SOME ISSUES FACING WORK FOR EQUITY IN MATHEMATICS EDUCATION

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American research involving mathematically underachieving populations is grappling with many theoretical and empirical issues at present. In this talk, I hope to present three such issues; while, of course, the theoretical debates and research findings are much more nuanced than can be presented in a short paper, my goal is to provide the distinctions as sharply as possible so as to move forward this session's conversation.

POLICY GOALS: CLOSING THE GAP OR RAISING THE BOTTOM?

Concerns about underachievement in the United States derive from the existence of **group-based** differences along outcomes such as student achievement, learning with understanding, course taking, post-secondary degree attainments, and careers. The existence of differences related to social and demographic grouping variables – such as gender, race, class, ethnicity, and language proficiency – suggests that the *real* problem is one of differential achievement (differences between groups) rather than one of under-achievement (a single group of students performs less well than expected or desired). The distinction between under- and differential achievement is critical since how the problem gets framed shapes the terms of the debate and the subsequent policy goals.

"Do no harm."

When new policies, new curricula, or new instructional practices are first proposed, one of the most important criteria for their adoption is that they "do no harm." If the problem is *underachievement*, then "do no harm" means that the groups in question should not worsen along some outcomes. On the other hand, if the issue is *differential achievement*, "do no harm" means that gaps should not be exacerbated as a result of the intervention.

The distinction between "closing the gap" versus "underachievement" can be seen very clearly in the case of the television show known as *Sesame Street*. This children's show is now seen throughout the world in many languages. Its main social themes involve people of multiple backgrounds living in harmony and respect by modeling how well-known puppets (Big Bird, Bert, Ernie, and Oscar the Grouch) cope with the problems that they encounter in their everyday lives. For example in South Africa, *Sesame Street* has directly addressed HIV infection as a social problem.

Sesame Street was first developed to help preschool children who live in poverty acquire a range of knowledge and skills that would help them succeed in school, much as Maria Montessori developed her schools in Milan's slums to help the poor children of her time. The first evaluations of this program found enhanced learning in language arts; hence, an underachieving population actually did better because of Sesame Street. However, a reanalysis of the original evaluation data revealed that the poor children fell farther behind in reading readiness relative to middle and upper class children who also watched *Sesame Street*. In other words, the achievement gap between poor and wealthy children actually increased because of the program. Ironically, poor children in the United States

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now enter school at a greater disadvantage relative to their wealthier peers, in part because of *Sesame Street*. If "do no harm" means helping underachieving populations grow, *Sesame Street* is a success; "do no harm" means not exacerbating a pre-existing gap, then *Sesame Street* is a failure.

In the case of mathematics and/or science innovations, the distinction between closing the gap and focusing on underachieving student populations has not been fully explored. The few studies of reform curricula and instructional innovations find that poor children, African American students, English language learners, and/or female students do better (relative to their peers) with a range of interventions than without. With the exception of one exploratory study that focused on advanced problem-solving strategies by females versus male, I have seen no studies that look at whether or not the gap is exacerbated through such interventions.

Designing interventions to actually close the gap versus designing them to "merely" improve achievement.

I have seen no interventions, evaluations, or studies that are designed to focus on *closing* the gap in mathematics, science, or technology-related outcomes – let alone studies that seek to *keep* the gap closed once it has been closed. Such studies would be consistent with defining the policy as one of differential outcomes. Instead, interventions are designed to improve performance of one or another subgroup relative to a similar subgroup that does not participate in the intervention (and hence, serves as a "control" population); this position is consistent with polices tied to student underperformance.

NOTIONS OF EQUITY

Not all forms of student diversity, even if they are socially constructed, are necessarily issues of equity. Equity involves multiple conceptions that compete with one another for dominance and that are often contradictory. What is more, any single notion of equity can be pushed to an extreme that would render it untenable. In my own work, I have found at least 8 major ideas that seem to undergird how people talk about and act on issues of equity. Equity in mathematics and science can be thought of as fundamentally an issue of: caring, social justice, socially-enlightened self interest, triage, opposed to excellence, democratic participation, equality based on social demographic groupings (typically, race, class, gender, and language), and power.

Interestingly, many distinct ideas about the nature of equity are often held by the same individual who will argue for completely different things, depending on the context in which an equity issue has come up. In other words, ideas about equity are contingent on the contexts in which they are operating.

Ideas about equity have historical roots that find expression in other disciplinary fields. What is more, they interact with people's conceptions of mathematics and of their students in ways that fundamentally trouble work in those domains.

MECHANISMS OF INEQUALITY

One of the most potent forces on current educational scholarship in the United States involves calls for "more scientifically based research" in education. While these calls have politically conservative underpinnings, they are finding their way into scholarly

outlets and, more importantly, into professional judgments about the quality of research studies. In part to respond to such call for "more-scientific research," but also in order to be taken seriously by other scholars in the field and to propose interventions that actually improve the quality of students' mathematics learning, scholarship that is positioned at the nexus of underachievement, differential achievement, and/or equity will need to seek to better understand the mechanisms by which socially-based inequality is constructed. As such, this work will need to engage, much more deeply than it has to date, in specifying the processes and/or mechanisms by which inequality is created and in more clearly tying those purported mechanisms to outcomes. Not only is such a disconnect no longer viable, scholarly inquiry that moves in that direction will conduct basic research, help mathematics and science educators better understand and engineer interventions with clearly articulated predictions based on those interventions, and help us understand *why* an intervention worked (or failed).

Embedded levels

Research on the "mechanisms of inequality," as I refer to this particular genre of work, will probably use mixed-methods research: quantitative descriptive studies showing the lay of the land, qualitative studies identifying mechanisms and showing how they function, mixed-methods studies tying mechanisms to their outcomes and making predictions for how interventions will perturb outcomes and the processes that are tied to those outcomes.

Research focused on the mechanisms of inequality will need to address issues of bias in the assessment of student outcomes and propose ways of overcoming those biases. What is more, this scholarship will need to inquire about whether students reason differently in mathematics or science based on their backgrounds and to clearly show how such differences in thinking are *consequential* for learning.

The "mechanisms of inequality" will need to be specified at multiple levels within the educational system. I hypothesize that researchers will find these mechanisms operating in the classroom (curriculum, instruction, assessment) and through processes that have impacts on what happens in the classroom (teachers' conceptions of their students and of mathematics); in the department and the school (teachers' professional communities, school environment, school-level collective norms supporting academics and caring, tracking, placement of students); and in the district (funding, policies). Mechanisms of inequality can begin outside one level but have impacts within a different level. For example, parental involvement in schools can have impacts on what happens in the classroom and the school; or, for another example, law suits filed against a school district and housing patterns in the larger neighborhood can have impacts on how individual schools operate.

Historical analyses

Careful historical analyses of an educational system might reveal how particular current-day practices, which are accepted as normal and non-problematic, have resulted in inequality. Inequality is not an historical accident; socio-historical mechanisms are at the roots of inequality. For example, tracking in the United States (streaming in many English-based systems) began as a system for classifying students so that they could be

prepared for their "proper positions in life" based on what their parents did. The children of working class parents were destined for working class lives; the children of those in power, were destined to lead; and the school was supposed to prepare both kinds of students for their places. From time to time, a sense of *noblesse oblige* among the privileged meant that they would sponsor some lucky individuals for educational opportunities that were better than they were entitled to based given their particular backgrounds.

Over time, tracking has been given a scientific patina through the use of intelligence testing for making decisions about which track a student should be placed in. Judgments about a student's worth or educability still entered such decisions. Formal course syllabi were developed to further differentiate opportunity; students destined for positions of power and authority received content intended to develop their thinking and judgment while students destined to labor received content that would develop proficiency in repetitive, low level tasks. Needless to say, achievement outcomes validated such circular beliefs about student educability. Hence, seemingly-rational relationships between tracking outcomes and career aspirations replaced vague notions of people's place in life.

Over time, certainly by the early 1970s, achievement tests replaced intelligence tests for making decisions about student placement. And the rhetoric involving tracking shifted towards promoting it as a more efficient way of matching people to reasonable or realistic aspirations involving their post-school futures.

That intelligence tests were biased – as evidenced by how whole banks of items were thrown out when urban Blacks outperformed rural Whites – was never commented on. Nor have many defenders of current-day tracking system noted that achievement tests were validated based on how well they correlated with intelligence tests and items enter both intelligence and achievement tests based on how well they predict over-all test outcomes. Hence, the initial bias in testing has been passed down across generation of tests.

One of the most pernicious outcomes of this history, moreover, has been that most current day practices in school mathematics and science were created based on assuming a tracked system. Hence, our entire education system is composed of closely interlocked pieces that work synergistically to mutually reinforce each another. Detracking, as an intervention, becomes problematic because educators have not developed the technical knowledge and skills that are needed to work within such a system.

One could think of similar historical analyses conducted on institutional practices that constrain curriculum development and other opportunity-to-learn processes.

Note: I focus my comments on the American context because the level of generality needed to make statements across the national educational systems with which I have first-hand familiarity (Peru, Chile, Norway, Greece, Sweden, South Africa, Thailand) is simply untenable. The more I learn about the social arrangements that create inequality in these different contexts, the more I am convinced that the particulars of issues involving equity require much more careful work than is possible in this short paper. I also do not write about technology because, quite frankly, that is an area in which I have not worked in the ways that other members of this session have. If I restrict myself to a context that I think I know something about (be it the content of school mathematics or the national educational system) and if I engage people in an open exchange contrasting scholarly ideas and research findings, we are more likely to find connections among ideas and to have much more satisfying results than if I try to write about areas where my knowledge is limited.