

UNTANGLING THE WEB OF DEFICIT DISCOURSES IN MATHEMATICS EDUCATION

ADITYA P. ADIREDDA, NICOLE LOUIE [1]

At an academic level [students] are quite low, they are quite low in their sociocultural and educational level too. [...] Every child learns, but sometimes they do not learn enough because of different characteristics, the home, genetic problems of learning (Maribel, grade 5–8 teacher, public school [in Chile]). (Darragh, 2019, p. 6)

[This student] demonstrated some understanding of the ϵ -inequality, but her knowledge of the rest of the definition was deficient [...] Mary did not fully understand the purpose of the phrase “for every ϵ ” [...] [nor did she] recognize the inconsistency between this notion and her notion of ϵ . (Researchers studying preservice teachers in a university in the United States, quoted by Adiredja, 2019)

Despite theoretical and practical advances in asserting anti-deficit perspectives, mathematics education continues to be entangled with deficit discourses at every level, including instruction from preschool to university as well as research and scholarship, as numerous studies conducted in recent years attest (*e.g.*, Adiredja, 2019; Jackson, Gibbons & Sharpe, 2017). We argue that deficit discourses comprise webs of meaning, reinforced by strands of thought that might appear neutral as well as ideas that are more commonly recognized as problematic. We use the term deficit *discourses* (rather than *views*, *orientations*, or *thinking*) to highlight the social, cultural, and historical construction of these perspectives, locating them not only in the minds of biased individuals but also in systems, institutions, and society at large. While deficit discourses are negotiated through individuals’ interactions, we argue that examining their *systemic* nature is essential for understanding why they persist.

Defining deficit discourses

Deficit discourses make two kinds of statements. First, they focus on students’ academic and intellectual shortcomings, with little or no recognition of their existing understandings and strengths. Second, they attribute such shortcomings to deficiencies located in students themselves, their families, or their culture, “without examining the links between school practices and student outcomes” (García & Guerra, 2004, p. 151), and broader social and historical contexts. For example, a teacher in Jackson, Gibbons and Sharpe

(2017) explained students’ difficulties with mathematics as follows:

We have students that come to school who don’t get support at home, those students tend to think that this is just [...] a place where you can come and try to have as much social fun as possible during the day and that’s a big challenge for us, the lack of parental involvement on this campus, the lack of educated parents on this campus. (p. 23)

An “overwhelming majority” of the teachers in the study talked about students’ mathematics learning using similar “deficit terms”, attributing struggles at least in part to student and family deficiencies (p. 23). Such explanations fail to recognize students’ resources and strengths, and fail to account for institutional, social and political factors. An anti-deficit perspective might prompt one to focus instead on how social inequality shapes unequal opportunities to learn, shortcomings of the metrics used to assess mathematical understanding, or on Black, Latinx and indigenous excellence in mathematics.

Critiques of deficit discourse are sometimes interpreted as synonymous with a ‘feel-good’ approach that precludes attending to students’ difficulties. But observing students’ conceptual shortcomings or differences in performance does not in itself constitute deficit discourse. Such observations can actually motivate valuable support, *if* they provoke learning about students, the resources they bring to learning, and the institutional contexts that support their learning (*e.g.*, Treisman, 1992).

A web of meanings that support deficit discourses

Deficit discourses do not stand on their own; they are reinforced by other narratives (see Figure 1). We begin with seemingly neutral ideas about mathematics (Figure 1, Box B). We then show how deficit discourses are also linked to fundamentally oppressive ideas tying ability to other categories (Figure 1, Box C), using racial categories as an example.

Deficit discourses and narratives about mathematics

Deficit discourses in mathematics education are intimately linked to conceptions of mathematics itself, which permeate

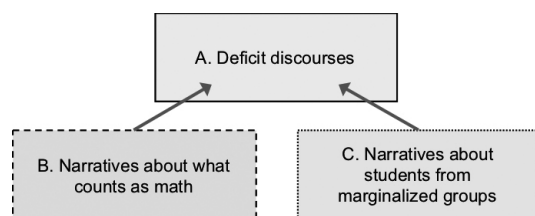


Figure 1. A web of meanings supporting deficit discourses.

not only schools and classrooms but also research about the learning and teaching of mathematics. Many scholars have highlighted the cultural and political nature of mathematics. Yet the discipline continues to be commonly viewed as *objective and universal*, a set of predetermined axioms and facts with an inherent logic that is “accessible to every human being through cognitive work” (Pais, 2011, p. 217). Expecting students in different countries to learn the same set of predetermined facts and skills, using essentially the same mathematics curriculum independent of their contexts, reflects such a perspective (Bishop, 2010).

Viewing mathematics instead as a social and cultural construction that always has and always will involve human choices and sensibilities can make space to explore students’ curiosities and leverage students’ perspectives. For example, acknowledging the contexts in which mathematical knowledge is constructed might prompt attention to marginalized students’ contexts as sites for generating mathematical knowledge that is meaningful to them, or as sites for empowerment and resistance through mathematics (Gutiérrez, 2009; Skovsmose & Valero, 2008).

Perceptions of mathematics itself as objective are linked to seemingly objective standards for mathematical thinking. Examining research on undergraduate mathematics education, Adiredja (2019) analyzed how over-privileging the following standards contributes to the reproduction of deficit discourses: 1) use of formal mathematical knowledge (*e.g.*, standard definitions and procedures); 2) use of formal mathematical language to encode such knowledge; 3) full consistency in mathematical explanations; and 4) immediate, externally recognizable changes in mathematical understanding. These standards insidiously de-value students’ informal mathematical knowledge and emerging understandings. They also make invisible the knowledge and understandings that students have, which support meaningful learning. Connecting these standards to *deficit master-narratives* about students of color in the US, Adiredja further argued that they bolster deficit discourses about students in general and marginalized students in particular.

In line with views of mathematics itself as objective and universally true, legitimate mathematical activity in schools is often framed as rote practice, involving memorization of established procedures and repetitive computation. This framing of mathematical activity creates only a narrow space for students to demonstrate competence. More multidimensional framing of mathematical activity includes practices such as sense-making, connection-seeking, experimentation, collaboration and argumentation. This expands the meaning of mathematical competence, thereby expanding who can be seen as capable. But multidimensional framing is rare and

easily co-opted by the hierarchical and exclusionary frames that dominate mathematics education (Louie, 2017).

Mathematics is also commonly viewed as *sequential*, composed of building blocks that must be mastered in a specific order. The myth of a necessary sequence has been challenged on philosophical grounds as well as empirical ones (*e.g.*, Ernest, 1991; Blanton & Kaput, 2005). Still, the metaphor of mathematics learning as travel along a ‘narrow path’ leading from the basic to the advanced remains powerful, and it reinforces deficit discourses by producing hierarchical categories of children: those who are ahead, those who are on track, and those who are behind; those who are ‘strong’ and those who are ‘weak’. These supposedly objective classifications are used politically, justifying the denial of rich learning opportunities to students who have ‘a weak foundation’ or are not ‘ready’.

Deficit discourses and systems of oppression

It is possible to view deficit discourses as problematic without reference to systems of oppression. The way that these discourses obscure students’ strengths and understandings is at odds with the basic constructivist principle that people build new knowledge on the basis of their prior knowledge. Deficit discourses therefore produce suboptimal learning. Additionally, viewing any person only in terms of their deficits is dehumanizing, apart from connections to oppressive systems.

However, we argue that deficit discourses are inextricably intertwined with social, cultural and historical discourses about who counts as fully human, as we suggested in the previous section. The ultimate function of deficit discourses is always to justify attitudes and behaviors that reproduce systems of domination, to legitimize oppression as the natural and moral consequence of dominant-group merits and subordinate-group deficiencies. To accomplish this, deficit discourses construct differences, frame those differences as evidence of the innate inferiority of subordinate groups, and make invisible the strengths, resources and knowledge that exist in marginalized communities. This phenomenon crosses national borders, as evidenced by a global body of research documenting and challenging deficit discourses in mathematics education based on race, ethnicity, class, gender, language, (dis)ability, immigration status and other categories.

Racial narratives in the US (which bear similarities to narratives in other countries; see the discussion of ethnicity in Frade, Acioly-Régner & Jun, 2013) provide a particularly clear, well-researched example of the entanglement of deficit discourses, mathematics and oppression. In the US, policy documents, scholarship and everyday public discourse associate Black and Brown communities and economically marginalized communities with deficits, calling attention to achievement gaps, dropout rates and other indicators of failure. Constant repetition of these associations has produced a false and oppressive “racial hierarchy of mathematics ability” (Martin, 2009, p. 297), positioning Black, Latinx and indigenous people as mathematically inferior to whites and some Asians and consequently as less deserving of meaningful, prestigious and lucrative learning opportunities and careers.

Well-meaning efforts to advance racial equity may inadvertently reinforce deficit discourses. Focus on racial achievement gaps is a prime example. In addition to reinforcing the racial hierarchy of mathematical ability, focusing on racial achievement gaps as the primary inequity in education distracts from structural issues including school segregation and grossly unequal funding (Ladson-Billings, 2006). Fixating on achievement gaps also erases the mathematical traditions and contributions of ethnic groups that are persistently framed as ‘underperforming’. Moreover, to the extent that documenting gaps relies on achievement measures that privilege white, middle-class ways of learning and knowing, this practice reinforces the dominance of white students and families at the cost of students and families of color (Martin, Gholson & Leonard, 2010).

Reproducing deficit discourses in mathematics education: a systemic perspective

Although the specific content of deficit discourses may vary across time and space, we conjecture that there are similarities in the processes through which these discourses are reproduced around the world. In this section, we advance a systemic perspective on these processes, which we argue is essential for understanding them and challenging them at a larger scale than through isolated local projects.

Deficit views are often treated as the property of biased individuals. The pervasiveness of deficit discourses—despite several decades of equity rhetoric and reform—suggests that they are cultural and systemic. At the same time, however, deficit discourses cannot exist without individuals’ participation in reproducing them. Take the example of Ms Michaels, a teacher in a study conducted by Louie (2019). Looking at her students’ work after a lesson, Ms Michaels compared one child’s strategy to a strategy she had taught for adding two-digit numbers, called ‘breaking apart’:

So what he should’ve done is, if it’s 35, it should’ve been broken apart and you should see 30 and then you should see a 5 down below. [...] I’m not sure where his numbers were coming from, but he wasn’t breaking apart correctly.

Measuring the student’s work against the strategy she had taught, Ms Michaels could interpret the student’s work only in terms of its divergence from her method. Researchers frequently engage in similar analyses, interpreting differences between students’ work and what they consider correct or ideal. Ms Michaels was prepared to put the child’s paper in a pile for incorrect work, when a colleague who had been observing the lesson pointed out that he had not been ‘breaking apart’ at all but using a different, equally correct strategy. Ms Michaels was “surprised” by this; it did not fit her perspective, particularly because she viewed the student as “one of those that talk a lot and they’re real distracted” and “not as engaged” as his peers. Although she did not mention it, the boy was also Black.

One interpretation of this incident might center Ms Michaels’ gaps in her knowledge and problems with her beliefs. We instead emphasize the interplay of societal-level and individual-level processes, represented in our model for

the reproduction of deficit discourses in mathematics education (see Figure 2).

Deficit discourses in society at large

Our model shows how learning and sense-making like Ms Michaels’ are embedded in nested systems, including the immediate settings of everyday interaction as well as the broader cultural norms and ideologies that pattern these settings. The top/outermost layer depicts deficit discourse at the societal level (Figure 2, Box 1A), showing that it is supported by constantly circulating narratives about what counts as mathematics (Figure 2, Box 1B) and about the ability, motivation and needs of students from marginalized groups (Figure 2, Box 1C). As we have described above, these narratives are culturally dominant. They permeate society, so thoroughly naturalized that most people interpret them as common sense, and even teachers and researchers who are well aware of deficit discourses and wish to counter them are not immune to their influence (Louie, 2017).

Deficit discourses in local communities of practice

Deficit discourses come alive for people through their participation in social practices (Nasir, Snyder, Shah & Ross, 2013). This is reflected in the middle layer of Figure 2 (Boxes 2A, 2B and 2C), which focuses on local discourses as they are negotiated in specific communities of practice. Teachers like Ms Michaels, for example, are embedded in school faculties and subject-matter departments; researchers who study how students make sense of mathematical con-

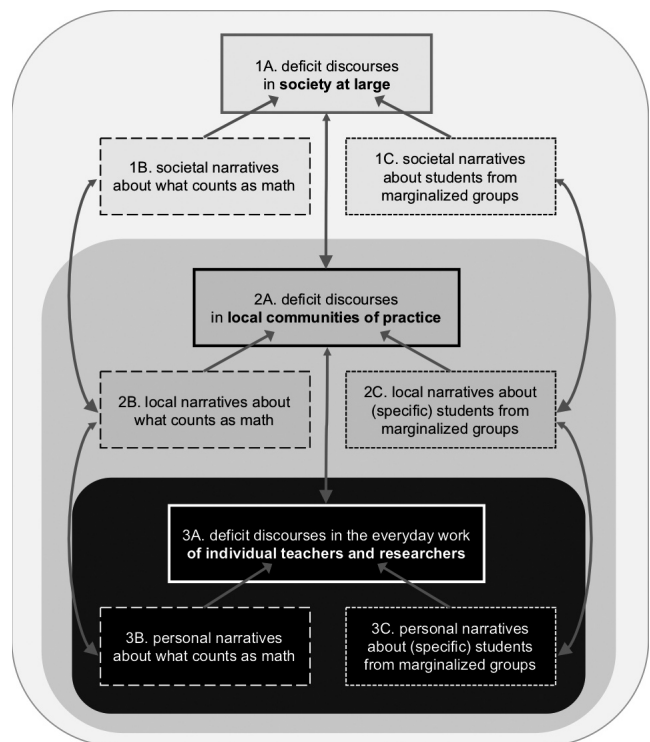


Figure 2. The web of deficit discourses in mathematics education and their reproduction across layers of social organization.

cepts are embedded in communities of scholars engaged in a shared conversation via conferences, research publications and so on.

Socially dominant discourses take on localized and specific meanings in teachers' and researchers' communities, as community members generate shared narratives about mathematics and students. For example, it might be a school norm for teachers to talk about their students as 'really low level' and 'not as strong as the ones at the magnet school' (as it was at Ms Michaels' school) or to talk about 'real math' as symbolic manipulation to the exclusion of other approaches—reproducing deficit narratives about students and narrow views of mathematics and mathematical ability. A research community might similarly produce and uncritically consume articles that report on students' struggles with particular mathematical terms and concepts, reinforcing standards and values that buttress deficit discourses (Adiredja, 2019).

Deficit discourses in individuals' sense-making

The bottom/innermost layer of Figure 2 (Boxes 3A, 3B and 3C) indicates the tendency for individual teachers, researchers and others to employ deficit discourses in their everyday work. The dominance of deficit discourses makes entering instructional or research situations with a deficit lens automatic, with seemingly objective questions such as: Are there errors in the students' work? Is there evidence of familiar misconceptions? Are students misusing certain mathematical terms? These questions are commonplace but not neutral; they orient teachers and researchers to deficits in students' mathematical thinking and obscure resources and strengths. In cases where errors and misconceptions exist, the subsequent interpretations can dangerously turn into generalizations about a student's mathematical (in)ability and reproduce and sustain local and societal deficit discourses. This generalization is particularly likely, and particularly detrimental, when the targets of interpretation are students of color who are already subject to narratives that constantly attack their intelligence, motivation and commitment to learning.

Systemic efforts to challenge deficit discourses in mathematics education

The relationship between dominant discourses and local ones is reciprocal if not equal (indicated by the bidirectional arrows in Figure 2, with arrowheads of different sizes). There is always the possibility of alteration, so that communities and even individuals may challenge deficit discourses. For example, the 'Recife group' of researchers (so dubbed by Frade, Acioly-Régner & Jun, 2013, p. 107) collectively produced a body of work showing that although particular groups of people failed in school contexts, they were able to solve mathematics problems in their everyday lives (*e.g.*, Nunes, Schlieman & Carraher, 1993). This research challenged narrow conceptions of mathematical understanding as dependent on symbolic manipulation and formal instruction. Similarly demonstrating the potential for communities to disrupt rather than reproduce societally dominant discourses, networks of scholars have come together to organize social justice-oriented conferences (*e.g.*, Mathe-

matics Education and Society), propagate counter-narratives of Black excellence in mathematics education (*e.g.*, Leonard & Martin, 2013), and support one another in the face of right-wing bullying and harassment (*e.g.*, MathEdCollective, 2019).

Work in the San Francisco Unified School District (on the west coast of the US) provides one example of a multi-level approach to challenging deficit discourses in practice. In addition to offering workshops to support individual teachers to adopt anti-deficit ideas and instructional practices (Figure 2, Layer 3), district-level mathematics leaders have worked to build and sustain school-based and cross-site professional communities of educators to support one another in redefining mathematical competence and dismantling racialized ability hierarchies (Figure 2, Layer 2). They have advocated for an anti-deficit vision for mathematics education at a societal scale as well (Figure 2, Layer 1), for example by supporting the elimination of ability tracking in mathematics courses both within and beyond their own district (Barnes & Torres, 2019).

Concluding remarks

Although anti-deficit ideas have gained acceptance within some areas of mathematics education, deficit discourses continue to influence much of the teaching and research that occurs in the field. As Frade, Acioly-Régner and Jun (2013) have written, "despite all academic advances [...] deficit thinking is still a cloud hanging over the educational context, particularly in relation to mathematics education" (p. 130). In this article, we have untangled webs of deficit discourses in mathematics education to explain why these discourses remain. We have argued that a web of meanings concerning the nature of mathematics, mathematical ability and race connect to and mutually reinforce one another. Understanding this web clarifies ways in which we all might inadvertently reproduce deficit discourses by upholding ideas that appear neutral or objective. Additionally, by linking deficit discourses to dominant conceptions of mathematics itself, we have attempted to illustrate that the reproduction of deficit discourses is deeply embedded in our field and its assumptions.

We have also delineated a web of activity spanning multiple layers of society. Rather than locate deficit discourses in the minds of prejudiced individuals, we argue that mathematics education can only begin to challenge these discourses when we accept that they are characteristic of the oppressive systems in which our students and we ourselves are embedded. Because of this embeddedness, radically disruptive ways of thinking about students and about mathematics do not come easily. The dominance of deficit discourses often makes alternatives seem counter-intuitive, unnatural and questionable. Working across societal, local and individual levels is therefore necessary. The framework from the current article can inform how the field conceptualizes and enacts anti-deficit approaches in the pursuit of equity and social justice.

We join Aguirre *et al.* (2017) in urging the field to take up challenges to deficit discourses as an "intentional collective professional responsibility" (p. 124). It is important to continually expand what counts as mathematical competence,

and to seek out and highlight the resources and strengths of marginalized communities. Equally, it is important to recognize *disrupting deficit discourses*—and not merely *avoiding* their most explicit forms (e.g., by not blaming families for low student achievement, or not using the word ‘misconception’)—as part and parcel of working in mathematics education. Scholarship that disrupts deficit discourses has existed in a variety of collectives within mathematics education for some time. However, until such work becomes the norm instead of being left to a minority of scholars whose focus is equity and social justice, deficit discourses will continue to be reproduced, adapting to superficial attempts at justice and equity in order to persist (Larnell, Bullock & Jett, 2016; Pais, 2011). Choosing *not* to disrupt deficit discourses should stand out as unusual and be recognized as a political act, in willing defense of the status quo.

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Note

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