the classroom, hindering students from advancing academically.

Culture spans a wide range of topics, some of which are more important for teachers to understand than others due to their direct impact on teaching and learning (Gay, 2000). In recent culturally responsive teaching literature, there has been a drive to establish distinct pedagogical frameworks and methods. To conduct culturally responsive teaching, it is necessary to investigate teachers' cognitive processes, views, and mental techniques in addition to specific pedagogy (Milner, 2010).

Classroom Culture

Classroom culture is crucial, as well as the subject taught in the classroom and the possibilities outside of it (Bayer and Wilcox, 2019). Racial, ethnic, cultural, economic, and religious diversity is growing in our society and classrooms (Mensah, 2021). Culturally

responsive teaching, a framework developed by Geneva Gay, focuses on culture, race, and equity and is defined as “using the cultural knowledge, prior experience, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them” (Gay, 2000, p. 29). Culturally responsive teaching, a collection of pedagogical knowledge and skills that assist and create successful outcomes for each student, is a term that specifies the pedagogical skill sets required of teachers. Culturally responsive teaching has grown into a subfield of multicultural education that focuses on how teachers adapt pedagogy, prior experiences, and views to increasingly diverse classrooms (Mensah, 2021; Gay, 2000). Educators use culturally responsive teaching as a technique to achieve multicultural education goals.

Culturally relevant teaching, originated by Ladson-Billings, defines culturally relevant pedagogy (or culturally relevant teaching) as a “theoretical model that not only addresses student achievement but also helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools” (1995, p. 469). By employing cultural references to transfer knowledge, skills, and attitudes, culturally relevant teaching gives students a boost intellectually, socially, emotionally, and politically. Culturally relevant pedagogy aims to problematize instruction and inspire teachers to inquire about the nature of the student-teacher relationship, the curriculum, schooling, and society (Mensah, 2021; Ladson-Billing, 1995).

Recently, a rapidly expanding (and primarily qualitative) body of education research has concentrated on classroom pedagogy and emphasized the significance of "culturally relevant pedagogy" (CRP) as a powerful strategy to maximize the academic potential of historically marginalized students, such as those from underrepresented groups of race, class, and gender

(Dee & Penner, 2017). Culturally relevant instructors exhibit three CRP domains: their perceptions of oneself and others, their social organization, and their conceptions of knowledge. All students have the potential to succeed academically, give back to the community, and learn, according to culturally sensitive teachers (Dee & Penner, 2017; Ladson-Billing, 1995). Teachers create a cooperative community of learners by interacting with the children and upholding open communication when CRP is utilized with fidelity.

To make learning more relevant and effective, culturally responsive teaching also entails creating culturally appropriate curricula and culturally responsive instructions (Gay, 2002). Learning materials can be linked to students' personal lives in various ways, ranging from simply posting a song that acknowledges their students' backgrounds to a more thorough examination of the teaching material to ensure that it does not only reflect mainstream perspectives (Landsman, 2006). In addition, CRT includes examples of cultural caring, creating a learning community, and communicating effectively across cultures (Gay, 2002). Team building, Social and Emotional Learning (SEL) activities and collaborative learning may support students from various groups in becoming acquainted with one another, facilitating the interchange of cultural information, learning to value diversity, and employing their peers' cultural resources in creative problem-solving (Johnson & Johnson, 2000). This collaboration allows the students to build relationships and accept their peers.

Culturally Responsive Mathematics

Teachers must learn about the different parts of students' cultures through their research and meaningful relationships with students, ranging from tangible cultures, such as family experiences, artifacts, and events, to intangible cultures, such as values, traditions, language, and identity (Morrison et al., 2008). This has been linked to increased school engagement, interest,

and educational achievement for minoritized students (Aronson & Laughter, 2016). CRT entails building a culturally diverse knowledge base through learning about differences in communication and learning styles and paying attention to the students' cultural characteristics and reality.

For many years, the field of mathematics education has worked to define and describe what constitutes instruction for "ambitious mathematics" (Boston & Wilhelm, 2015), including conceptually focused, inquiry-oriented instruction that uses cognitively demanding tasks, supports students in making sense of mathematical relationships, emphasizes students' sense-making and mathematical reasoning, and encourages students to engage with each other's ideas (Boston & Wilhelm, 2015). All children should be able to comprehend math, and it is essential to promote the idea that everyone is a mathematician (Harding-DeKam, 2014). Student success is based on more than just whether or not they can demonstrate that they have learned the content or can use the skill in other areas; it also takes into account how comfortable they feel in the classroom and how connected they feel to the teacher (Al-Bahrani, 2022). These variables promote a student's sense of belonging, which may also improve learning outcomes (Rask & Bailey, 2002; Wilton et al., 2019). Culturally sensitive mathematics should be an expectation in the diverse elementary classroom.

Culturally Sensitive Mathematics

Culturally sensitive math is crucial in the classroom because it enables students to relate to the subject matter personally. Research supports the development of culturally responsive mathematics as a tool for comprehending children's backgrounds in terms of culture, worldview, experiences, beliefs, traditions, and relationships with their families. Implementing teaching is most effective when environmental factors, such as prior experiences, community contexts,

cultural backgrounds, and ethnic identities of teachers and learners, are considered. (Gay 2010). Furthermore, the connection between mathematics and culture can be most meaningful when tied to the child's cultural background. These interpersonal connections must be created based on the children's knowledge. Teachers can help students develop a relevant and unique world perspective by incorporating culturally responsive mathematics into the classroom. For children in school, mathematics "comes alive" and takes on a life of its own, going beyond being just a problem from a math textbook (Harding-DeKam, 2014). Teachers can draw on students' understanding of their cultures and lifestyles to help them make mathematical connections.

Utilizing a culturally sensitive mathematics framework within the teaching and learning cycle through involvement, curriculum, vocabulary, using the child's native language, and assessments must be implemented (Abulrahim & Orosco, 2020; Harding-DeKam, 2014). The curriculum, however, needs to meet the demands of the learners considered culturally diverse and learning a new language in their classrooms. Traditional methods of instruction dominate the practice of teaching basic skills despite reform agendas calling for the development of mathematics education for all learners (Abulrahim & Orosco, 2020). Furthermore, most mathematics instruction in the U.S. is based on standardized textbooks, teaching methods, and exams that are not standard for children with disabilities (Bartell et al., 2017). This one-size-fits-all method ignores students' cultural assets and learning experiences, which impacts how they respond to math instruction. To meet the expectations of different students, these curricula must incorporate culturally sensitive mathematics instruction (Abulrahim & Orosco, 2020).

Qualities supporting Culturally Responsive Teaching are student perspectives, positive attitudes toward other cultures, and knowledge of the cultures in the school (Abacioglu et al., 2020). Teachers can only engage in Culturally Responsive Teaching effectively if they have

mindful attitudes toward diversity and are conscious of their own, sometimes biased, attitudes and ideas about other cultures. A culturally relevant pedagogy shifts the nature of student-teacher relationships, putting the student in charge of their behavior and learning results (Schmeidel, 2012). Teachers and students should engage on a more personal level, based on compassion and understanding, to feel invested in the classroom and better manage their conduct. Teachers who value and include culture, language, heritage, and home/community experiences in mathematics instruction can improve students' academic performance (Abulrahim & Orosco, 2020; Gay, 2018).

Teachers make the most of students' linguistic and cultural expertise and use these assets to develop critical thinking abilities. Educators who use CRP to achieve equity and equality are a topic that requires further exploration. By exploring teachers' perspectives on developing and practicing culturally responsive teaching, this study hopes to add to our understanding of additional implicit biases that may affect equitable grading and student achievement.

Consultation/ Coaching Model

Cognitive Coaching

Costa and Garmston (2002) created the staff development method, currently known as cognitive coaching, drawing on John Dewey's (1984) theories on reflective acts that serve as the fundamental building blocks of teacher professional development. Since its inception in 1984, cognitive coaching has developed into a type of coaching support in several contexts, including the corporate sector, mentorship programs, and, most frequently, for educators to further their professional development (Costa & Garmston, 2016).

Cognitive coaching is a model for peer coaching or supervision. In a supportive partnership, department chairs, resource teachers, peers, mentors, and administrators can benefit.

It is not meant to be an evaluative process but rather a process supporting collegial relationships in becoming self-reflective in their work (Costa & Garmston, 2002; Horne, 2022). Cognitive coaching aims to increase instructors' self-efficacy through self-reflection and self-analysis through planning and reflecting conversations on their teaching (Killion et al., 2012; Devine et al., 2013). There are four underlying assumptions of the model—that is, (1) teaching is a contextual and ongoing decision-making process, (2) our perceptions drive all behavior, (3) behavior changes after a change in perception, and (4) coaching facilitates change in behavior and perception—are what account for the widespread use of cognitive coaching in the field of education (Costa & Garmston, 2016).

Self-modification, where teachers gain the ability to see their actions and those of their students and reflect on lessons, is the primary goal of cognitive coaching (Costa & Garmston, 2002). Lesson observation, post-conference, and pre-conference are the three steps in this process. During this process, the mentor guides the teacher to critically evaluate their methods while always being impartial and refraining from adding their opinions to the discussion. Teachers can explore and develop their abilities with the help of cognitive coaching, which also helps them to expand on what they already know (Horne, 2022).

It is essential to consider that a cognitive coach's default position is to apply cognitive coaching methods and strategies in every situation, shifting to different support roles as necessary. A coach may need to switch to cooperation (thinking and working together) or even consultation (sharing ideas, locating knowledge a teacher might not have), depending on a particular educator's circumstances and needs. When such changes occur, a coach must indicate the change in the support roles used and may eventually return to the cognitive coaching position. When cognitive coaching influences teachers' cognitive processes and enhances their

ability to learn independently, it is an effective professional development tool. Research indicates that cognitive coaching, like instructional coaching, has the potential to help educators grow professionally (Devine et al., 2013). It encourages self-reliance and metacognition, which allows educators to accomplish their professional and personal objectives. These objectives include behavior modification, self-monitoring, and self-management. Education research studies show that Cognitive Coaching improves instructors' knowledge, planning, self-reflection, and critical thinking skills (Devine et al., 2013).

B.I.A.S. Model

A four-step method called the B.I.A.S coaching model identifies bias and creates new behavioral pathways (Harris, 2023). By following these processes, the educator is encouraged to recognize their underlying bias(es), identify the impact, come to terms with reality, and change their perspective on their behavior. The model's central claim is that bias ultimately leads to the inequality we witness and encounter at work or within schools (Harris, 2023). The B.I.A.S coaching paradigm outlines a method for addressing implicit or explicit bias in behavior and ideas at the individual level:

B >> BECOME AWARE

I >> IDENTIFY

A >> ACCEPT

S >> SHIFT

Biases often exist in subtle ways. The first stage in this process is to identify any implicit or explicit bias that a person may have in their work environment. We are given the ability to know and make decisions through awareness; for instance, we can close the knowledge gap that has resulted in bias. On the other hand, if we are unaware, we are predisposed to ignore the

necessity of reviewing behavior and stick with the current bias and result. Coaching is very effective in raising awareness. By probing deeply into the organizational culture and the individual's ideas, attitudes, and behaviors related to it, coaching can raise awareness of any prejudices that may have been hidden (Harris, 2023).

After establishing the basis of awareness, the person moves on to the second part of the B.I.A.S module, where they determine the effects of their bias. What opportunities have they missed out on because of their bias? Has anything come of this, either positively or negatively, for them or others? This phase is especially effective for identifying the effects of explicit prejudice and behavior that is not yet acknowledged as wrong (Harris, 2023). When the impact of explicit bias is conceded, the discussion may change from being dismissive and convincing to being willing and involved.

The next phase is acceptance. Being conscious of bias and realizing its effects may cause someone to feel cognitively dissonant (McLeod, 2023). Based on the cognitive dissonance theory, there are two possible outcomes: either they accept the new, contradicting information and adopt a new belief and worldview, or they absorb the information and maintain their preexisting belief system and worldview (Harris, 2023). Acknowledging this point and helping the person overcome this discomfort can help with acceptance. Through coaching, teachers can get past sentiments of empowerment and responsibility to recognize and confront their biases (Harris, 2023). We can only generate the chance for long-lasting behavioral change when we accept things.

Changes in behavior are the focus of the B.I.A.S coaching model's final step. It is expected to experience periodic slip-ups when modifying behavior, even with strong drive and

good intentions. Continuous coaching will guarantee that the teacher receives assistance in identifying biases and creating new behavioral pathways (Harris, 2023).

To achieve equitable diversity in the classroom, we must do a deeper personal examination to uncover teacher biases and understand how they can influence our actions and decisions (Harris, 2023). The B.I.A.S coaching model, interconnected with cognitive coaching, can provide a method for addressing biases individually. To achieve significant and long-lasting changes, utilizing these two strategies requires an in-depth analysis of uncovering implicit bias, which is then reinforced with ongoing assessment and responsibility. Mainly when aimed at educational leaders, a shift in a small number of people's attitudes, beliefs, and actions can spark a more significant change in the school environment culture, progressively enabling fairness and a sense of belonging for everyone (Harris, 2023).

Conclusion

Cognitive coaching is an effective strategy for assisting educators in increasing their critical thinking abilities, self-awareness, and independence. Its foundation is that, instead of receiving instructions from an instructional coach, educators can learn more efficiently when led by a coach who facilitates their cognitive processes. In the K-12 school system, teacher biases are evident not only through race and gender but also through grading practices. As explained in this chapter, grading biases can long-term affect students and their school careers. Chapter 2 gave the reader background of the literature and previous educational research about explicit and implicit biases in the mathematics classroom and STEM fields. This study adds to the current research by highlighting the importance of understanding where biases stem from in conjunction with coaching strategies to help identify those biases to ensure classroom equity and equality.

The next chapter will describe the study's methodology and procedures, summarizing the study's data and findings.

CHAPTER 3: METHODOLOGY

This study used four case studies to investigate how middle school teachers from a southeastern school district utilized cognitive coaching strategies to improve best practices for grading student work. Based on research, grading biases among teachers exist, especially in math classrooms. To assist with understanding these biases, teachers must be aware of their own biases and unknown biases that come with grading student work (Feldman, 2019).

This qualitative research consisted of data collected through observations and in-person interviews transcribed through journaling and NVIVO, a transcription program. Interviews were recorded to find themes that impact grading practices. Participants comprised four middle school math teachers from sixth to eighth grades. Race, gender, years of experience, and certifications varied.

Chapter 3 includes a review of the problem statement, an overview of the research design and questions, and a complete discussion of the research methodology, design, and implementation. It also includes data collection and analysis and an overview of the participants and study site. Data was collected through interviews and observations. Using these two qualitative methods, I can observe, listen, and draw conclusions to identify implicit biases teachers may show while grading student work.

RESEARCH DESIGN

Qualitative Research

This study used a qualitative methodology. When a problem or topic needs to be studied, and further inquiry is required to examine the group or population, qualitative research is conducted. Qualitative research is conducted when we want to understand the context or setting in which participants in a study address a problem or issue (Creswell & Poth, 2018).

Furthermore, case study research is defined as understanding or exploring an issue using real-life settings with individuals and systems over time through detailed data collection using multiple avenues of data collection. Qualitative research aims to gain a more profound knowledge of a given situation rather than focus on numerical data (Creswell & Poth, 2018). One of the advantages of qualitative research, particularly case study research, is that it helps researchers collect data in the environment in which study participants interact with the subject at hand. The data was collected through document analysis, behavior observation, and participant interviews (Creswell & Poth, 2018). This study aims to gain insight into how middle school mathematics teachers grade for equity and how unknown biases may affect their grading practices.

The study utilizes a case study research design, which is valuable for examining organizational processes (Yin, 2017). The study will benefit from a descriptive qualitative approach due to its nature in understanding a specific narrative told by teachers. Case studies should clarify, describe, analyze, and educate. In a qualitative case study design, the researcher collects, deciphers, and evaluates the data (Yin, 2017). This study benefited from collecting various data types, categorizing them, and developing themes.

Furthermore, the compiled viewpoints from participants were used to build a larger framework to help others understand the complicated interplay between various aspects, including cause-and-effect correlations (Creswell & Clark, 2018). A case study design was selected for this research because of the opportunity to observe and investigate how middle school mathematics teachers grade student work and how biases may interfere with the grading process. This single case study focused on a suburban middle school in a Northeastern district.

Consultation Process

As described in Chapter 2, the cognitive coaching model includes a three-step approach where instructors can work with a peer, coach, or mentor to examine the invisible thinking that underlies their practices. Three conversations are part of the process: planning, observation, and reflection. The mentor guides the teacher to critically evaluate their methods while always being neutral and refraining from adding their opinions to the discussion. In addition to building on their current skills and enabling teachers to explore and enhance their capacities, cognitive coaching supports teachers' metacognition (Horne, 2022; Costa & Garmston, 1992).

A preconference, lesson observation, and post-conference are all part of cognitive coaching. This model will be used as a framework in this study, but it was modified to fit the purpose of the study. The preconference, as seen in this study, was the first observation and interview. The pre-conference process using the cognitive coaching model is similar to the planning process. During this practice, the coach and mentor ask the teacher to go into further detail about the learning objectives and how they will be assessed during the lesson to see whether the students understand (Horne, 2022; Costa & Garmston, 1992). However, during this study, the time was used to ask questions about participants' grading practices, why they chose to grade student work the way observed, and about known biases.

The next phase, the mentoring portion of cognitive coaching, involves the coach watching the teacher mentor carry out the lesson or instructional strategies following their planning discussion (Horne, 2022). Furthermore, only the information the instructor sought at the pre-conference is gathered by the coach during the actual lesson. These observations might center on how well a student performs regarding goal achievement, their behavior while on task, or a specific student's issue behavior (Costa & Garmston, 1992). For this study, the mentoring process looked different. Based on the first round of the interview and two observations, the

mentoring process was utilized to coach strategies for bias awareness during the second interview. During this time, the B.I.A.S coaching model was created by Jen Harris in 2023.

The B.I.A.S coaching paradigm outlines a method for addressing implicit or explicit bias in behavior and ideas at the individual level:

B >> *BECOME AWARE*

I >> *IDENTIFY*

A >> *ACCEPT*

S >> *SHIFT*

During the second interview with each participant, this model enabled the mentor to coach teachers to become aware of implicit biases, thus changing their awareness and mindset for the biases.

B >> *BECOME AWARE*—The Mentor helped participants understand the different biases. Interview questions were geared to receive responses from participants that helped them know that biases are natural human tendencies. The mentor also exposed biases observed during the initial observation towards groups/ individuals.

I >> *IDENTIFY*- This stage was used to help participants identify their own biases through questioning. Their views and grading decisions were observed through interview questions and discussions.

A >> *ACCEPT*- Participants' behavior was observed during the interview, and biases were identified. Signs of discomfort or acceptance, thoughts of why decisions were made initially, and continued to offer strategies to help build a toolbox of recognition and acceptance of one's biases.

S >> *SHIFT*- This phase was evident through the conversation while interviews were

conducted. Any observed shifts (understanding of own biases, mindset to change behavior, strategies to change own behavior) were documented. The shifts observed helped shape the final observation and interview.

Self-modification is the ultimate goal of cognitive coaching; educators must learn to keep an eye on their own and their students' behaviors and remember the lessons' content (Costa & Garmston, 1992). By concentrating on prejudice and behavior in the workplace, the B.I.A.S coaching model provides a method for addressing bias individually. This methodology requires thoroughly examining underlying implicit bias to facilitate significant and long-lasting changes. This model is supported by ongoing evaluation and accountability. When focused on decision-makers and leaders, a shift in a few people's attitudes, beliefs, and actions can spark a more significant change in the workplace culture, ultimately fostering equity and inclusion for all (Ruikangma, 2023). The B.I.A.S and cognitive coaching models were used for this study as they created a solid foundation to use while working with participants to help change their mindset for identifying biases when grading student work.

Role of the Researcher

The author's role was to observe the biases associated with grading math assignments and assessments as well as use the Cognitive Coaching Process to help teachers shift their grading behaviors. To do this, six interactions with each participant occurred: three observations and three interviews. An observation journal analyzed the data, and the interviews were transcribed using themes to determine the implicit biases teachers bring when grading student work.

Research Questions

RQ1: What implicit biases can be identified during consultation sessions with math teachers?

RQ2: How do participants react to the implicit bias consultation process?

RQ3: How does consultation affect detected implicit biases in math grading?

Study Site & Participants

The research was in a suburban middle school in a Northeastern School District. The school's current enrollment is 715 students in grades 6 through 8, and school reports show that forty-one percent are low-income (SC Report Card, 2023). Out of the seventy-eight faculty members, seventy-three percent have advanced degrees, forty-five are classroom core teachers, and nine are math teachers. Out of these math teachers, four volunteered to be a part of this study. Below is a chart describing each teacher’s demographics, years of experience, and education.

Table 1

Demographics of the Participants

<i>Teacher</i>	<i>Subject/Grade</i>	<i>Years of Experience</i>	<i>Gender/Ethnicity</i>	<i>Highest Level of Education</i>
Teacher 1	6 th grade (General & Accelerated Math)	16 years of experience	Female/ Caucasian	Masters
Teacher 2	6 th grade (Inclusion & General)	4 years of experience	Male/ Hispanic	Bachelors
Teacher 3	7 th grade (Honors & General)	7 years of experience	Female/ Caucasian	Masters
Teacher 4	8 th grade (Inclusion & Algebra)	20 years of experience	Female/ Caucasian	Masters

The four participants were chosen based on the characteristics from Table 1.

Observations and one-on-one interviews were conducted to facilitate conversations related to the

research topic. All participants were teaching grade-level mathematics when the observations were completed. Participants were chosen by purposeful sampling and had similar biases and bias profiles. The gender and ethnicity of both students and teachers were vital to the study.

Research Approvals

Consent from the participating middle school was obtained before any data, observations, or interviews were viewed and conducted. Institutional Review Boards, or IRBs, review research studies to ensure they comply with applicable regulations, meet accepted ethical standards, follow institutional policies, and adequately protect research participants. Participants were selected after the Institutional Review Board (IRB) process, and the study was approved. After permission was granted for the study, the next step was the site approval from the school district and the school site principal. Following this, the four participants were contacted to explain the study, and requesting their involvement was maintained.

Participant confidentiality by assigning observations, interviews, and alphanumeric codes (Teacher 1, Teacher 2, etc). Participants' names were not disclosed to anyone, including the school district. Participation in the research study was completely voluntary. If a participant chose not to participate, another participant was asked based on an interview process determined at the time of need. Before each one-on-one interview, each participant was provided an informed consent document and asked to read it thoroughly and sign in agreement. This document explained the purpose of the study and participation guidelines. Furthermore, a statement reminding the participants of their rights and informed consent, including that they can choose not to answer any question and that participation is optional, was read.

Data Collection

Study Procedures

The study analyzed four observations and three interviews per participant. In the observations, participants graded their students' math work. The researcher carefully noted any biased actions related to gender, ethnicity, low income, or other perceived biases during this process. This helped in understanding how different factors may affect grading practices.

1. **Baseline Observation-** The first observation served as a baseline for the study. The teachers were observed grading math work that consisted of current skills learned in class. Student work was a mixture of numeric and open-ended questions. Various types of questions were utilized so that handwriting bias, gender bias, race bias, and any unknown biases could be observed. This first observation was used to understand how the teacher grades, what tools are used for grading, and what type of student work/assessment was being graded. (See Table 2). It is essential to note that this study looks at specific implicit biases in the grading pedagogy, and student achievement was not a priority.
2. **Baseline Interview-** During this interview, open-ended questions (Table 3) were developed based on the observations and preplanned questions. Based on the consulting framework, an interview protocol was designed to determine the implicit biases of the four participants in delivering their mathematical instruction and grading. Participants knew that responses would be recorded, but their names would not be used in the final paper. During this interview, questions were asked to understand the participant's grading style and grading pedagogies and to define reasons for what math work needs to be assessed.

3. Coaching Interview- Questions for this interview (Table 2) were created based on the first observation and interview questions to provide coaching strategies to receive responses from participants that helped them understand that biases are natural human tendencies. The second interview was conducted with questions using a consultation framework. These questions aimed to help shift the participant's mindset with biases as they grade student work by challenging their views and grading decisions. During this time, the cognitive coaching model was used to set up coaching strategies, similar to a mid-conference, and tactics from the B.I.A.S model were used to help shift thinking. The goal of this session was the “B”: Become Aware, in which participants became aware of the different types of biases they showed while grading student work. Another goal was the “I”: Identify and help participants identify their biases through questioning.
4. Coaching Observation—This observation was similar to the first in that biases were observed and noted. The difference was that each participant had been provided with cognitive coaching strategies from the B.I.A.S model during the coaching interview; therefore, any new shifts in mindset as the participants graded their student work were also noted.
5. Final Interview- The last interview asked questions about what was seen from the previous observation and what was witnessed with the change in mindset of unintentional biases. With the coaching strategies being shared and utilized, this interview was also used as a post-conference, asking more opinionated questions about their feelings about the coaching strategies. A list of questions that were asked throughout the interviews is shown in the table below (Table 2). Additionally, this interview utilized the “A”: Accept

to ask questions of observed behavior as biases were identified. Answers were sought for any discomfort or acceptance, as well as any thoughts of why decisions were made initially. The mentor continued offering strategies to help build a toolbox for recognizing and accepting one’s biases. Lastly, “S”: Shift was utilized to find if any participants encountered shifts (understanding of their biases, mindset to change behavior, strategies to change their behavior).

6. Final Observation- After coaching strategies were discussed and time was given for teachers to implement, each classroom was observed for a third time, and teachers were asked if they used the techniques discussed during the consultation interview. Not only were teachers’- and students’ interactions observed, but the teacher grading their math assignments were observed. After observing the teacher’s grading, any emerging themes were combined with other observations and interviews. After a few grading observations, the final one was given, along with student work the researcher provided. (synonyms for observe: detect, witness, perceive)

Table 2

Interview Questions

Research Questions	Interview Questions
What unintentional implicit biases can be identified in math grading?	<ul style="list-style-type: none"> • What process do you use to grade math assignments? What are you looking for as you grade? (Interview 1) • When students ask for help or clarification, how do you respond? (Interview 1) • Is this different depending on the student. Please describe. (Interview 1) • How do you choose what student work to grade? (Interview 1)

Table 2

<p>How do participants react to the implicit bias consultation process?</p>	<ul style="list-style-type: none"> • How would you define bias? (Interview 2) • How do personal biases affect your teaching in the classroom? (Interview 2) • Are you aware of any biases that you may have exhibited while grading student work? (Interview 2) • Can you self-identify any biases that you may have shown during grading? (Interview 2) • On a scale of 1-5, 5 being confident, how would you rate yourself in noticing your biases as you grade student work? (Interview 2)
<p>What effect does consultation have on detected implicit biases in math grading?</p>	<ul style="list-style-type: none"> • Did the strategies offered to you help you identify your own biases when grading student work? How? (Interview 3) • Was it difficult to hear the biases displayed and how did you choose to change your mindset to help your biases? (Interview 3) • How has the coaching process helped you become more aware of biases? (Interview 3) • How do you feel now after the coaching strategies compared to before? (Interview 3)

Data was collected for this study through observations and interviews. Each participant was observed, grading their student’s general math class work. A variety of work to be graded varied from teacher to teacher. Examples of graded assignments are skill sheets in which teachers seek correct answers. Exit slips are where students have to explain a process in which they come to a final answer and a mix of skills, math processes, and open-ended questions. During these observations, it was noted how teachers graded student work by gender, name, handwriting, race, and demographic information. The data from the observations were used to record themes and create case study vignettes.

Three interviews were completed to ask participants open-ended questions about their grading protocol to find implicit biases. Teacher interviews lasted approximately 30 minutes and

were requested to be done after school hours so student learning was not interrupted. Additionally, interviews were held in person/ virtual, depending on the teacher's schedule. It was requested that interviews be recorded so I could listen to the interview and code for themes and big ideas. Future interview questions were created based on the previous observation and interview themes to clarify the data and address all research questions.

To truly understand implicit biases and help teachers understand them, each classroom was observed up to 3 times, as well as interviewing the teachers three times. After the initial observation and interview, themes emerged that helped prepare the second observation/ interview. The second round of observations and interviews helped teachers see that implicit biases affected the way we graded and strategies that supported teachers in this area were discussed. Strategies were provided by using the consulting framework, cognitive coaching intertwined with the B.I.A.S model to assist teachers in understanding their own biases and rethinking how they grade student work. The similarities and differences were coded from the first and final interviews and observations. The data collection and analyses will be described in the following paragraphs.

Plans for Data Analysis

During observations, a journal was kept to jot down thoughts, teacher actions, conversations, and anything else that could benefit the study. After the observations, the notes were used to explore emergent themes that helped develop more possible interview questions. The observational protocol (Creswell & Clark, 2018) created three columns representing observational, descriptive data, and reflection notes. After one-on-one interviews, notes and recordings, if participants would rather be virtual, were transcribed to ensure accuracy.

After the initial observation and interview, baseline data was collected in all case studies, providing a framework for the intervention implemented for this case study. The study observed four mathematics classrooms to determine how the teacher interacted with the students and how assignments, projects, class work, and assessments were graded. Notes of the interactions were dictated in a journal while observing teacher actions, questions, and student responses as they interacted with students. A research journal was kept during the study, and any documents, organizations, or public documents that may be needed were analyzed (Creswell & Clark, 2018) so observations could be used in the findings section. After observations, interviews were developed from observational themes. Interviews took place in person, one-on-one, in the same room, unless the interviewer expressed interest in a virtual interview (Creswell & Clark, 2018). The researcher followed the interview protocol in which the participants were questioned about the activities and recorded the interviewee responses.

All interviews were recorded and transcribed using two different software programs: Otter and NVIVO. Otter was used to record the participants' voices during the interviews and then uploaded to NVIVO for transcribed purposes. NVIVO coding was utilized to analyze the participants' words and phrases and better understand their ideas and thoughts. Interviews were transcribed and coded using NVIVO, a type of qualitative data analysis that emphasizes the participants' actual spoken words (Manning, 2017), to find additional themes to help shape this study.

They coded the classroom observations and interviews, allowing in-depth analysis to find connecting themes among the observations and interviews. The following key for coding are gender bias (G), race bias (R), grading bias (I), and other (O) for quotes and actions that were observed. Furthermore, themes were related to research questions. Through observations and

interviews, along with the demographic data, it was determined if the teachers demonstrated implicit bias while grading student work and whether coaching had an impact. Throughout this process, information was shared with the participants of any observed implicit biases through the consultation process.

Further observations will determine if strategies shared during the consultation changed their instruction and impacted their willingness to grow professionally. Other findings during observations and interviews were defined and coded as needed. Furthermore, observing and interviewing each participant individually allowed for the display of each case study as a separate vignette so that each story could be detailed based on the witnessed growth.

Summary

This study aimed to narrate how middle school math teachers showcase implicit biases while grading student work. The research problem driving this study was that teachers have explicit and implicit biases that may affect grading pedagogies. A qualitative methodology approach was utilized for this study with a case study design. The research setting was a suburban middle school in a Northeastern School District. The population of this study was four middle school math teachers who teach general mathematics classes. The data in this study consisted of observations and interviews. The data collected contained real-life narratives and experiences of teachers grading student work, which were connected to the research questions. The data was collected using a hybrid consultation method of cognitive coaching and the B.I.A.S. model. Data was analyzed using NVIVO, and themes were developed. All ethical guidelines, including informed permission, participant respect, and confidentiality, were followed.

CHAPTER 4: FINDINGS

Grading practices are multi-faceted and meant to serve many purposes (Olsen & Buchanan, 2019). Grading assesses a student's work effort, participation level, and ability to follow instructions; grades compare students to a standard and one another, and it conveys an objective estimate of a student's quality of work or mastery of learning. Grades serve as a motivator and a deterrent. They can perform each task in several instances, but not simultaneously. Implicit biases have the potential to influence how students learn, affect how students are graded and could affect performance in subsequent academic pursuits (DeCuir-Gunby & Bindra, 2022; Ferguson, 2003; Gershenson et al., 2015; Quinn, 2020; Sprietsma, 2013). Teacher biases can influence classroom expectations and how teachers assess students' academic achievement.

This study focused on automaticity, or the choices we make without conscious thought. Specifically, the study examined how math teachers improved their current understanding of the practice and evolution of culturally responsive teaching by analyzing the lived experiences and metacognition of practicing middle school teachers as they assessed student work and uncovered their personal implicit biases in mathematics.

Qualitative interviews and observations were conducted with four middle school math teachers. All four teachers teach multiple levels of math classes; however, only general math classes were used for this study. Three of the educators were white females and one Hispanic male. Their years of experience varied from 4 to 25 years, and their educational background varied from Bachelor's to Master's degrees. A pseudonym was used for the participants and referred to as a number (e.g., Teacher 1).

Numerous grading observations and three scheduled interviews were conducted at different times throughout the study with all four participants. Observations and interviews were separated into a purpose for each: *Baseline, Coaching, and Final*. More than three observations were done because participants were eager to have their grading routine observed. Participants were observed grading paper/ pencil assignments and digital work, as well as low, mid, and high grades, such as classwork, homework, quizzes, and assessments. This chapter analyzes conclusions from observations and interviews and describes emerging themes.

Research Questions

This case study aims to uncover teachers' implicit biases regarding grading student work.

The research questions to guide this study include:

RQ1: What implicit biases can be identified during consultation sessions with math teachers?

RQ2: How do participants react to the implicit bias consultation process?

RQ3: How does consultation affect detected implicit biases in math grading?

Findings

Twelve observations and three interviews were conducted at different times throughout the study with all four participants. Observations and interviews were separated into a purpose for each: *Baseline, Coaching, and Final*. More than three observations were done to observe what was said in the interviews. I observed participants grading paper/ pencil assignments and digital work, as well as low, mid, and high grades, such as classwork, homework, quizzes, and assessments. Results from observations and interviews were analyzed, and emerging themes were identified. This chapter's observations and interview questions describe these emerging themes in detail.

Overview of Qualitative Results

Interviews

The responses were obtained in thirty-minute sessions, three different times, with four middle school math teachers. All interviews were recorded and transcribed using two different software programs: Otter and NVIVO. Otter was used to record the participants' voices during the interviews and then uploaded to NVIVO for transcribed purposes. Using the transcribed NVIVO, each response was grouped by emerging, familiar themes to create overarching themes. The responses, grouped by emerging themes, were summarized and put into tables below for each interview question. The interviews aimed to determine whether or not teachers had any preexisting biases while assessing different types of student work.

Observations

Twelve observations were completed during the duration of this study. Observations were recorded and transcribed using a journal. During the observations, participants were asked to share their answer key point values as well as talk through their grading routine as they evaluate student work. The observations aimed to watch the participants' grading routine and how teachers utilized the answer key to award points, witness if biases were evident, and confirm what was said in the interviews. During observations, if a bias was seen, a note was made and brought up in the following interview to help coach participants.

Interview 1

The first interview was given as a baseline. Therefore, questions were developed to understand the participant's knowledge of grading practices and their process. Furthermore, it was intentionally driven to learn how to coach the participants using the B.I.A.S model (Harris,

2023). During this interview, the “B” from the B.I.A.S model was utilized to help participants become aware of biases from initial observations.

Question 1. What process do you use to grade math assignments? What are you looking for as you grade?

Table 3

Grading Math Assignments

Teacher	Example Quote
Teacher 1	“Answer key and show my work and then to calculate how much how many points each question is going to be worth” (Interview 1, Jan. 16).
Teacher 2	“I make the answer key for my team. It depends on the assignments as what I look for”. If it is a low grade, I look more for completion, but a quiz or test, I make sure the math work is shown and the answer is given” (Interview 1, Jan. 16).
Teacher 3	“We collaborate as a team, but I like to make my own answer key just to be sure that I have everything right. I like to have my own and then I keep my paper copy and the digital copy just in case” (Interview 1, Jan. 16).
Teacher 4	“Answer key according to what I think the kids should have answered them, then when I'm actually grading. I look at my key as to what the answer should be, and how the kids answered theirs. I'll give them points towards how much they have that I think they should have as an answer” (Interview 1, Jan. 16).

Table 4

Points Awarded when Grading Student Work

Teacher	Example Quote
Teacher 1	“Points come from however many they get correct out of how many total to get their percentage. And I also look for work shown for partial credit if they got the final answer. Half of work for partial credit.” (Interview 1, Jan. 16).

Table 4

Teacher 2	“If it's a low grade it's usually going to be just, did you get it right. High grades I look at the question and I usually will get you some points if you're showing me work that's relevant. I do try to take more time to look at those responses because if you're showing me work that is pretty close to what I'm looking for, I will give most points” (Interview 1, Jan. 16).
Teacher 3	“When we do the paper and pencil more so I'm looking at process. Plus showing their work. It just gives me the option to give them partial credit if they have something right that I can try to give them some points for versus taking off everything” (Interview 1, Jan. 16).
Teacher 4	“If I see that they have the process on the side, but they chose the wrong answer, I will give them some credit for that because I think it's only fair. I know what it should be, and then I look what they have. And they're either going to have what I have or something close to it or something not at all. So, I'll grade it accordingly. If it's if it's an assessment, where they're actually writing something, or showing me their work, I see that they have started and the work they need to get the answer, then I'll give them points towards it. To just keep up their confidence” (Interview 1, Jan. 16).

Question 2: When students ask for help or clarification with graded work, how do you respond? (Interview 1)

Table 5

How Do Participants Respond to Students asking for Help

Teacher	Example Quote
Teacher 1	“Typically, I asked them what they got or how they got their answer, or what part are they struggling on, or can I see the work that they've already done? I don't help with a quiz or test; I just say do your best” (Interview 1, Jan. 16).
Teacher 2	“With a low grade I'll help. I usually let them work with a partner. If we are taking a quiz or a test, I tell all students that I cannot help them the only thing I will ever do for a kid is read the question to them” (Interview 1, Jan. 16).

Table 5

Teacher 3	“When we're taking a test or quiz, I tell them to read it carefully. Make sure you checked all of your work and like kind of give the look if I could easily see something they're doing wrong. But I try not to help as much as possible because I actually want to know what you know or don't know. When we do those mid grades that are take home or like a low grade in class are something that we're working on and they ask for help. I'm more willing to help because they have more days to get it done or figure it out” (Interview 1, Jan. 16).
Teacher 4	“If a kid comes up and says to me and says I know how to find the slope but I don't know what to do next. What do I do next? Then I will actually work through them. We will work through the process, maybe they just need that little bit of a leap. I will give them the help and the clarification by going through the process with them again, and maybe just talking through it with them, helps them realize, oh, I just forgotten this. So, the talking through process” (Interview 1, Jan. 16).

Question 3: Are your reactions different depending on the student? Please describe.

(Interview 1)

Table 6

Teacher Reactions Towards Students

Teacher	Example Quote
Teacher 1	“Would love to say no, however, I'm sure that it does depend. If the student had asked the same question prior to starting the quiz or a test, and I clarified and I explain how to do that, and then they ask again during the test, there's no help, even with a low-grade assignment. I mean I want them to figure it out. But if they are working hard in class on a graded assignment and it is a low grade, I may direct them to use their resources or talk it out with them. If the student or group has shown no work effort or off task, I am less likely to help them. They need to figure it out” (Interview 1, Jan. 16).
Teacher 2	“If I see that you've been actively working you were communicating with your group and everyone at your group is confused that you also talked to the group besides you and you're stuck, I like to lead with questions or guide with questions. Or I might just look at where they went wrong and say, here's where you went wrong, because sometimes they just don't see where they went wrong. If you're not going to try than I'm not going to try” (Interview 1, Jan. 16).

Table 6

Teacher 3	“I know it shouldn't be. I feel like being in class makes that tough because there are some that are just so low compared to the other ones. And there are some who just work a lot harder and they are still really low so they're just struggling and there's some who do nothing every single day and I don't really feel like they deserve help. I do feel like my facial expressions might be a little more helpful towards some than others based on who I know is giving 100% effort and just still struggling and compared to those who are just show up every day and turn in what they do” (Interview 1, Jan. 16).
Teacher 4	“I will help everybody that wants help. But my response might be different. Because if it's just somebody who just wants me to do the work for him, I can't validate that. But if it's someone who genuinely has been trying and just doesn't, just doesn't know what to do next, then I'm going to walk them through it. Because again, it goes back to that confidence piece too” (Interview 1, Jan. 16).

Question 4: How do you choose what student work to grade? (Interview 1)

Table 7

What Assignments Are Worthy of Grading

Teacher	Example Quote
Teacher 1	“Based on standards and the skills that they will later be assessed on, so if it's a key point that they're later going to see or the skill that they have to master” (Interview 1, Jan. 16).
Teacher 2	“With my team, we do a really good job of discussing what we're going to grade and what we're not going to grade. Our high grades are usually they end up typically being unit tests for high grades. Mid grades are usually followed at the end of each lesson. And our lessons are broken up into sessions. So, at the end of each lesson, we'll do a quiz. And if not, at the end of each lesson, then it's my if two lessons are very similar, then we'll combine those two lessons so that it's a quiz. And then in between, the quizzes will do low grades that are usually not as long, they're shorter. And they're just to see if the kids understand what they're doing. It's more so practice” (Interview 1, Jan. 16).
Teacher 3	“I don't do a lot of paper pencil for low grades just because I hardly feel like I ever have time with iReady to actually do an assignment like that. So, our low grades are there already my path lessons. Mid grades are usually on paper, some are digital, and unit tests are planned out based on the math units” (Interview 1, Jan. 16).

Table 7

Teacher 4	“I just want to see if they're able to apply their thinking to something else other than the book pages. So, I use a mixture of digital apps, quizzes, test, iReady paths. I do try to assign graded work in which I can see their work, their process. Digital work doesn't help me see that, but I do try to mix it up” (Interview 1, Jan. 16).
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Observations

Emerging themes became apparent upon the completion of the first interview with all participants and the first two observations, Table 8 showcases where points were awarded for partial credit and how the teacher chose to award the points. Additionally, the table shows how many times credit wasn't given at all. See Table 8.

During the first two observations, I had the opportunity to observe participants grade class work, digital work, quizzes, exit slips, and unit tests. All participants used an answer key to grade. Participants did provide feedback to all students, especially on paper/pencil work, quizzes, and tests. Teachers made comments, drew arrows to show concepts, checked for mathematical errors, and even drew smiling faces if students did well with their work. All teachers corrected the math work or provided feedback on all paper and pencil-graded assignments.

Regarding digital assignments, Teacher 2 graded quickly and awarded points; however, they gave no input. If a student got an answer wrong, teacher two did not mark which answers were wrong. The teacher just submitted the grade to the student. Teacher 3 had the computer grade the work; however, they still used the answer key to check what the computer graded. Most of the questions were multiple-choice questions. Still, if there were any short answer questions, the teacher manually graded them and provided feedback if the answer needed to be

Table 8

Baseline Total Points versus Partial Credit

Participant	Number of assessments graded during observation	Number of total items graded (including all assessments)	Number of total items where no credit is given		Number of total items where partial credit is given			
			Incorrect answer	Other reason (e.g. handwriting, bad behavior, didn't attempt)	Missed pre-determined math step	Effort perceived	Good behavior perceived	Other reason
Teacher 1	0	2	20	1	3	1	2	4
Teacher 2	0	2	19	0	2	4	4	0
Teacher 3	1	2	4	10	8	8	2	5
Teacher 4	1	2	16	7	10	11	0	10

corrected. Furthermore, all of them would award partial credit for each problem if work was shown but the answer was wrong or little to no work was shown, but the answer was correct.

Specifically, during the first observation, I saw the participants in action do what they stated in the first interview. Each participant had their answer key with overall points totaled; teachers explained how it was broken down, and I had the opportunity to witness their thought process as they graded. During this time, I heard how and why partial, no, and complete credit would be awarded. These results were collected in Table 8. Partial credit being awarded on an individual basis. Partial credit was given when work was shown, but the answer was wrong; a student may need to remember the negative sign or the decimal was in the wrong spot. Partial credit was also given to students who attempted to explain their thinking but needed more understanding. Different teachers had different responses to the problem. Some participants said they needed help to read the number or understand the given process. Others pointed out mistakes like forgetting a negative sign, incorrectly balancing the equation, or making math errors. These errors ultimately led to incorrect answers. Teachers often make comments such as, "These students constantly score 100%," "This student found it challenging to work in small groups," or "This student usually performs excellently." It was noticeable that teachers graded work more quickly when they knew the student had already mastered the skill. The teachers carefully examined the problem and gave points promptly. If a student found it challenging, the teachers graded it with more attention to detail.

I also observed teachers giving and providing points to students if the teacher perceived that the students showed effort in class. 24 times, 16%, during observations, points were given due to effort. It became apparent, especially with teachers 3 and 4, that the students performed actions such as asking questions that looked to the teacher like 'effort'; grace was given when it

came to points. If there were students who slacked off in class, did not show any effort during practice or instructional time, and showed little to no effort on the assignment, it was quickly noted, and the points were deducted.

Baseline Interview and Observation Summary

Through the first few grading observations and the baseline interview, the consultation process allowed me to see and hear implicit bias come to the surface. As I was observing teachers grade assessments, classwork (paper/pencil and digital), and exit slips, biases such as, “I cannot read that sentence,” “Is that a 2?” and “I think I understand what the student is trying to say,” and lastly “what are they doing here” were just a few forms of biases that I noticed affected how the teacher awarded points. I wanted to see how each participant graded and how they chose to give points to students for a final grade.

After a few observations and the first interview, all four participants brought personal biases. I could see that the relationships built with their students affected their grading. Math is said to be black and white when it comes to grading. The answer is right or wrong. However, outsiders need to see the work one does to get the answer. Work must be shown when solving a math problem, mainly if a calculator is not used. Even if the question is multiple choice or short answer, work was expected to be shown for all problems. Therefore, all participants chose to give credit for the work shown. Through these first two observations, partial credit was given to 49% of the assessed items. Biases regarding how many points were awarded for the work began to emerge. All teachers gave full credit if work was shown. It was checked over quickly to see if the answer was correct. If the answer was wrong, credit was still given for the work shown, and the teacher provided feedback, or awareness was made of the mistakes by circling the errors. All teachers took time to look at the work to see if the answer was wrong and where the mistake

was. Therefore, points were deducted if the answer was bad, but students still were awarded points. If the student did not show work and the answer was incorrect, all points were deducted, but if the answer was correct and work was not shown, teachers gave all credit for the correct answer. In summary, all teachers used an answer key and expected work to be shown for points, but points were given for the correct answer, and it was in the best interest if students showed work and the answer was incorrect, as points were still awarded.

Interview 2

Interview 2 served the purpose of identifying and affirming biases with the participants. The interview questions served more for a conversation, so I could utilize the cognitive coaching model to help participants establish their biases. Questions were formed around the “I” *Identified* from the B.I.A.S model wheel (Harris, 2023). Questions were posed to support teachers in recognizing their biases and to modify their methods for grading student work, and techniques were provided during the coaching process. Teachers who participated in this interview were given two instructional B.I.A.S. models (Appendix 1 & 2) to reference. This allowed them to identify their own biases when grading assignments and begin acknowledging them to change their behavior when grading.

Question 1: How would you define bias? (Interview 2)

Table 9

Bias Definitions

Teacher	Example Quote
Teacher 1	“A preconceived idea, based on something that we know or think that you think” (Interview 2, Feb. 7).
Teacher 2	“I think I would define bias as something that influences your opinion away from a neutral role stance or position. Being neutral to me is being open minded and not being in favor for something or not in favor for something” (Interview 2, Jan. 31).

- Teacher 3 “I think bias is when you have a certain opinion towards one kind of topic versus another. I tend to think of politics biases. But yeah, you're more strongly opinionated about one idea versus others” (Interview 2, Jan. 31).
- Teacher 4 “Bias is... are we talking grading...anyway... is where you show favoritism to certain students” (Interview 2, January 31).

Question 2: How do personal biases affect your teaching in the classroom? (Interview 2)

Table 10

Personal Biases in a Mathematics Classroom

Teacher	Example Quote
Teacher 1	“I definitely think that they do sometimes. Obviously, we might know some more things about some students and give them more of a break or more chances than other kids. Like if we know that they're going through something or have personal social emotional struggles or things at home that are out of our control. I am more lenient or give them some grace.” (Interview 2, Feb. 7).
Teacher 2	“I feel like I try to avoid biases. I feel like I do a better job of avoiding my biases when I grade just because I can hide names. I think overall even if I like a kid if I know that getting a bad grade can help them grow, so I remind myself of that. I think that I can be biased when I'm in the classroom. With punishments, you know, I think sometimes whenever there's a kid who I have a better relationship with, I might be more prone to letting them get away with things. That's where I see biases in the classroom. For me, I don't think I see it as much as grading. Because I do try really hard to not be biased. But I will say I mean, I am biased when it comes to grading with my inclusion class, just because I know that they have a lot of learning disabilities, and I don't want that to be something that prohibits them from succeeding. And with my other math class. there's a lot of higher end students that I will just say, you got it wrong, like you don't need that extra cushion. But I feel like that's just a part of like being equitable, versus being equal. And I feel like that might interfere with biases, but I also feel like that I have to keep them separate” (Interview 2, January 31).
Teacher 3	“I know I shouldn't. But I feel like my biggest thing for my personal bias is based on behavior and level of effort from kids. When I have a kid who comes in and does their work, and they're quiet and they participate when they can, I feel more inclined to help them when they do need support” (Interview 2, January 31).

Teacher 4 “I mean, being a professional, personal bias should not affect my teaching. Sometimes being a human, that's difficult, but like they always say go back to number one, be a professional” (Interview 2, January 31).

Question 3: Are you aware of any biases you may have exhibited while grading student work? (Interview 2)

Table 11

Grading Bias Awareness

Teacher	Example Quote
Teacher 1	<p>“I don't know. I guess maybe you call it a bias based on like formative assessments sometimes like I don't think I necessarily graded differently, but like using the example you just said, that student is going through something and you're grading the formative assessment. Do you go okay, I think I know where they're headed. I'm going to give them partial credit. Or I kind of understood I think that's a two..., so I'm going to give it to them. Or they're going through a rough time, maybe their head wasn't fully there in class and they need some more instruction or need to revisit on a smaller group type scale. Rather than just giving them what they earned on that particular assignment” (Interview 2, Feb. 7).</p>
Teacher 2	<p>“I do think I acknowledged it as a bias. I'm like, does student really need the partial points? Am I just trying to find a reason to give them partial points to help their grade? I see myself giving partial points if a student is missing a lot of questions, because I don't want them to fail. Or they are doing really well and I don't want their grade to go down. I find myself pausing and reflecting on what points I just gave” (Interview 2, January 31).</p>
Teacher 3	<p>“Yeah, for sure. I do feel I can be more lenient when it comes to students who gives more effort during class. If it is somebody who's giving effort and trying, I'm more lenient to help them out with points here or there. But if they're a jerk in class or not doing their work, then I'm not going to help out with points. So yes, class participation and attitude definitely affect how I grade” (Interview 2, January 31).</p>
Teacher 4	<p>“Yes. So just giving them points because I know they know. I know what they're trying to say so I'm going to give them the points. They are trying. Trying to do so the points are given. I know if a student is struggling, and I've been working with them, and in my mind, I know what they meant. Even if they didn't write it. Sometimes I give them credit because I know what they were thinking if they didn't show it into my writing. And I know I shouldn't do that” (Interview 2, January 31).</p>

Question 4: Can you self-identify any biases you may have shown during grading?

(Interview 2)

Table 12

Self-Identify Biases

Teacher	Example Quote
Teacher 1	<p>“If a student is going through something and you're grading the formative assessment. Do you go okay, I think I know where they're headed. I'm going to give them partial credit. Or I kind of understood I think that's a two so I'm going to give it to them. Stuff like that. Or I know that they're going through a rough time, maybe their head wasn't fully there in class and they need some more instruction or revisit the concept on a smaller group type scale. Rather than just giving them what they earned on that particular assignment” (Interview 2, Feb. 7).</p>
Teacher 2	<p>“I do think I acknowledged it as a bias. I'm like, does this student really need the partial points? Or no? Am I just trying to find a reason to give them partial points? So, does this kid deserve? doesn't deserve? It could be a matter of knowing the student is low versus high or are they going through something that could be affecting their work ethic” (Interview 2, January 31).</p>
Teacher 3	<p>“If it is a kid who just struggles in math in general, but they try every day. They'll try to answer a question here or there. They attempt the work on their own first. I'm more inclined to give them a hint or two when they're taking a test or quiz. I am more lenient with my ML students and IEP students” (Interview 2, January 31).</p>
Teacher 4	<p>“Like I stated before, those struggling students. Like if they haven't written the response, but I see their work and I know what they needed to do or what I taught them to do, I'm assume what they meant and I should never assume” (Interview 2, January 31).</p>

Question 5: On a scale of 1-5, 5 being confident, how would you rate yourself in noticing your biases as you grade student work? (Interview 2)

Table 13

Confidence in Grading Student Work and Identifying Biases

Teacher	Example Quote
Teacher 1	“Maybe a 4. Because I try to just grade what they do. I mean, it has nothing to do with race, ethnicity, socio economic status. Can they show me that they can do the math? Can they show me what they learned” (Interview 2, Feb. 7).
Teacher 2	“I'd say 3.5. Because I think that biases are there, whether we want them to be or not. I think we can be pretty cognizant. I feel like there's so much grading happening that I don't even know what I'm doing half the time. I'm just mindlessly grading. Sometimes it's mindlessly grading but I'll put full concentration to like my high grades but about the low grades when I'm just mindlessly looking at an answer key in check, right” (Interview 2, January 31).
Teacher 3	“I would say a 4 because I feel like I'm usually pretty obvious when I'm doing it. But like when you ask about general or handwriting biases, I just haven't really thought of that. So, I think there's probably more I display, but maybe I need to try to pay attention as I grade in the future” (Interview 2, January 31).
Teacher 4	“Probably a 3. Because I know I have them but noticing them or becoming aware of them is a different story” (Interview 2, January 31).

During the interview with Teacher 1, she defined biases but then explained a situation: “We might know some more things about some students and give them more of a break or more chances than other kids. Like if we know that they are going through something or have personal social-emotional struggles or things at home that are out of our control, we may grade with grace” (Interview 2, Feb. 7). I think this is important to note that teachers who built relationships with their students became evident during the interview and observation. They do understand personal situations and will validate these when grading. This situation is problematic because the points are given based on individual circumstances. Teachers may not consider that other

students might also be facing challenges that they are unaware of, leading to discrepancies in grading. Teachers need to understand that each student's struggles affect their academic performance. All students should be given a fair chance to succeed, regardless of their situations. It is unjust to assume that other students' grades may suffer if they do not share information with the teacher. Each student has the right to privacy and should not be pressured to reveal personal matters. Academic performance should be based on individual effort and ability rather than on disclosing personal information. Students should be able to focus on their studies without feeling obligated to reveal private matters to their teachers.

Teacher 2 discussed the concept of grading and stated, “Student X always does a terrible job in class, and by the end of the year, you start grading his work without even giving it a second glance instead of genuinely looking for ways you can give him points, you got it wrong, it is wrong. That is when I feel like an unintentional bias starts to develop” (Interview 2, January 31). Teacher 4 describes a bias as a sports example. Teacher 4 states, “like if I am a teacher who is a coach. One of my students is in my class; I might try to help them do better on their test so that they can play that game that night” (Interview 2, January 31). During this time, I saw participants ponder if they genuinely showed biases when grading student work. They were questioning their behavior and pausing to confirm their thoughts. All participants stated that teachers should not have biases; however, they know they have them and began considering them as the interview and coaching process went on.

Observations

Through my observations, I was able to personally witness some of the improvements that have occurred since the study started. See Table 14.

From Table 8, 49% of perceived biases were noted. In Table 14, 40% of perceived biases were noted. Grading was done more deliberately by teachers, especially with assessments. They took their time giving feedback and were more reluctant to grant partial credit because they changed their behavior to think through what counts as partial credit (for all) so bias does not creep in. Teacher 1 paused many times to think about whether partial credit was given or the answer was wrong. Due to the assignment, she was looking for what she explicated taught; however, she awarded more partial credit because the students got the answer and showed work but may have used another proof to get their answer.

Participants began to say comments like, "I am using my answer key more intentionally," "The answer is either right or wrong," or "Is the answer what my answer key states? If so, credit is given; if not, it is incorrect." Therefore, all teachers began to see math as black or white, right or wrong. As a result of this cognitive behavior change, educators became more aware of when their prejudices were being used and could intervene in their thought process by saying, wait. I adopted a bias and went back to my previous way of thinking. When it came to grading, Teacher 3 stated, "Being aware of my prejudices helps me maintain parity among my students. Everybody is on an equal footing " (Interview 2, Jan. 30).

Table 14

Coaching Total Points versus Partial Credit

Participant	Number of assessments graded during observation	Number of total items graded (including all assessments)	Number of total items where no credit is given		Number of total items where partial credit is given			
			Incorrect answer	Other reason (e.g. handwriting, bad behavior, didn't attempt)	Missed pre-determined math step	Effort perceived	Good behavior perceived	Other reason
Teacher 1	0	1	1	1	2	2	0	7
Teacher 2	1	1	16	4	6	6	0	0
Teacher 3	0	1	10	2	3	0	1	1
Teacher 4	1	1	18	2	1	4	0	3

Coaching Interview and Observation Summary

Through the coaching process, we discussed racial and gender biases in grading. I therefore posed questions to each participant that would pierce the surface of these concepts. The teachers said they grade fairly without considering gender, color, or other considerations. Their attention was directed towards the student and their mathematical abilities. Yet, when I observed teachers evaluating student work, three individuals raised personal biases regarding effort. A student's effort in class—visible or not—is more important than their gender or color in math work, as perceived through interviews and observations. However, with this comes an unintentional bias as the teacher perceives the effort as personal. When analyzing work, teachers looked not only to see if the math problem was worked out but also to consider whether the student had participated in class or asked questions. The assignment's point value was correlated with the level of work the teacher perceived to be good.

During the second round of interviews, I gave the participants the B.I.A.S. model wheel and explained what each letter stood for (Appendix 1). I engaged the participants with the meaning of each letter and discussed what we would do with the wheel as we furthered the study. Furthermore, I inquired further to heighten the awareness of teacher biases. I asked participants if they believe they show biases in grading regarding gender, ethnicity, disability, race, and handwriting. There were some pivotal points during this time that teachers may not necessarily have shown these biases in grading what I observed; however, they are there in general. For example, in building relationships, if the teacher and student relationship is strong, how much assistance will the student receive during class and general participation during math class? For instance, Teacher 2 discussed how minority students—particularly those who are black and brown—are given easier grades because, in their view, society has made it more difficult for

them to succeed because of personal struggles, such as, a mother working two jobs, a single-family home, or caring for younger siblings. Biases are evident if there is an English language barrier. Furthermore, because Teacher 2 is Hispanic, is this the result of personal prejudice? The teacher gives some students the benefit of the doubt, while others in similar situations do not receive the same consideration. Being black or brown does not always mean a student is struggling economically or facing family dysfunction. By using skin color as a marker for support, the teacher may unintentionally exclude students who genuinely need help and include those who do not. Looking beyond appearance and assessing each student's needs is essential because the participants experienced what some of their students were going through.

If they participated most of the time, how much help would they receive? For one participant, it was evident that these biases did affect their grading. This question helped participants understand that biases, whether known or not known, are there, and educators must begin to become aware of them so their behavior can start to shift and help close the gap as they grade student work. As participants were answering this question, one connection among all participants was more on behavior bias than actual grading biases. However, participants were beginning to make the connection that their biases forming during class instruction were carrying over to evaluating student work.

Interview 3

Interview 3 took shape like a coaching session. We used the B.I.A.S. model (Harris, 2023) to help teachers accept the biases shown during grading and discussed a few strategies that could help change the participants' grading behaviors. Participants were open to hearing about and accepting their own biases. Questions were formed around the “A” *Accept* and the “S” *Shift* from the B.I.A.S model (Harris, 2023).

The third interview functioned as accepting the themes that emerged from the earlier interviews and the biases that were evident during the observations. During this time, I continued with the cognitive coaching session. I disclosed all the biases I discovered during the observation and interview processes to every participant:

Table 15

Bias Found During the Study

Teacher	Evidence of Implicit Biases
Teacher 1	This participant showed the least number of biases. The biases I did see, was handwriting biases, achievement biases, and awarding partial credit.
Teacher 2	This participant had the most biases. Handwriting, achievement, gender, and race biases were shown through interviews and observations.
Teacher 3	This participant showed more behavior biases when grading. Comments were made, such as, “they chose not to complete the classwork or ask questions, so of course they got this question wrong” (Observation 2, February 9).
Teacher 4	This participant showed biases through feelings. For example, she knew what students asked for help with the assignment, she knew what students she helped guide, and to this teacher, these actions indicated effort on the part of the student. Points were awarded partially or she assumed what the student was trying to convey, therefore, points were given.

Question 1: Did the strategies offered to you help you identify your own biases when grading student work? How? (Interview 3)

Table 16

Coaching Strategies

Teacher	Example Quote
Teacher 1	“I think you did help me identify that. As you call it, the overachiever bias that I probably grade there's more quickly because I assume that they are on track and going to get most if not all, correct. Whereas somebody that I know is not as good

at math or doing the work I might grade a little bit slower. Or with a little more watchful eye” (Interview 3, February 16).	
Teacher 2	“Yes. I’m definitely becoming a bit more aware of my biases. Your wheel made me slow down my grading and helped bring more awareness to any biases that were creeping out” (Interview 3, February 15).
Teacher 3	“I think as a teacher I shouldn’t have a bias and I am glad I am aware of it. I should help everyone. It helps me go forwards. I am trying all my kids equally” (Interview 3, February 15).
Teacher 4	“I was able to identify that I was displaying biases by students who were low achievers and I was trying to help them more than maybe my high achievers” (Interview 3, February 13).

Question 2: Was it difficult to hear the biases displayed, and how would you change your behavior to help your biases? (Interview 3)

Table 17

Accepting Biases

Teacher	Example Quote
Teacher 1	“No, it wasn’t hard to hear. I am always willing to receive feedback. And hearing my biases, I am willing to change my mindset. I want to grade all student work with a watchful eye, grade at the same pace, same rate” (Interview 3, February 16).
Teacher 2	“I think it’s difficult to hear any type of constructive criticism. As any decent human, we should strive for equality and fairness amongst all people, but especially as educators, we should be striving to promote an equal opportunity environment for all students. To be made aware that I do have biases brings a bit of discomfort; however, I do think that it’s beneficial because I want to be able to rid myself of those biases. My mindset shifted from “I don’t think I have biases” to “I hope to rid myself of my current biases”” (Interview 3, February 15).
Teacher 3	“Yes, definitely. I think that becoming aware was probably the biggest one for me because I know I have them but it's just being able to take note of here's the ones I do most frequently and then identifying those things. And now that I've been reading since then I feel like I am more aware. I don't want to give anybody any upper hand on somebody because I shouldn't do that as a teacher. So definitely

think becoming aware of what mine were and identifying that and looking to kind of make some changes” (Interview 3, February 15).

Teacher 4 “It was not difficult, because I appreciated the feedback and to find out how I can be better. So that was not difficult. I would choose to change my mindset because I noticed even after we did the second interview or when you observed me, I was more apt to grade; this is what the answer should be. And just going on from that. It didn't matter who the student was. Just follow my answer key.” (Interview 3, February 1

Question 3: How has the coaching process helped you become more aware of biases?

(Interview 3)

Table 18

The Coaching Process

Teacher	Example Quote
Teacher 1	<p>“I guess I am more aware that it's happening in the building or with teachers; I didn't give it much thought. But I'm interested in to hear that there are some biases when they're grading, which is kind of surprising to me. Especially when it comes to math because math is black and white; directions are straight forward. There are right and wrong answers. Now we are providing partial credit for work shown. They need to get to the right answer to receive credit. Showing work helps the teacher see their thinking process and can be used to fix misconceptions. But for a grade, it is right or wrong. Higher level math and state testing will not give partial credit for showing work. It is important that we prepare students accurately” (Interview 3, February 16).</p>
Teacher 2	<p>“I think that the coaching process has helped me be more aware of my biases. I think now I try to leave no room for the second guessing of whether a student deserves points or not. I feel like I'm trying to be more computer-like, if you will, in the sense that if it's right it's right, if it's wrong, it's wrong. This method isn't ideal to me, but it does seem to make it fairer because it eliminates the room of looming biases” (Interview 3, February 15).</p>
Teacher 3	<p>“Yes. The coaching process helped me for sure. The first time we met, and you asked if I had any and I was like, yes. It's not necessarily a race or a gender thing, but for me, it's who's putting in effort in math, I need to be more willing to help all kids. I'm going to have kids who are less willing to put in the effort and try because math is really hard for them. They just don't like it because of that. So, I need to be fair across the board, regardless of what they do on their end, because that's my job as a teacher” (Interview 3, February 15).</p>
Teacher 4	<p>“The coaching process has made me identify something I didn't know was there. And then once we identified it, I need to shift my thinking to not use that bias anymore. Just use my answer key and do everything like, everybody's on the same. Same base or same playing field. I would like to have student turn in their paper with a number on it so I can't identify their paper but then I will begin learning their numbers, but I want to find a way of not knowing who they are” (Interview 3, February 13).</p>

Question 4: How do you feel after understanding and using the coaching strategies compared to before when grading student work? (Interview 3)

Table 19

Teacher Feelings and Affirmation

Teacher	Example Quote
Teacher 1	“I feel that I do want to make that shift to be completely unbiased; that would be the ultimate goal. I am willing to think about the biases that I show and make the shift to grade more fairly. I am more willing to think about my grading practices” (Interview 3, February 16).
Teacher 2	“I feel that now I’m just more aware of my biases. I’m appreciative of the biases that I wasn’t aware of and am striving to grade more fairly amongst all students and eliminate my biases. I plan to continue to reference my little wheel you made so that I can remember about looming biases and remember to prevent them” (Interview 3, February 15).
Teacher 3	“In terms of grading, like one thing I kind of want to try, that I’ve never really done before is covering up the names of the papers. And I have no way to tell who the student is, so I am not thinking about effort or behavior. That’s one change I want to make to try to help myself not have those biases. In terms of in the classroom to regardless of if they’re difficult kid or somebody who doesn’t typically put an effort making them get the help that they need, whether that be small group with myself, because it’s easy to say like I don’t want to work with that kid. But I need to make sure they get the help they need, deserve” (Interview 3, February 15).
Teacher 4	“Compared to before, I would say that grading is actually less work. Because I’m not thinking so much about the person in front of me. I’m just thinking about the math that I taught the student. So, I’m just looking at the problem is seeing the problem and I’m not bringing any outside emotions into the grading process, so it’s actually easier in a way” (Interview 3, February 13).

During the coaching process, using the B.I.A.S model made teachers more conscious of and able to recognize their prejudices when judging student work. I noticed that teachers' perspectives were changing. Their methods of grading made this clear. I observed teachers making more deliberate use of their answer keys; they gave students the same amount of time to

ensure their answers were correct or incorrect, regardless of whether the student had a history of doing well or poorly on previous assignments. Partial credit was still awarded but for more intentional reasons. Teachers assigned grades promptly and equitably. Teacher 4 said, “Grading is easier now knowing that I am aware of my biases. I use my answer key and just grade. It is right or wrong, no gray area” (Interview 3, February 13).

Table 20

B.I.A.S Model

Coaching Steps	Process Quote
B: Become Aware	“Hmm I don't think so” (Interview 1, January 16). “I see biases in the classroom with punishments and relationships. For me, I don't think I see it as much as grading. Because I do try really hard to not be bias” (Interview 1, January 16).
I: Identify	“Yeah, I think I am identifying my biases because I start to notice like, Oh, my about to give them a better grade than what they deserve. And I'll acknowledge that and I will. Then I will prevent myself from doing it. Before I put down the actual grade? Like, I might mark it? And then I'm like, why am I doing that?” (Interview 2, February 8).
A: Accept	“I think because as a teacher, I know I shouldn't have biases. It's always hard to hear that I am doing that stuff. But I'm glad that I was made aware of it so I could make changes. Because I know I shouldn't do that and I should help everybody the same. So yes, I definitely think it was difficult to hear it just because nobody wants to be doing something wrong ever. But I definitely think it helps me going forward to do less or none of that, hopefully, so that I'm treating all my kids equally in the classroom regardless of the effort they put in or anything else” (Interview 3, February, 13)
S: Shift	“I would choose to change my way of grading because I noticed even after we did the second interview or when you watch me do it, I was more apt to just okay, this is what they were supposed to have. And this is what the answer should be. And just going on from that. It didn't matter who the student was. Just follow my answer. (Interview 3, February 13).

Observations

During the final grading observations, I observed the shift and teachers' grading based on the answer key and the criterion set from their point system. They were not as quick to award partial credit or decipher handwriting. It was right or wrong. Every participant realized their own unconscious biases after the last consultation. See Table 21.

After doing the last observations, I saw that the teachers had altered their grading practices after learning the consequences of their implicit biases and how they could impede the development of their students. From the beginning of the study, 49% of biases were evident. By the midpoint of the study, 40% of biases were still evident. By the end of the study, and after coaching participants about their personal biases, Table 21 shows that biases are still evident but teachers followed their answer key and process with more intent. During the last grading observation, only 4% of biases became apparent. Partial credit was handled by teachers with less difficulty than in the past. Mostly during the last observation, partial credit wasn't even thought of or suggested on their answer key. Even if the procedure was demonstrated and mostly accurate, the math problem was marked wrong if the solution needed to be corrected. Teacher 4 stated, "After the coaching process and understanding my biases, I see that grading is faster; it is less stressful. I just grade. I do not think about the math or the person. I just grade" (Interview 3, February 13).

Table 21

Final Total Points versus Partial Credit

Participant	Number of assessments graded during observation	Number of total items graded (including all assessments)	Number of total items where no credit is given		Number of total items where partial credit is given			
			Incorrect answer	Other reason (e.g. handwriting, bad behavior, didn't attempt)	Missed pre-determined math step	Effort perceived	Good behavior perceived	Other reason
Teacher 1	1	1	14	2	0	0	0	0
Teacher 2	0	1	14	0	1	1	0	1
Teacher 3	1	1	22	0	0	0	0	0
Teacher 4	0	1	17	0	0	0	0	0

Lastly, when assessing student work, the behavior topic was brought up. Throughout the study, teachers were hesitant to award points when students did not attempt the assignment, lacked full participation, failed to pay attention to instructions, or showed a lack of effort because the student did not try the assignment, was not fully involved, did not pay attention to the teacher's instructions, or did not show effort. Teachers are aware of their students' behavior in class. They can identify who puts in effort according to their definition and who does not. This helps the teachers provide support to those who need it most. Understanding each student's level of commitment is critical to creating a positive learning environment. Therefore, when teachers assess student assignments, they often consider the effort, their definition of effort, put forth by students. Students who actively participate in class and approach assignments with determination are usually rewarded with higher grades, especially when partial credit is involved.

Conversely, students with disruptive behavior or a negative attitude toward math may be less likely to be granted partial credit for their work. Teachers see behaviors they attribute to effort and that this is one of their blind spots—allowing these specific student behaviors to guide the awarding of points in a way that may be very unfair to students who are not showing the correct behaviors.

Final Interview and Observation Summary

During the last interview, I had a thorough conversation with Teacher 1 regarding the origins of partial credit and the typical black-and-white answers in math classes. Teacher 1 raised a valid point. This teacher said the multiple-choice math questions on state tests are all black-or-white; the response must be corrected. The student and the work are invisible to the device. Why, therefore, do educators worry about partial credit? Teacher 1 said that the job completed in math class needs to align with how students would be assessed on the summative assessment;

therefore, should the graded assignments align with state testing? The participant said that because students are more than just test scores in the classroom, here is where teachers display their unconscious biases. Is it reasonable to give partial credit for their work? Giving students partial credit when you know they will not receive it on the summative assessment makes no sense because they need to master the standards and practice mathematics to comprehend the material and tackle problems. Still, we math teachers continue to do it. We provide them partial credit, particularly when seeing their work and thought process. For math teachers, it is a genuine struggle.

During this time, we discussed using the BIAS model to help us become more aware of our biases. I attempted to enlighten the participants about many unconscious biases we might display as math teachers; I talked with them about their prejudices and the ones the study had discovered. To become more conscious of our biases and maximize their potential as impartial judges, we also talked about how to accept and modify them. After the coaching process and the study were completed, participants shared with me that they were starting to recognize their prejudices; they discussed with me how they could change their behavior when assessing student work.

Conclusion

During the study, I had the opportunity to observe implicit biases during consultation sessions with four math teachers. Throughout the multiple observations of watching math teachers grade student work, I saw their biases come through more during their thought process of grading than biases towards the student due to race, gender, ethnicity, or socioeconomic status. Every participant responded favorably to the consultation process during the interview. They were relieved to learn about the evident biases. During the consultation process, they

started to change their perspective and become more conscious of their own biases and how they affected how they graded assignments. Teacher 2 now awards points with greater diligence.

They used to grant points to these children more freely, but now that they are aware of the bias, they are more deliberate in awarding points, and what works for one student also benefits all of the other students. In summary, during the baseline of observations and interviews and the consultation process, the implicit biases were *handwriting, achievement, and behavior biases*.

Table 22 exhibits the themes.

Table 22

Theme Implicit Biases

Implicit Bias	Quote
Handwriting	<p>“Although I love some neat handwriting. I'm pretty good at reading sloppy handwriting is so as long as I can read it. It could be as sloppy as big as whatever and if they, if I can make it out, then they get the credit” (Teacher 1, Interview 2, February 1).</p>
	<p>“I definitely think that if your handwriting is absolute garbage and I can't read it, I am more repelled and I don't want to give you full points. I feel like you don't deserve full points if I can't even read it” (Teacher 2, Interview 2, January 31).</p>
	<p>“Honestly, I don't think I've ever paid attention to student handwriting. The only time I think handwriting would affect grades would be I like physically can't read what you tried to write. I'll mark or whatever, like if it's taking off points because I don't know what you're trying to say. I'll take it off and if they come up and tell me like but they said whatever it was supposed to. Then I'll take another look at it and try to give points back if I can kind of see where they came from” (Teacher 3, Interview 2, January 31).</p>
	<p>“A lot of my student handwriting is not very good. I've just gotten so used to just deciphering what bad handwriting looks like. I just, it's not an I don't have it. Who it doesn't matter who they are. It's just if it's bad, I figure it out. If it's really bad, I'll ask them what they said” (Teacher 4, Interview 2, January 31).</p>

Table 22**Achievement**

“I think there are some kids in here that I'm like, this kid is really low, I'm going to grade them a little easier. Because it's my second academic, there's a lot of higher end students that I will just say, you got it wrong, like you don't need that extra cushion” (Teacher 2, Interview 2, January 31).

“If it is a kid who just struggles in math in general, but they try every day. They'll try to answer a question here or there. They attempt the work on their own first. I'm more inclined to give them a hint or two when they're taking a test or quiz” (Teacher 3, Interview 2, January 31).

“If I know if a student is struggling, and I've been working with them, and in my mind, I know what they meant. Even if they didn't write it. Sometimes I would give them credit because I know what they were thinking if they didn't show it into my writing. And I know I shouldn't do that” (Teacher 4, Interview 2, January 31).

Behavior

“It's just more of what effort are you giving me? Are you at least trying? If you are great, I'll try to support you a little bit more if I'm able to. And if you're not, then I'm not giving you extra help. If you're not going to put in the effort, why should I help you more than you need to? If they, again, are somebody who's giving effort and trying, I'm more lenient to help them out with points here or there” (Teacher 3, Interview 2, January 31).

“I help everybody but the answer may be different. But my thing is, if you have put in the time in class, and I see that then I'm more willing to help you than someone who's not. But my response might be different. Because if it's just somebody who just wants me to do the work for him, I can't validate that. But if it's someone who genuinely has been trying and just doesn't, just doesn't know what to do next, then I'm going to walk them through it” (Teacher 4, Interview 1, January 16).

These biases will be discussed in the next chapter.

CHAPTER 5: SUMMARY, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

This study examined the biases math teachers may showcase when grading student work. This study also looked at a coaching process, providing teachers with strategies to help them become aware of their biases. This study employed a qualitative methodology. This method made it possible to gain a deeper grasp of the research problem and the participants' experiences accessing student work. The qualitative data was collected through three observations per participant and three interviews with four math middle school math teachers from grades sixth to eighth. This final chapter interprets the findings by relating them to the literature review, problem statement, conceptual framework, and research questions. Finally, conclusions and suggestions for future strategies are discussed, limitations are described, and recommendations for further research are provided.

Biases have a range of effects on people. Our biases influence our attitudes, perceptions, and decisions, whether they are deliberate or not (Daumeyer et al., 2019; Glock & Kovacs, 2013; Olson & Fazio, 2009). Our society and culture are deeply embedded with prejudices and biases. Unbeknownst to us, culture influences the attitudes, values, beliefs, and perceptions that guide our day-to-day behavior (Kumar et al.; N., 2022). Teacher biases are influenced by the institutions and societies in which they work (Starck et al., 2020). Research shows that many teachers' biases are influenced by the factors of students' race, gender, socioeconomic background, and sexual orientation. Knowing the biases can affect how the student behaves in the classroom and how a teacher evaluates academic student performance (Papageorge et al., 2016; Rynders, 2019).

Especially in the STEM fields, biases are found in gender and race. STEM fields are often filled with males; it is considered a “dude” culture (Miller et al., 2021) because society has set up males for more success than females. Males are perceived to excel in STEM fields. There is a bias that males are better at math and science and enjoy technology and engineering-like classes. Women have to work harder to prove themselves in these types of fields. Research has shown that females are interested in STEM, but these curiosities begin to dwindle in middle school due to self-perceptions, self-doubt, perfectionism, and loneliness (Elliot et al., 2020). For this narrative to change, the same learning settings and opportunities should be available to all students, and schools should embrace and recognize individual differences (Urbani et al., 2022).

Current research shows that due to their attitudes, opinions, and life experiences, teachers are reported to rate students' work and make judgments differently based on their gender and ethnicity. Numerous studies have been conducted on teachers' culturally constructed attitudes and beliefs regarding their interactions with students and academic expectations (Bakari, 2003; Byrd, 2015; DeCuir-Gunby & Schutz, 2014; Kumar et al., 2018). More specifically, the fact that the majority of white teachers are teaching students from other less valued cultural groups is concerning because research indicates that white teachers may have deep-seated feelings of ambivalence toward minority and immigrant students in the United States, where White American culture is privileged and seen as the standard by which all other cultural groups are judged (Delpit, 2006; Ladson-Billings, 2014; Milner, 2011; Sleeter, 2012).

In this study, implicit biases were observed. However, the biases found in previous research studies, such as student's race, gender, socioeconomic background, and sexual orientation, were not directly observed in this study. The biases discovered in this study might come from how teachers view good behavior, effort, and handwriting based on their culture.

Even though I do not entirely make the connections between these biases and broader social groups, I acknowledge that they might be linked to the teachers' beliefs about what constitutes positive behavior in the classroom. It is essential to understand how these biases can affect students' learning experiences and how teachers can work to be more aware of their cultural perspectives when evaluating students. By recognizing and addressing these biases, teachers can create a more inclusive and equitable learning environment for all students.

To understand if the teachers in this study showcased cultural competency during grading, some conversations were shifted during interview two and directed toward race and gender regarding behavior and effort in the classroom. Participants discussed classroom behavior concerning effort and how those actions influenced grading in several instances; however, the behaviors discussed, such as slouching, putting one's head down, repeating directions, talking out of turn, and showing an attitude because students hate math, did not have to do with race. Teacher 3 explained how, in her math class, the lack of effort from a white female is similar to that of a black male. They both need more effort when it comes to math. Therefore, the grading of student work showed an effort bias, not necessarily race bias. These two students were graded the same way. It was also mentioned by Teacher 1 and Teacher 2 that girls are perceived to have more excellent handwriting than boys, but I did not find this perception to be correlated with grading. Handwriting biases were seen during observations when teachers awarded or deducted points due to the work shown. During my observations, it did not matter if the handwriting was female or male; what mattered was the work being legible and understandable. Lastly, Teacher 2 explained in interview two that he shows favoritism to the girls and the brown and black children. He acknowledges these biases, but I did not see evidence of this in the grading observations of student work. Most of the connections between the biases I

observed and more significant social categories are only apparent after the ones explicitly stated by Teacher 2.

The implicit biases found were *handwriting, achievement, and behavior biases*. These biases were more prevalent in grading student work than in identifying the student by race, gender, socioeconomic status, or sexual orientation.

Research Questions

This qualitative case study aims to uncover teachers' implicit biases in grading student work.

The research questions to guide this study include:

RQ1: What implicit biases can be identified during consultation sessions with math teachers?

RQ2: How do participants react to the implicit bias consultation process?

RQ3: How does consultation affect detected implicit biases in math grading?

Qualitative interviews and observations were conducted with four middle school math teachers. All four teachers teach multiple levels of math classes; however, only general math classes were used for this study. Three of the educators are white, and one is Hispanic. Three are female, and one is male. Years of experience vary from four to 25 years, and their educational background ranges from Bachelor's to Master's degrees. A pseudonym has been used for the participants and referred to as a number (e.g., Teacher 1).

Summary

The interviews aimed to obtain more information for all research questions to understand any pre-existing biases teachers may have while grading multiple student work forms. The initial interview and the first few observations were given as a baseline. It was driven intentionally to

understand how to coach the participants and how the B.I.A.S model would be used to understand teachers' biases. The coaching interview and observations served as a coaching session where I observed some changes in grading practices. I also used the interview to coach participants in identifying personal biases they may not have noticed. The final interview session and last few observations allowed me to observe a shift in behavior among all participants and to understand if the cognitive coaching process impacted the teachers. The observations uncovered unconscious biases, taught me about the participants' grading procedures, and supported the interviews. My objective was to observe the coaching process's impact on the instructors' behavior and how awareness of biases might modify behavior in the grading process to create a more equitable and fair system for all students.

During this study, three overarching bias themes emerged: *handwriting bias*, *achievement bias*, and *behavior bias*. This section summarizes each evolving theme and provides examples of the participants' thoughts and feelings.

Handwriting Biases

Grading student work can be complicated, especially when it comes to math. Math work comes in many forms: numbers, explanations, variables, and even symbols. Specifically, math assignments range from book pages to written explanations, exit slips, digital tasks, quizzes, and formative and summative assessments. All these come in writing, whether in numbers, words, or symbols.

While observing teachers grade student work, the handwriting bias appeared in 14% of all times teachers awarded no credit, and 13% of the times teachers awarded partial credit in the early part of the study. there would be times that the tilt of the head or the popular question was asked, "What is this number?". If it was an open-ended question, it did not matter the math

assignment format; there were times that teachers would read the sentence and do their best to make sense of it due to the handwriting. As I observed the participants grading student work, all teachers at some point during the study had the task of deciphering student handwriting. They would question the work, such as:

“Is that a 2. I think that is a 2. I will go with a two and mark it correct” (Teacher 1, Observation 1).

“I cannot even read this number sentence. What number is this? This should be negative. This question will receive no credit; I cannot read it” (Teacher 3, Observation 2).

“Okay, hmm...” and reads slowly...” it goes to get gas for my mom’s car, and we went to get gas...I do not know what he said there...hmmm...lower but slower. I cannot keep reading this, I do not understand the answer, I am marking it wrong” (Teacher 4, Observation 2).

When it came to student handwriting, depending on the assignment, the given credit varied. Overall, if the teacher could understand the answer, make out the number, and see the teacher’s thought process, partial credit, if not all, was given. Additionally, I found teachers giving more partial credit to students if handwriting was an issue on assessments rather than classwork. During interviews, teachers explained that assessments weigh 50% of a child’s grade versus classwork, which only weighs 20%. Therefore, I witnessed more intent when grading assessments and the teachers taking more time to decipher the handwriting. Very few times, a student received little to no credit due to handwriting on evaluations.

“I will put full concentration into my high grades but not on the low grades when I am just mindlessly looking at an answer and checking it” (Teacher 4, Interview 2).

During the interviews, I asked the participants to share if they were aware of handwriting biases when grading student work. Their responses were:

“Although I love some neat handwriting, I am pretty good at reading sloppy handwriting. So as long as I can read it, it could be as sloppy, as big as whatever, and if I can make it out, they get the credit” (Teacher 1, Interview 2).

“I think that if your handwriting is absolute garbage and I cannot read it, I am more repelled and do not want to give you full points. You do not deserve full points if I cannot even read it. I think it goes back to many girls who have better handwriting. So, if it looks good, you will probably get more leniency.” (Teacher 2, Interview 2).

“The only time I think handwriting would affect the grade would be when I physically cannot read what you tried to write. So I will mark what I cannot read; points are deducted because I do not know what you are trying to say” (Teacher 3, Interview 2).

“Many of my student handwriting is not very good. So, I have just gotten used to deciphering what bad handwriting looks like. It does not matter who they are. It is just that if it is bad, I figure it out. If it is awful, I will ask them what they said. Points are given if I know what they are trying to say” (Teacher 4, Interview 2).

Math is black and white; the answer is either right or wrong. However, with these responses, teachers had some gray areas to explore when grading paper/pencil work. Participants were aware that handwriting could be an issue, and they tried to give credit where it could be provided, but if the work needed to be more legible, the work was graded appropriately and marked wrong. The gap and the biases that came into play were related to how points are awarded. All teachers were observed using an answer key, and points were predetermined based on the work shown and the answer. However, the grey area that came into play was that the teachers were questioning partial points and how to award points based on the student's handwriting and the ability of the teacher to read it. The points awarded were at the teacher's discretion, based on whether the answer could be deciphered. This is why this is a bias when it comes to grading. Most teachers said it is wrong if they cannot read it. Teacher 4 at least suggested that she would ask for clarification from the student.

Achievement Bias

Every math classroom is filled with diversity. Students' math abilities range from low to high. All students learn math at a different pace, but in the end, teachers must teach the grade-level content so that students can learn, grow, and prepare for the next grade. When looking at

the achievement gaps that fill a classroom, grading student work can be difficult. Depending on the graded assignment, teachers may feel obligated to provide an alternative assignment, particularly for a multilingual learner or a learner whose primary language is not English. Therefore, grading can become complex.

While observing teachers grade student work, the achievement bias appeared in 0% of all times teachers awarded no credit, and 43% of times teachers awarded partial credit in the early part of the study. As I observed teachers' grading, the assignment did not matter; if the student was a learner who did well and was good at math, the teacher knew it, and the pace at which they graded the student's work was faster. If the students were viewed as learners who struggle in math, then grading was more intentional. Therefore, the subsequent bias that was evident was achievement. Throughout the observations, comments were made, such as:

"This student is great. Always gets a 100 or at least an A" (Teacher 2, Observation 1).

"This girl always does well and puts forth her best effort" (Teacher 1, Observation 3).

However, if the student was a low-level achiever, grading was more intentional, partial points were awarded more frequently, and feedback was given as rewriting the equation, circling the operation or wrong number, or checking over the work shown.

During one of my latter observations, Teacher 1 saw the name on the paper, which had very nice handwriting, and stated, "This girl does very well in class. She participates and looks... she is following all the steps that I taught her". Teacher 1 continued to say, "This student always does well," and quickly glanced at the work shown. Since every question was accurate, a 100% grade was given. During the same observation, Teacher 1 noticed a student's messy handwriting on a paper but also knew from the boy's name that the student struggled academically and frequently attended small groups. To read the handwriting, Teacher 1 had to

take her time and grade the work more slowly. Student names were not exposed during the observation process.

Along with verifying accuracy, Teacher 1 also ensured the result was handled correctly regarding math processes. Partial credit was awarded for incorrect responses, and constructive criticism was provided—mainly in math corrections. Furthermore, Teacher 2 swiftly skimmed through a digital assignment knowing the students who were top achievers. Grading slowed significantly due to the low-achieving students in the class, and more often than not, the answer key was examined to ensure that the answer was, in fact, incorrect. Additionally, Teacher 2 graded assessments with greater intent when the participant recognized a low-achieving student; partial credit was frequently considered to self-validate the reasons for awarding the credit. Teacher 2 evaluated the high-achieving children very quickly.

During the second interview, I wanted to know more about their reasons regarding grading and achievement.

“I am more lenient with my ML (multilingual) students and my kids with an IEP or 504 for math-related things. I try to give them a little more partial credit where I maybe would not do that with my regular-ed kid” (Teacher 3, Interview 2).

In this quote, the teacher indicates a belief that grading is more about making connections with students, building relationships, and grading with their hearts. It is about the child and who they are as a learner. The teacher wants to help the low-achieving students succeed.

“I taught them that I know what they are trying to say, and I will give them that work and the points. They are trying” (Teacher 4, Interview 2).

In this quote, the teacher indicates a belief that grading is not about correct answers and that grades can be given for unrelated things, like effort.”

“I am like, this kid is low; I will grade them easier. In my second academic, there are many higher-end students that I will just say, you got it wrong like you do not need that extra cushion” (Teacher 2, Interview 2).

In this quote, the teacher indicates a belief that grading is not about correct answers or the work; it is about self-esteem.

Educators generally appeared to be more eager to assist students they perceived to make an effort in class, per their definition of what it looks like and sounds like, than those who did not attempt at all. The teacher's definition of effort is being perceived throughout grading. Conversely, when a student asks for help and does not put much effort into class discussions or homework, teachers are either less willing to assist them, or their assistance may appear different from those who put in some effort or at least try. As a result, this unconscious bias may impact teachers' grades. Students' work affects their grades, and teachers who know their students are the ones who might not put forth as much effort as others. This bias may be preparing learners for failure in math class rather than teachers attempting to maintain equity and assist all students.

Behavior Bias

Students think they are either good at it or not. Moreover, sometimes, when students feel they are not good at something, their behavior may show a lack of effort, caring, and trying. In my observations, it is evident that each participant had a select few students who showed little to no effort on their graded assignments. While observing teachers grade student work, the behavior bias appeared in 10% of all times teachers awarded no credit, and 18% of times teachers awarded partial credit in the early part of the study. In a few instances, problems were left blank; the student needed to attempt to answer the question. Some questions showed a need for more effort in showcasing how the student came up with the answer. Lastly, it was evident

that some students just put an answer down to provide an answer. Problems were marked wrong in these instances, and all points were deducted. However, I began to question this practice. Does behavior/ lack of effort correlate with how the teacher awards points? Therefore, in my interview, I asked the participants if student behavior affects the support they give when the graded assignment is assigned. Their responses found that, yes, behavior can affect the way a teacher grades an assignment.

“I would love to say no; however, I am sure it depends. If the student had asked the same question before starting the quiz or a test, and I clarified and explained how to do that, and then they ask again during the test, there is no help, even with a low-grade assignment. I mean, I want them to figure it out. However, if they are working hard in class on a graded assignment with a low grade, I may direct them to use their resources or talk it out with them. If the student or group has shown no work effort or is off task, I am less likely to help them. They need to figure it out” (Teacher 1, Interview 1, Jan. 16).

“I know it should not be. Being in class makes that tough because some are just so low compared to others. Moreover, some work a lot harder, and they are still deficient, so they are just struggling, and some do nothing every day, and I do not feel like they deserve help. I feel like my facial expressions might be more helpful towards some than others based on who I know is giving 100% effort and still struggling compared to those who show up every day and turn in what they do” (Teacher 3, Interview 1, Jan. 16).

“I will help everybody who wants help. However, my response might be different. I cannot validate if somebody wants me to do the work for him. However, if someone genuinely has been trying and does not know what to do next, I will walk them through it. Because again, it goes back to that confidence Piece too” (Teacher 4, Interview 1, Jan. 16).

Overall, teachers were more willing to help students who were perceived to show effort during class than those who did not appear to try. On the contrary, if a student shows little effort during class discussion, does not attempt the work, and asks for help, participants are less likely to help, or help given may look different than with others that show effort or at least trying. Therefore, this implicit bias can affect the way teachers grade. Teachers are familiar with certain behaviors of students they associate with effort, and when they see an absence of this, they are

less likely to grant partial credit. Instead of teachers trying to keep all students equal and offer help across the board, this bias could set students up for failure in math class.

The Cognitive Coaching Process

Participants appeared to be eager to discover what biases were shown as they graded student work. Cognitive coaching is one way to increase instructors' self-efficacy through self-reflection and self-analysis through planning and reflecting conversations on their teaching (Killion et al., 2012; Devine et al., 2013). During this process, the mentor guides the teacher to critically evaluate their methods while always being impartial and refraining from adding their opinions to the discussion. Teachers can explore and develop their abilities with the help of cognitive coaching, which also helps them to expand on what they already know (Horne, 2022).

As I was coaching the participants through the interview questions and observing the coaching process in action, teachers were beginning to shift their responses to indicate biases, which may come from personal biases or biases that have become the norm of grading, a culture of what is accepted in the education world. When comparing Tables 8, 14, and 21, the counts of bias grading decreased throughout the study. From the beginning of the study, 49% of biases were observed, whereas with the coaching strategies and teachers becoming aware of their biases, grading biases decreased to 41% down to 4% by the end of the study.

Because I saw some new implicit biases, such as handwriting, achievement, and behavior, contrary to what research has stated, I asked the participants to share their thoughts on what biases were, how they can impact their teaching and classroom practices, impact grading practices, and how they would rate themselves on becoming more aware of their own biases when grading math assignments and assessments.

As a whole, participants define biases as a concept or view about a subject that we know based just on our perceptions. Biases are things that, when viewed objectively, sway our opinions. During the coaching process, participants gave examples with their definitions:

“We might know more about some students and give them more of a break or more chances than other kids. If we know they are going through something, have personal social-emotional struggles, or things at home that are out of our control, we may grade with grace” (Teacher 1, Interview 2, February 7).

“Student X always does a terrible job in class, and by the end of the year, you start grading his work without even giving it a second glance instead of genuinely looking for ways you can give him points. That is when I feel like an unintentional bias develops” (Teacher 2, Interview 2, January 31).

Inclusively, participants understand that explicit or implicit biases can affect the classroom environment, attitudes and perceptions towards students, and their grading procedures:

“I think that they sometimes do. We might know more about some students and give them more of a break or more chances than other kids. Like if we know that they are going through something or have personal social-emotional struggles or things at home that are out of our control and more lenient” (Teacher 1, Interview 2, February 7).

“I think I am more biased to be more lenient with my ML students and my kids who have an IEP or 504 for math-related things. Where I could not get it, I tried to give them a little more partial credit where I maybe would not do that with my regular ed kids. Because I know they need additional support, it is harder for them to begin with math” (Teacher 3, Interview 2, January 31).

Lastly, teachers rated themselves on the higher end of the scale when asked how aware they are becoming in noticing and understanding their biases:

“Maybe a four. Because I tried just to grade what they do, it has nothing to do with race, ethnicity, or socioeconomic status. Can they show me they can do the math” (Teacher 1, Interview 2, February 7)?

“I would say 3.5. Maybe closer to 4. Because I think that there are biases, whether we want them to be or not. I think we can be pretty cognizant of them” (Teacher 2, Interview 2, January 31).

“I would say a four because I am usually pretty obvious when doing it. However, when you ask about general or handwriting, I have not thought of that. So I think there is

probably more I could try to pay attention to as I grade stuff in the future” (Teacher 3, Interview 2, January 31).

“I got to be honest, probably a three” (Teacher 4, Interview 2, January 31).

I asked this teacher why, and she declined to explain.

The Effects of Consultation

Cognitive coaching is a valuable professional development strategy when it impacts teachers' mental processes and improves their capacity for autonomous learning. Similar to instructional coaching, research suggests that cognitive coaching can support educators' professional development (Devine et al., 2013). Therefore, using this as a professional development tool was highly effective in helping teachers understand their biases. Pre-service teachers must learn to be culturally competent through teacher education programs (Gay, 2000; Sleeter, 2001). Encouraging pre-service teachers to recognize the significance of culture in their own and their future students' thoughts, feelings, and actions is crucial to building their cultural competency.

Furthermore, master teachers must also learn to be culturally competent through professional development or coaching opportunities. A key component of developing teachers' cultural competency is helping them understand the importance of culture in the ideas, feelings, and behaviors of both themselves and their future learners (Kumar et al., 2022). Findings show through observations and interviews that teachers grew through this process. By the end of the study, teachers were accepting their biases and shifting their behaviors when grading student work. To establish an inclusive learning community, it is also necessary to refute the notion that student grades and peer comparisons are the leading indicators of how well instruction works (Kumar et al., 2022). Teachers were grading more intentionally for all students. They consistently utilized their answer key, which was used with more intent after this coaching

process. They wrote what they expected the student to have on their paper. It was wrong if the student’s work did not match what the teacher sought. There was no room for interpretation or time for biases to occur. Findings of the effects of the cognitive coaching process are below in Table 23.

Table 23

The Effects of the Cognitive Coaching Process

Question	Quote	Effect
Did the strategies offered to you help you identify your own biases when grading student work? How?	<p>“I think you did help me identify that. As you call it, the overachiever bias that I probably grade there's more quickly because I assume that they are on track and going to get most if not all, correct. Whereas somebody that I know is not as good at math or doing the work I might grade a little bit slower. Or with a little more watchful eye” (Teacher 1, Interview 3).</p> <p>“Yes, definitely. I think that becoming aware was probably the biggest ones for me because I do know I've had them but it's just being able to take note of here's the ones I do most frequently and then identifying those things. I don't want to give anybody any upper hand on somebody because I shouldn't do that as a teacher. So definitely think becoming aware of what mine were and identifying that and looking to kind of make some changes” (Teacher 3, Interview 3).</p>	<p>All participants agreed that the coaching strategies helped them self-identify personal biases, it helped them become more aware to identify biases, and has led them to be more intentionally with grading.</p>
Was it difficult to hear the biases displayed and how did you choose to change your mindset to help your biases?	<p>“ I think it’s difficult to hear any type of constructive criticism. As any decent human, we should strive for equality and fairness amongst all people, but especially as educators, we should be striving to promote an equal opportunity environment for all students. To be made aware that I do have biases brings a bit of discomfort;</p>	<p>All participants welcomed the feedback as they believe it helped them become a better evaluator. The coaching process helped them to grade equally among all their students, whether high achievers or low achievers. All</p>

however, I do think that it's beneficial because I want to be able to rid myself of those biases. My mindset shifted from "I don't think I have biases" to "I hope to rid myself of my current biases" (Teacher 2, Interview 3).

of them saw the value in changing their mindset in order to create an equal opportunity for all students.

"I know I shouldn't have biases. It's always hard to hear that I am doing that stuff. But I'm glad that I was made aware of it so I could make changes. Because I know I shouldn't do that and I should help everybody the same. So yes, I definitely think it was difficult to hear it just because nobody wants to be doing something wrong ever. But I definitely think it helps me going forward to do less or none of that, hopefully, so that I'm treating all my kids equally in the classroom regardless of the effort they put in or anything else" (Teacher 3, Interview 3).

How has the coaching process helped you become more aware of biases?

"I think that the coaching has helped me be more aware of my biases. I think now I try to leave no room for the second guessing of whether a student's deserves points or not. I feel like I'm trying to be more computer-like, if you will, in the sense that if it's right it's right, if it's wrong, it's wrong. This method isn't ideal to me, but it does seem to make it fairer because it eliminates the room of looming biases" (Teacher 2, Interview 3).

"It has helped because now it is identified. It is not race to gender. It is more achievement or effort. Less willing to put in the effort and math is hard. I need to be fair across the board. It is hard. Less effort and more support" (Teacher 3, Interview 3).

"It has helped identify something was there and what do I need to do and not to do anymore. So, I have accepted it and then shift my thinking. Everyone is on the same

The coaching process helped all participants by improving their grading process. Utilizing the B.I.A.S. wheel during this process assisted teachers to become aware of their biases, identify them, accept it, and shift their behavior. During observations, I witnessed this process. Teachers paused when one of their self-identified biases appeared but they used their answer key to help guide them and graded as the answer key intended. Even though there was some hesitancy with this new mindset, teachers see the benefits of creating a more equity grading practice. It eliminates the biases.

	playing field and just use the answer key. It has helped to shift my mindset” (Teacher 4, Interview 3).	
How do you feel now after understanding and using the coaching strategies compared to before when grading student work?	<p>“To be a completely unbiased grader. That’s the goal. Think about the biases and help change them. There is somewhat of a change as you grade” (Teacher 1, Interview 3).</p> <p>“I feel that now I’m just more aware of my biases. I’m appreciative of the biases that I wasn’t aware of and am striving to grade more fairly amongst all students and eliminate my biases. I plan to continue to reference my little wheel you made so that I can remember about looming biases and remember to prevent them” (Teacher 2, Interview 3).</p> <p>“Compared to before it is less work. Just thinking about the math not the student. Not bringing any outside biases or personal biases into it. It is easier to grade” (Teacher 4, Interview 3).</p>	<p>In terms of grading, all participants stated they are willing to shift their behavior and they are eager to try other ways to grade more fairly; such as, use numbers instead of names on graded assignments. It was concluded, that after the coaching process and use of the B.I.A.S model wheel, that grading can actually be less work knowing self-biases because the teachers are not thinking about the student on the paper, they are truly looking at the math; the process, and the answer. Emotions are not tied to the grading process.</p>

In summary, utilizing the coaching process throughout the study helped participants understand biases in the classroom. Spending time with each participant through interviews and observations allowed me to witness the biases that mathematic teachers bring to the table when they grade student work—accepting these biases and acknowledging that we have them allowed the educators to shift their behavior to grade more fairly and enable all students to show growth and succeed.

Implications of Research

Race and gender are significant themes in much of the research on implicit biases and how they manifest in math classrooms. However, biases against gender or ethnicity were not

directly observed in this study. Although participants graded student work by name, this had little impact on how teachers discussed about evaluated the work. The present study identified implicit biases in handwriting, achievement, and student effort/behavior. Indeed, these findings contrast with previous research studies: race, gender, socioeconomic status, and sexual orientation biases; however, this may be because underlying perceived biases have limited perceptions in this study. The data collected is only based on teacher perceptions. Do the biases found in the study stem from other biases that teachers have already formed when entering the classroom? Research indicates that white teachers, specifically white female teachers, may have deep-seated feelings of ambivalence toward minority and immigrant students. This is concerning given that White American culture is privileged in the United States and is seen as the standard by which all other cultural groups are judged (Delpit, 2006; Ladson-Billings, 2014; Milner, 2011; Sleeter, 2012). The cultural influences and life experiences of white educators differ from those of students of color in today's classrooms. These distinctions directly contribute to the need for more demanding and excellent instruction relevant to the experiences of students of color (Dawson, 2019).

While teacher perceptions can impact various behavioral and academic outcomes, Redding (2019) contends that the strongest indicator of student achievement is a shared cultural understanding that results from validating an alliance between the instructor and the student based on racial/ethnic matching. Therefore, this study's themes show different biases than previous research, which could stem from already established biases due to teachers' perceptions of what good behavior, effort, and handwriting look like in their culture.

Developing a rapport with students can have an impact. However, creating a relationship with a student goes beyond simply learning their name and understanding their strengths and

weaknesses. Understanding cultural variances and traits is also a part of it. Various aspects of culture are relevant to teaching and learning, some of which are more crucial for educators to understand than others (Gay, 2002). These include cultural values, traditions, communication, learning styles, relational patterns, and contributions. The teachers taking part in this study had cultivated strong relationships with their students. Too many educators believe that math and science classes are incompatible to maintain disciplinary integrity; however, this is not true. Every subject has a place for cultural diversity (Gay, 2000). In general, teachers knew about the students they were grading. If I had asked, they most likely could have told me a narrative about every one of them. This is when the different biases started to show. All the grading opportunities I saw demonstrated that the teachers genuinely wanted the best for their students because they were close to them; they sincerely cared. This is why participants needed help with awarding partial credit. They saw the need for it in their heart, but in their head, they knew it may not help the student.

Various variables were being used to award partial credit. The most frequent explanation for partial credit was that although students showed their hard work and mental processes, their mathematical mistakes resulted in inaccurate answers. Teachers thus acknowledged students' efforts and ability to offer input, but they withheld credit for the solution. When teachers found the correct solution, they gave only partial credit due to the students overlooking the unit, the negative sign, or the decimal point. Lastly, during an interview, there was a discussion of the idea that students receive half credit due to the teacher's attempt to remedy the student's numerous missed problems. The instructor recorded that giving them some credit for trying the task would help boost their self-esteem and improve their grade. Participants' biases were

apparent in the feedback, and partial credit was given during the grading process despite having access to an answer key.

I helped teachers modify their practices and helped participants identify their grading biases using the cognitive coaching conceptual framework. I was able to help teachers become conscious of their prejudices. I helped them modify their behavior so they could reevaluate how they grade student work using the BIAS wheel.

Limitations

This study had a few limitations. First, there was a small sample size: Four people participated in this investigation. A larger sample size is necessary to uncover more unconscious biases among math teachers. More themes and biases that could help with future studies might have been present with a bigger sample size. Additionally, the study was completed in one school, which is considered suburban and located in one of South Carolina's largest school districts. Suppose the sample size is larger and more varied, for example, multiple schools with varied student populations or schools in various districts. In that case, I believe it would benefit more middle schools to participate in the study. Alternatively, the research could be expanded to include k-12 mathematics classrooms. Finally, the time allotted for doing the study was insufficient. For this investigation, data collection took place over around 1.5 months. When gathering statistics in the school, district criteria needed to be followed. To effectively educate educators on implicit biases and help them recognize, acknowledge, and change their thinking, time is required to build trust with the teachers, to consult with focus groups and people properly, and to reflect on the process.

Furthermore, it would have been helpful to have had extra time for a reflection section in this study. For instance, the participants could have been asked about their thoughts on the

coaching process, considered their new perspective and the nature of future grading, and discussed future grading procedures. Additionally, adding student interviews would have been interesting, too.

In summary, this study's unique contribution is the inclusion of white and ethnic minority teachers. Teacher educators must acknowledge and address their own biases. This can be achieved by investigating the origins of the biases, learning strategies for confronting them, and facing them head-on through brave dialogues with individuals from diverse cultural backgrounds (Jett & Cross, 2016).

Recommendations for Future Research

In contrast to previous research, certain implicit biases discovered in this study were not evident in any other investigations I have researched. To find out if these biases are more explicit in the classroom, along with the biases other researchers witness, it would be advisable to carry out this study with more math teachers and in more schools with more time. The study could dive deeper into teachers' implicit biases regarding culture, gender, and other factors.

To help instructors see the biases they display in the classroom, schools adopting the cognitive coaching model may provide a professional development opportunity on diversity, culture, and biases. The B.I.A.S. wheel created for this study could be used in professional development to help teachers recognize their biases, become conscious of them, and start changing their perspectives. Furthermore, the diversity and culture of the school have to be covered in professional development. The curriculum, the school environment, and the school's vision will all benefit from using culturally appropriate approaches.

Additionally, partial credit has the potential to create biases, yet it also offers a means of encouraging students who may feel disheartened by making frequent minor errors in math. This

study awarded partial credit in 41% of all assessment items, indicating how prevalent this practice is for math teachers. When considering the fairness or unfairness of giving partial credit, it is essential to gather viewpoints from various individuals affected, such as teachers, students, and parents. By understanding the perspectives of different stakeholders, we can better assess how partial credit impacts students' learning experiences and the overall educational environment. Moreover, another approach would be to record every instance of partial credit awarded across all observations (regardless of the total number), identify the student who was granted credit based on their primary social category, and then conduct a final count of the recipients of partial credit by social category. For instance, what proportion of boys and girls received partial credit? How many students are white compared to non-white? What is the ratio of native English speakers to ELLs? Etc.

Furthermore, research on digital assessments should be conducted. Every year, technology is moving forward in the classroom. Instructors are incorporating it into their everyday lessons more and more, which includes having students turn in digitally graded work. During my observations, there were only two participants who graded digital work. All the participants told me that digital assignments are given within their math classroom; however, it is often for practice. To understand the math concepts, practice time must be allotted so students can grasp the material with guidance. Digital assignments included Pixel art, district digital content, such as iReady, Khan Academy, break-out rooms, scavenger hunts, and fun math activities to encourage motivation and practice time. The two individuals who used digital evaluations expressed interest in switching to digital work since, aside from entering the key and having the machine score it, there is little to no effort required on their part, and no biases are present.

Finally, it would be great to investigate whether teacher bias affects student achievement to advance this research. With grading weighing heavily on how a student's performance is perceived, could teacher biases hinder a student's success in a mathematics classroom? Teachers need to become aware of their biases so their behavior can change, and they need to understand that their biases, even with grading, can affect student performance and grades.

Conclusion

This study investigated implicit biases—the decisions we make without realizing them by examining the lived experiences and metacognition of middle school teachers in practice as they evaluate students' mathematical work; the study specifically looked at how math teachers enhanced their present understanding of the practice and evolution of culturally responsive teaching. This investigation of grading biases in middle school math classes also looked at how these biases present themselves and how they affect students. Investigations were conducted into the possible impacts of implicit stereotypes, instructor expectations, assessment design, cultural factors, and other variables on the grading process. This case study aims to reveal educators' unconscious biases while assigning grades to students.

This study's findings differed from recent research. Much of the research on grading biases in a mathematics classroom stems from race, gender, ethnicity, and self-identity, whereas this study found underlying biases in handwriting, achievement, and behavior. The two systems that make up our brain and our cognitive process are the reason for biases (Kahneman, 2011). Biases happen because our system is activated and acts without thinking. System 2 occurs when there is time to process and connect to what is happening. Hopefully, with the cogitative coaching process utilized in this study, the beginning stages of shifting the mindset will continue. System 2 will begin to take over for teachers to process the purpose of grading and award points

where all students can be successful but also allow the teacher to give credit where credit should be awarded.

Since implicit biases are a natural part of human nature, they are not always harmful. Teachers must be conscious of their implicit biases because of their impact on our students. In addition to impacting students' grades, grading biases can also cause poor accomplishment levels, student failures, a lack of desire, and a lack of self-efficacy. However, grading biases can sometimes have the reverse impact. Because teachers award partial credit points and give students credit because they know and believe the student understands the topic, it might give students false hope that they comprehend a concept. However, biases can also help students receive a better grade on an assignment due to the teacher awarding partial points. Both positive and negative effects on grading can be attributed to implicit biases.

Many decades of research indicate that student-teacher relationships impact students' behavioral functioning and academic performance. Furthermore, teachers' self-efficacy may impact connections between teachers and students. There are advantages and disadvantages to the interactions between educators and students; however, there are racial and gender differences in how teachers evaluate and react to conduct (Chestnut et al., 2021). Teaching methods and grading practices can be different; educators who are flexible and open to new ideas can best support their students. We must continue creating these relationships with all students and implementing culturally responsive practices to improve White supremacy and teacher behaviors to teach fairly, evaluate with equity, and assist all our students in achieving success in a math classroom.

Personal Journey

Throughout this journey, I have reflected on my teaching processes and the skills I use to teach my students. My classes and consistent research exposed me to becoming more accepting of the different cultures in my classroom. I have always felt that I am accepting of all students who walk through my doors, but my journey has allowed me to see that I have biases like everyone else. The way I grew up and the expectations I was held to are the attitudes I brought with me into my classroom. I have changed and refined some of my beliefs, practices, and attitudes toward students, which have helped me evolve into the teacher I am today. I find myself more patient, more willing to answer questions without getting upset because I have repeated myself over and over, more apt to listen rather than respond, be a safe place for students, and still have high expectations but at a height that all students can reach, being open to allow other students help each other, incorporating culture into my lesson plans, allow time for students to share their stories, and see students value and worth. I am not saying I did not do this before my journey, but my path of being a researcher has opened my eyes to be better: be a better human, teacher, and friend. Building relationships with my students has always been my goal, but now it is more intentional and necessary.

During this study, I evolved with the participants as I saw them shift their behavior in their grading practices since they were now aware of their implicit biases. What I learned and found as a researcher has helped me implement the suggestions in my grading practices. I also evolved with them and saw that I needed to change my practices while watching, listening, and challenging them to think more deeply. My personal biases also changed, and I am still aware of them as I grade. I have discovered that everyone has preconceived notions going into this process. Throughout this process, I have learned that everyone comes to the table with personal biases. These biases may result from an individual's upbringing, culture, life experiences, or

worldview. We must acknowledge, reflect, and shift our behavior so the achievement and equity gaps can continue to close. Our students have equal opportunity to learn, showcase, and celebrate their learning.

APPENDIX

Appendix 1

B.I.A.S. Wheel




Appendix 2

B.I.A.S. Model


B.I.A.S Model

Break the Bias




B- Become Aware

The first stage in this process is to identify any implicit or explicit bias that a person may have in their work environment. This could range from cognitive bias, affinity bias, attribution bias, or confirmation bias.




I- Identify

The second stage becomes awareness. This stage can be powerful for explicit biases and understand the behaviors that follow. This stage is helpful in identifying potential benefits of bias awareness and changed behavior.



A- Accept

In this stage, awareness of bias and identifying the bias may lead to cognitive dissonance; which means to accept the conflict or absorb it into already existing information and ignore it.



S- Shift

The final stage centers on the shifts in behavior. Fostering the growing cultures of belonging and encouragement will help support the change and remove the cultural/ social barriers to change.

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