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BAD AT MATH? AN INTRODUCTION

The most common response I get when I tell someone that I teach math for a living is that they were never good at math. There are variations to this answer, of course, but the essential point is that the individual I am speaking to is *bad at math*. Have you heard this comment or even said it yourself at times? Personally, I have gotten this response throughout my entire adult life both from those who have had little formal schooling and from those who have terminal degrees in their fields. As a high school teacher, when speaking to parents about the difficulties their child was having in mathematics, I was frequently surprised by their admission that they too had trouble with math. Now, as a college professor, I'm told by students and other faculty alike that they are *bad at math*. Among my colleagues, this is striking and perhaps unexpected. We are people who have devoted our lives to the pursuit of knowledge, yet, even among these learned individuals, I hear the *bad at math* comment frequently. Let me make this clear: Individuals who possess a PhD, who have published articles and books, who create new knowledge through research, and who are, by all the traditional measures, smart are comfortable saying that they are not good at mathematics. And they are not the only ones.

During the third quarter of Super Bowl LV, the Tampa Bay Buccaneers led the Kansas City Chiefs 24 to 9. The Buccaneers had possession of the ball and seemed poised to score again. One of the CBS announcers noted that he felt the Chiefs could come back at this point—being down by 15 points—but said that if Tampa Bay scored a touchdown or, perhaps, even two, this would no longer be true. Then he fumbled through the calculation of how many points behind the Chiefs would be should each of these scenarios occur. At one point he said, “I have trouble with the nines,” referring to the fact that the calculations involved subtracting 9 points from the Buccaneers' total in each case. There were an estimated 96.4 million people viewing Super Bowl LV on CBS as he said this. The fact that so many people across all walks of life are comfortable publicly admitting they are *bad at math* doesn't sit right with me. Some might feel shame admitting that they cannot read, yet when it comes to mathematics, people openly admit their inability to do math seemingly without shame or hesitation.

As a mathematics educator, I would love for all individuals to appreciate and understand mathematics the way that I do. The feeling I get when I finally understand a problem I have been struggling with for weeks is quite addictive and one of the reasons why I decided to study math in the first place. I believe wholeheartedly that many more people can grow to both love and excel at mathematics than currently do. They too can experience the rush that comes from finally seeing a way through a problem that one has been working on. However, for this to be the case, the way in which we conceptualize and teach mathematics in our society needs to fundamentally change. So, too, must our acceptance of the socially constructed belief that it is permissible for many among us to be bad at the subject. The implications of society's acceptance of this belief and related beliefs are vast; they have a profound effect on mathematics education and, as a result, on our society as a whole.

Throughout the 20-plus years during which I have been teaching mathematics, many educational reforms have come and gone. The stated goals of adopting them have included increasing the number of students who excel in mathematics. These reforms have not truly been successful for myriad reasons. One is that the reforms have lived alongside the belief that to be bad at math is normal and to be expected. That is, there exists a crosscurrent that erodes efforts made to engage all students in the successful study of mathematics. Reforms, however well intentioned they may be, fall short when society fails to fully believe that they can be successful in a way that ensures that all (or even most) students excel in mathematics.

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In their book, *The Stories We Tell: Math, Race, Bias and Opportunity*, Faulkner et al. (2019) talk about *belief stories* and their ability to influence our decisions even in the face of data that contradict the story itself. For example, if we believe that Black and Latinx students struggle with mathematics more than white students do, whether we admit this to ourselves or the belief operates more subconsciously, we will be less likely to refer Black and Latinx students to accelerated mathematics programs, even if the students we are selecting for such programs have similar academic

records. Faulkner et al.'s work highlights the fact that blind referrals made without knowledge of the students' gender, race, and ethnicity lead to a greater number of Black and Latinx students being referred to advanced programs.

BELIEFS AROUND MATHEMATICS AND MATHEMATICS EDUCATION

The acceptance of failure in mathematics, just like all belief stories, permeates our society. It is perpetuated in the media and cemented in our popular culture. More troubling, however, is that this acceptance finds its way inside our classrooms, boardrooms, and government agencies. It impacts decisions around pedagogy, policy, and practice and affects the lives of those who must live with the consequences of such decisions. A further result of society's belief that it is okay to be *bad at math* is a narrowing of the conversation such that blame for failure is placed squarely on the individual. *I am bad at math*. Given this, the way to resolve the problem is for me—the individual—to receive tutoring, participate in a support program, dedicate more time to doing mathematics, or any number of other interventions. In framing difficulties in mathematics this way, we neglect the broader issues that impact mathematics education. We fail to consider the impact of a system of public education that is deprived of resources, one that disenfranchises students from marginalized communities, and one that often fails to support, value, and treat teachers like the professionals they are. We further neglect to push back against curricula that center algebra above all other branches of mathematics, textbooks that do not adequately reflect our students or value their lived experiences, and standardized exams that fail to adequately capture our students' abilities.

Similarly, we have, as a society, constructed other beliefs around mathematics and mathematics education that if not dismantled are harmful to the students we serve and the larger society of which we are a part. Here are some of those other dangerous beliefs:

1. Mathematics is all about numbers and equations.
2. Mathematics is about getting to the one correct—the *only* correct—answer.
3. Someone who does mathematics is smart, and part of what it means to be smart is to be able to do computations quickly in one's head without the need for aids or research.

4. There exist a small number of *math people* for whom mathematics comes naturally.
5. The educational system is somehow irreparably broken.
6. There exist achievement gaps in mathematics.
7. It is not important to attend to identity when teaching mathematics.
8. Mathematics is neutral and its teaching apolitical.

Each of these commonly held beliefs impacts the teaching and learning of mathematics. Further, they frame the discussion around mathematics education; they define teacher preparation programs; they are reflected in teacher licensing requirements; they inform the development of policies, funding, and curricula; and in the end, they have a broad and lasting effect on the teaching and learning of mathematics and the students we aim to serve. We need to acknowledge that the way we frame mathematics and mathematics education also forces upon us ways of responding, engaging, and reforming the discipline. Thus, efforts at meaningful and sustained change for the better require us to attend to these constructs.

Additionally, we cannot separate our discussion of the beliefs that frame mathematics and mathematics education from the society in which this education system is embedded. Dr. Jean Anyon (1997), an educational researcher who explored the inequities around schooling in U.S. society, put it very clearly when she said, “attempting to fix inner city schools without fixing the city in which they are embedded is like trying to clean the air on one side of a screen door” (p. 168). At this point in history, we can no longer deny that our society is built upon institutionalized racism, which fundamentally affects our system of schooling and thus the teaching and learning of mathematics. Additional forms of oppression such as sexism, ageism, ableism, heterosexism, and classism have impacted and continue to impact the development of the systems of public education that exist in many places in the world today—especially in the United States and Canada. These forms of oppression play a pivotal role in the lives of the students and families served by the school systems therein as well as the lives of the faculty, administrators, and staff who work in them. Any attempt to improve mathematics education must acknowledge the fact that our educational systems—from classroom interactions, to teacher preparation, to school funding, to curriculum—exist within societies that are rife with inequality and in which power and privilege play a prominent role.

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Therefore, any attempt to understand this system and dismantle the beliefs that drive the teaching and learning of mathematics must attend to these realities.

WHOM IS THIS BOOK FOR?

This book is written for all those with an interest in the teaching and learning of mathematics. Most especially, it is aimed at the teachers, administrators, and instructional leaders such as mathematics coaches, mentors, professional development providers, and teacher educators who work in schools today. You live the realities described herein and are uniquely positioned to lead efforts toward chipping away the harmful beliefs that currently exist—beliefs that, if not dismantled, severely limit efforts at improving the educational experiences of students with respect to mathematics. The ways in which you, as teachers, engage with students, parents, and the content you teach impact how mathematics is viewed and the beliefs that students and others cement around mathematics and mathematics education. As instructional leaders, you work with teachers to strengthen the ways that mathematics is taught. Your suggestions, your support, and the discussions you lead impact how these teachers conceive of mathematics, how they develop as educators, and what beliefs they pass on to their students. As administrators, you make decisions around curriculum, academic policies, budget, and hiring that impact the environment in which students, teachers, and instructional leaders work. It is this environment in which most people develop their beliefs about mathematics, and it is this environment where we can rewrite the story of what mathematics is, what it means to be good at it, and who can excel at it. You all, in your related and varied roles, have substantial influence on how mathematics will come to be seen and understood for generations to come.

HOW CAN THIS BOOK HELP?

The chapters that follow attempt to deconstruct commonly held beliefs about mathematics and/or mathematics education. Each chapter incorporates narrative and reflection into a discussion that highlights relevant research while paying particular attention to issues of power, privilege, and systems of oppression present in society. All of the chapters focus on the K-16 system in the United States and, to a lesser extent, Canada with a special emphasis on those schools that serve predominantly Black and Latinx students. They are also rooted in my experiences as an educator, a researcher, a student (the first in my family to go to college), a gay woman, the daughter of immigrants to the United States, and the parent of a school-aged child. Improving the mathematical experiences of those typically marginalized in mathematics is my passion and life's work. My hope, and the goal of this book, is that by critically examining the social constructs that frame mathematics and mathematics education, we can step outside the usual discourses, expand the conversation, and undertake authentic substantive changes toward equitable mathematics education.

This introduction is followed by 11 chapters. Chapter 1, *What Does It Mean to Be Good at Math?*, looks at the commonly held beliefs about what it means to be good at math and their implications. Chapter 2, *Beyond Numbers and Equations: What Is Mathematics?*, challenges traditionally held beliefs that center the definition of mathematics on numbers and algebra. In Chapter 3, *Mathematicians and Mathematicians in Training*, we examine commonly held beliefs about who mathematicians are and what they look like. We look at depictions of mathematicians in popular culture as places where stereotypes are reinforced. Chapter 4, *We Are All Math People*, confirms the existence of *math people* by redefining what that term means. In Chapter 5, *Identity in Mathematics Education*, we challenge the idea that mathematics education is such an objective discipline that it need not concern itself with issues of student identity. In Chapter 6, *School Mathematics*, we step back and uncover where many of our commonly held beliefs about mathematics and mathematics education originated: school. In Chapter 7, *Mathematics as Gatekeeper*, we examine the role that mathematics plays as a gatekeeper to future success. We look at mathematical testing and its role in our society. Chapters 8 and 9 move to system-level concerns surrounding education. In Chapter 8, *Achievement Gaps or Opportunity Gaps?*, we push back against commonly accepted narratives about achievement gaps between more affluent white students and their less mainstream peers. National discussions

of the achievement gap are rampant within education, particularly as they relate to math and particularly in the wake of schools' reactions to the COVID-19 pandemic. In Chapter 9, *Is the School System Broken?*, we challenge commonly held beliefs about the purposes of schooling by considering the role that the educational system has as a reproducer of the inequality present in our social world. In Chapter 10, *Teaching Mathematics as a Political Act*, we challenge the commonly held idea that mathematics is neutral, objective, and apolitical. We consider the many ways that the teaching of mathematics is a political act in terms of what content is taught, whose stories are told, and how mathematics is contextualized. In the book's last chapter, *Where Do We Go From Here?*, we consider the power that you—as teachers, instructional leaders, and administrators—have to dismantle the harmful beliefs that currently exist around mathematics and mathematics education.

Each chapter ends with a series of questions for reflection aimed at teachers, instructional leaders, and administrators so that you can further engage with the ideas of the chapter. How can you, in your sphere of influence, take the ideas in the chapter and further them? How can you use your power, privilege, and position to act on the concepts therein to instill changes needed to strengthen mathematics education and best serve our most vulnerable students?

You will also find a Book Study Guide at resources.corwin.com/badatmath that is designed to help you and your colleagues work together as a community to digest the content in this book, try some of the activities together, and implement changes in your day-to-day practice.

I recognize that the topic of this book is complex, and the issues raised are beyond the influence of any one individual to fix. Only a collective effort will lead to needed change. I also recognize that I don't have all the answers—no one person does. For every facet of this topic, whole books could be written—and many have been! It would be impossible to cover it all in one single book, and I'm grateful to be able to stand upon and lean into the work of so many others striving collectively toward a more joyful and equitable mathematics learning experience for all. So, throughout this book, I try, where possible, to offer concrete ideas for small shifts you can start with, as well as additional resources such as books, websites, organizations, and podcasts to continue deepening your learning and practice.

HOW CAN YOU USE THIS BOOK?

This book should serve to ignite conversations at every level of education around what mathematics is, what it means to be good at mathematics, who is good at mathematics, and how the political and the mathematical are intertwined. It should serve as a springboard to talks about social justice and the ways mathematics education can promote it. It can be used in professional learning communities with in-service teachers as well as in courses for pre-service teachers. As the basis for professional development or a teacher book club read, this book has the potential to extend conversations already happening across pockets of North America. In the end, I call on you to build upon the work you already do to support equitable mathematics education and to join me in challenging the harmful beliefs that exist around mathematics and mathematics education so that there may come a day when no one is proud to announce they are *bad at math*.

A NOTE ON LANGUAGE

As Robin DiAngelo, best-selling author of *White Fragility* (2018), writes in her 2021 book *Nice Racism: How Progressive White People Perpetuate Racial Harm*, “Language is not neutral . . . the terms and phrases we use shape how we *perceive* or make meaning of what we observe” (p. xvii). As such, I acknowledge that the words I use in this text do not simply describe the realities discussed; they make meaning of them and reflect my own perceptions. Therefore, I feel it necessary before delving into the content of the book that I make clear some of my choices around language. When I am writing about racialized people, I use the current most recognized term for the group: *Black*, *Latinx*, and *Indigenous*. I do this even when the research I am citing differs in language (such as use of the term *Hispanic*) because I believe there is value in using terms that have evolved through time and are the current most recognized ones available. It is also in keeping with the current research in my field. I use the phrase *people of color* to describe all those who are nonwhite. I use the phrase *underrepresented groups in mathematics* in keeping with the definition of the National Science Foundation to describe those whose representation in mathematics degree programs and math-related careers is lower than their representation in the U.S. population (National Center for Science and Engineering Statistics, 2021). I use the phrase *students typically marginalized in mathematics* to describe not only those who are underrepresented but all who have been pushed to the margins of this discipline.

I often juxtapose the educational opportunities typically afforded to white students in contrast to those afforded to people of color, creating a binary dynamic that I understand fails to capture the many experiences and cultures present in both groups. This is, in part, due to the constraints of the research cited, of language in general, and of my own inability to find a way to address these issues while attending more adequately to the diversity within each group. I understand that collapsing peoples into these groups erases the nuances that exist within them, but hope that for the purposes herein these broad categories serve as useful and aligned with the current research literature. I capitalize *Black*, *Latinx*, and *Indigenous*. I once capitalized *white*, as it too is a racial category, but later learned that this is a practice among white supremacists. Not wanting to emulate such people, I no longer capitalize *white*.

When using terms like *men*, *women*, *girls*, and *boys*, I refer to all who identify with these terms—to people's primary identities. I acknowledge that some do not identify with either gender or do not do so consistently. I have avoided using *he* or *she* when gender is not known, choosing instead to use nongendered terms like *students*, *individuals*, and *people*, or the pronoun *they*. I could have added a third gender category but for brevity and flow did not. Some might be marginalized by this omission, and for that I do apologize.

I am hopeful that this clarifies some of the choices I have made with respect to language but acknowledge that no choice is perfect. I may be excluding some with my words while marginalizing others. Neither is intentional. I acknowledge too that I am part of the racialized system that exists in our society and that while I aim to be less racially oppressive, I too have been socialized into this system and play a role in the systemic racism that exists. I strive to be less ignorant on these matters, but my attempts are imperfect as well.