

Elementary teachers' endorsement of deficit discourses about mathematics and the relative risk of educational racism and sexism

Erik Jacobson, Indiana University, erdajaco@indiana.edu

Abstract: This study explores the prevalence of deficit and anti-deficit discourses among elementary teachers in the US and their relationship to racist and sexist beliefs about mathematics learning. By combining attribution theory and equity scholarship, the research investigates the endorsement of these discourses through survey data. Findings reveal that both deficit and anti-deficit discourses are common among teachers and strongly related to the endorsement of racist/sexist and anti-racist/anti-sexist statements about mathematics learning. Surprisingly, belief in innate mathematical ability is associated with greater endorsement of anti-racist/anti-sexist educational statements, while belief in educational opportunity is not significantly associated with lesser endorsement of racist and sexist statements. The study emphasizes the need for teacher education to address these tangled discourses and suggests that anti-deficit discourses alone may be insufficient to dismantle deficit discourses in mathematics education.

Teachers in the US often resort to deficit discourses when discussing mathematics education. These discourses are comprised of both seemingly neutral and clearly problematic ideas that shape thinking about math ability (Adiredja & Louie, 2020, p. 42). Researchers studying equity in mathematics learning have used interviews and classroom observations to demonstrate the racist nature of these supposedly neutral discourses (Jackson et al., 2017; Martin, 2009; Shah, 2019). In this study, I combine attribution theory from cognitive psychology with equity scholarship as a lens to identify and quantify the prevalence of deficit discourses. Through survey data and quantitative techniques, I explore their relationship to racist and sexist statements about math learning. This large sample, quantitative approach has the potential to inform teacher education and policy change in new ways.

Background and Conceptual Framework

Research suggests that merely having good intentions is not enough for equitable instruction (e.g., Rubie-Davies et al., 2006). Teachers' beliefs about the sources of racial and gender differences in math outcomes, or attribution beliefs, may influence their follow-through on equity intentions. Students' learning opportunities are connected to teachers' sense of efficacy which can vary by student (Schwab, 2019). Thus, a teacher's attribution beliefs shape a student's opportunities to learn via teaching self-efficacy. Teachers with genetic attribution beliefs may be less motivated to offer instructional support, as they believe struggles result from innate ability beyond their power to change. In contrast, teachers with educational attribution beliefs, who attribute struggles to insufficient learning opportunities, are more likely to adapt or increase instructional interventions.

Deficit discourses in mathematics education connect two types of deficits: students' academic shortcomings and deficiencies within students, their families, or their culture (Adiredja & Louie, 2020). These discourses often overlook students' existing knowledge and the impact of learning opportunities and social contexts on students' struggles or success. The first type of deficit, "narratives about what counts as mathematics," is based on conceptions of mathematics as objective and universal (ibid, p. 43). These conceptions establish standards that can emphasize students' shortcomings rather than their strengths. The still common but debunked view of mathematics learning as a linear process (Blanton & Kaput, 2005) also contributes to this deficit view. The second type of deficit, "narratives about students from marginalized groups" (Adiredja & Louie, 2020, p. 43) includes narratives about deficits in ability, intelligence (Leyva, 2016), culture (Solórzano & Yosso, 2002), and personal effort (Oppland-Cordell, 2014). These narratives focus on individuals' membership in marginalized groups, attributing underachievement to the group rather than external, sociohistorical factors such as learning opportunities. Addressing these discourses may help promote more equitable and inclusive mathematics education.

Teachers' beliefs about students significantly influence their judgments and classroom organization (Reyna, 2008). Attribution theory examines how individuals attribute behavior to internal or external causes (Graham,

2020). Teachers often possess attributional biases (Bertrand & Marsh, 2015), and tend to attribute student failure to factors internal to students and external to themselves (Kulinna, 2007). Research further shows that teachers' attributions relate to student variables like gender and race (e.g., Espinoza et al., 2014). Three kinds of attribution beliefs are genetic determinism (Keller, 2005), social determinism (Rangel & Keller, 2011), and school meritocracy (Wiederkehr et al., 2015). Genetic determinism (BGD) posits that innate biological traits primarily shape individuals (Keller, 2005), and is associated with stereotyping and prejudice. Social determinism (BSD) suggests that social factors permanently mold an individual's character (Rangel & Keller, 2011) and is linked to negative stereotyping and prejudice. Belief in school meritocracy (BSM) maintains that school success depends on effort (Wiederkehr et al., 2015), and is related to social inequality legitimization.

I introduce the term "attributions of mathematical excellence" to characterize deficit discourses in mathematics education and make two key contributions. First, it highlights the prevalence and insidious nature of positive language in describing what counts as mathematics. This conceptual stance supports the methodology of examining teachers' implicitly held beliefs through coded, identity-neutral language, which echoes narratives about students from marginalized groups (Louie et al., 2021). The second contribution is to focus on the attributions that underlie deficit discourses, leveraging social psychology research to distinguish different types. Teachers' beliefs about the sources of unequal outcomes in mathematics education are consequential, as certain beliefs may reinforce racist and sexist outcomes, while others could help disrupt them. Notably, anti-deficit attributions of mathematical excellence recognize the role of schooling and its social and historical context in shaping student outcomes. This perspective suggests that anti-deficit attributions can create space for teachers to engage in anti-deficit noticing, which deliberately challenges deficit discourses and intentionally elevates the humanity, intelligence, and mathematical abilities of marginalized people in routine instructional interactions (Louie et al., 2021).

In this study, I focus on genetic and educational attributions of mathematical excellence and address the following research questions.

1. How common are deficit discourses—and anti-deficit discourses—about mathematics? How commonly do teachers endorse explicitly racist and sexist statements—and anti-racist/anti-sexist statements—about mathematics learning?
2. How are identity neutral deficit discourses (and anti-deficit discourses) related to analogous racist and sexist statements (or anti-racist, anti-sexist statements) about mathematics learning?
3. What is teachers' risk of endorsing racist or sexist genetic statements (or anti-racist or anti-sexist educational statements) about mathematical learning relative to their identity neutral attribution of mathematical success to innate ability or to education?

Methods and Procedures

The study involved 313 participants, including 223 practicing teachers and 90 preservice teachers from a midwestern state, who were predominantly white (96%) and female (89%), reflecting the regional demographics of elementary teachers. Participants answered 64 survey items across four attribution categories, with each category containing eight pairs of identity-neutral items and identity-specific items expressing racist, sexist, anti-racist, or anti-sexist attributions. Participants rated the truth of each attribution on a 7-point scale from 1: Completely true to 7: Not at all true. Responses were dichotomized into endorsement (1-5) and non-endorsement (6-7). The survey was administered online via Qualtrics, and participants received gift cards as an incentive. Data collection concluded after a two-week period, with two follow-up email reminders sent. All participants provided informed consent, and the study was approved by an Institutional Review Board.

Relative risk, a technique borrowed from medical sciences, was used to analyze the survey data. Exposure was operationalized as a teacher's endorsement of an identity-neutral genetic attribution statement, indicating exposure to the corresponding deficit discourse. The consequence was the teacher's endorsement of an explicitly racist or sexist statement. The same interpretation was applied to teachers' endorsement of an identity-neutral educational attribution statement (exposure to anti-deficit discourses) and endorsement of an anti-racist or anti-sexist statement (consequence).

Findings

To answer the first research question, I examined the distribution of endorsement for each attribution item. All but one of the identity neutral genetic items were endorsed by a majority of participants, with endorsement

ranging from 52% to 77%. Endorsement of the last item was 38%. By contrast, the identity specific genetic items were endorsed by a minority of participants, with endorsement ranging from 13% to 43%. All the neutral educational items were endorsed by most of the participants, with endorsement ranging from 79% to 88%. Similarly, all the identified educational items were endorsed by most participants, with endorsement ranging from 50% to 80%. Thus, endorsement of either the genetic or the educational items was not uncommon for participants in this sample, whether the items were identity neutral or identified.

For the second research question, I computed the relative risk of a teacher endorsing the identified item given their endorsement of the neutral item in each item pair. For example, teachers who endorsed the identity neutral item (*I think that basic genetic differences determine to a large degree who becomes a professional mathematician.*) were 2.49 ($p < .0001$) times as likely to endorse the identified genetic attribution (*I think that basic genetic differences explain why there are far more male than female mathematicians.*) than others. In a second example, teachers who endorsed the identity neutral item (*In my view, students who excel in mathematics usually have more educational opportunities than students who do not excel in mathematics.*) were 1.86 ($p = .0019$) times as likely to endorse the identified educational attribution (*I believe that Asian students who excel in mathematics have more educational opportunities than students from other groups who do not excel in mathematics.*) than others. Across the seven genetic attribution item pairs, the relative risk of endorsing the identified item was always statistically significant ($p < .01$) and ranged from 1.90 to 10.67. Across the seven educational attribution item pairs, the relative risk of endorsing the identified item was always statistically significant ($p < .01$) and ranged from 1.73 to 3.05.

For the third research question, I used the median to summarize each teacher's endorsement ratings for the educational and genetic items. This enabled me to compute the overall relative risk based on summaries of both kinds of item in each attribution category. Teachers with median endorsement of identity neutral educational items (anti-deficit educational discourses) were nearly eight times as likely ($p < 0.001$) to endorse identified educational (antiracist) statements. Teachers with median endorsement of identity neutral genetic items (genetic deficit discourses) were more than 12 times as likely ($p < .0001$) to endorse identified genetic (racist and sexist) statements. Teachers with median endorsement of identity neutral educational items (anti-deficit educational discourses) were 12% more likely to endorse identified genetic (racist and sexist) statements, but this relative risk was not statistically significant ($p = .3824$). Teachers with median endorsement of identity neutral genetic items (genetic deficit discourses) were 25% more likely ($p = .0044$) to endorse identified educational (antiracist) statements.

Discussion

This paper uses survey methods to explore the prevalence of elementary teachers' deficit discourses about innate mathematical ability and anti-deficit discourses about the central role of educational opportunity in mathematical success. I also examined the risk of endorsing racist and sexist statements about mathematics learning relative to these deficit and anti-deficit discourses. The findings show that (1) deficit and anti-deficit discourses are both common, (2) deficit and anti-deficit discourses are strongly related to the teachers' endorsement of racist/sexist and anti-racist/anti-sexist statements about mathematics learning, respectively, and (3) deficit and anti-deficit discourses are distinct from each other in the sense that belief in innate mathematical ability is counter-intuitively associated with a greater endorsement of anti-racist/anti-sexist educational statements and that belief in educational opportunity is not significantly associated with lesser endorsement of racist and sexist statements about mathematical ability.

Attribution beliefs provide a useful lens for analyzing deficit and anti-deficit discourses in mathematics education. The first finding confirms the pervasive nature of both genetic and educational attributions for mathematical success. The methodological choice of using two versions of the same attribution statement (which differed only in whether race and gender were explicit) highlighted the strong relationship between common place, often unquestioned "threads" of discourse about mathematics ability and the more obviously problematic, explicitly racist and sexist "strands" that together make up deficit discourses in mathematics education. From a theoretical perspective, these results make plausible the claim that these apparently separate discursive elements are not actually distinct but are "tangled" together to form discursive "webs" that are challenging to navigate or extricate (Adiredja & Louie, 2020). The results also provide a sobering implication for teacher education: participating in both deficit and anti-deficit discourses evidently does not cause an internal contradiction for many teachers. If teacher education is going to unravel the webs of deficit discourses, anti-deficit discourses alone are likely an insufficient tool to dismantle deficit discourses.

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