Equity in School Mathematics Education: How Can Research Contribute?

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The NCTM’s Research Committee has prepared this article as a means to raise the awareness about equity and issues surrounding equity from a research perspective as well as to support the NCTM’s commitment to the Equity Principle. The committee discusses the concept of equity from three perspectives: as a subject of research, as a “critical lens” with which to examine research, and as a cross-disciplinary theme. Equity issues offer a unique opportunity to unite research and practice within mathematics education and across other disciplines.

The National Council of Teachers of Mathematics has a strong and long-standing commitment to equity in mathematics education. In Principles and Standards for School Mathematics, the first guiding Principle states that “Excellence in mathematics education requires equity—high expectations and strong support for all students” (NCTM, 2000, p. 11).

The goal of equity in mathematics education is ambitious. Scores on national assessments of mathematics achievement like the National Assessment of Educational Progress (NAEP) and the Scholastic Aptitude Test (SAT) suggest that equity of achievement is an elusive target (FairTest, 2004; Lee, 2004; NAEP, 2004). The performance gaps among students from various cultural, racial, ethnic, and socioeconomic backgrounds, and those designated with special needs, have persisted despite significant efforts to reach equity.¹ The profound opportunity-to-learn and educational resource gaps, documented by Oakes (1985, 1990) 2 decades ago, persist today in schools that serve many immigrants, low-income students, and students of color (Oakes, Joseph, & Muir, 2004).
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A meaningful response to the challenge of seeking equity in mathematics education for all students requires effort and resources from many concerned parties—schools and teachers, school administrators, students and parents, community organizations, and various levels of government and mathematics organizations. But there are some significant ways that research in mathematics education can play a critical role, as well. Reflecting the renewed emphasis that NCTM has placed on linking research and practice in mathematics education, this article outlines challenges and opportunities for theoretical and empirical research that seem likely to advance the Council’s commitment to equity. Many of the recommendations and questions posed here dovetail with those raised by the Changing Nature of Schooling and School Demographics (CNSSD) Working Group of the NCTM Research Catalyst Conference in 2003 (Tate & Lipman, 2003).

The first two sections examine the concept of equity to identify facets of the challenge and describe ways that research can focus directly on key equity questions. Subsequent sections consider ways that applying an “equity lens” to research focused on other facets of teaching and learning can contribute to understanding mathematics education issues. The next section describes how research on equity questions (and on other education questions) can profit from cross-disciplinary perspectives. We consider ways that mathematics learning can create opportunities for students to be active participants themselves toward equity and social justice. The article concludes by situating our work within a broader sociopolitical context and suggesting professional and ethical responsibilities relating equity, research, and practice.

EXAMINING THE CONCEPT OF EQUITY

The concept of equity encompasses many specific components. These components include both the conditions of learning as well as the outcomes. In describing opportunities for students to learn, Lipman (2004) discussed the

equitable distribution of material and human resources, intellectually challenging curricula, educational experiences that build on students’ cultures, languages, home experiences, and identities; and pedagogies that prepare students to engage in critical thought and democratic participation in society. (p. 3)

But results are equally important. Luther Williams, former assistant director of the National Science Foundation’s Education and Human Resources Division, advocated the necessity of “obliterating the differential” (West, 1993, p. 8) in achievement between white students and students of color as a component of equity.

1 Although the gender gap in performance has shrunk considerably in K–12 mathematics (NAEP, 2003), it remains on the ACT and SAT (FairTest, 2004). According to NAEP data, between 1990 and 2003, when comparing Hispanic students with Whites and Blacks with Whites, for fourth and eighth grades in mathematics, the only category where the gap has narrowed is between Black and White fourth graders (NAEP, 2004); for the other three categories (Black to White eighth graders; Hispanic to White fourth and eighth graders), the gaps have increased, although not statistically significantly.
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Gutiérrez (2001) argued that in an equitable world, one should not be able to predict certain outcomes solely from examining students’ race, class, gender, or other characteristics. Those outcomes include students’ achievement and participation in mathematics, their powers of analysis and reasoning, and their ability to “critique knowledge or events” (i.e., see them in a sociopolitical and a cultural-historical context). She also argued, as have others (e.g., Secada, 1989), that equity does not mean equality, and that equity requires that public institutions, recognizing present and past inequities, contribute to rectifying the economic and social inequalities and injustices of today.

A multitude of equity definitions is not necessarily a problem. In fact, different scholars may use alternate definitions of equity at various times for particular purposes. The main issue for us is how mathematics education research can contribute to understanding the causes and effects of inequity, as well as strategies that effectively reduce undesirable inequities of experience and achievement in mathematics education. One can pursue questions of equity directly as a focus of research, or one can use equity as a lens through which to examine frameworks, data, methodologies, and conclusions. Examples of both follow.

EQUITY AS A FOCUS OF RESEARCH

Equity as a legitimate object of study for mathematics educators can potentially move the field into new and significant directions. The following questions are a subset of issues that have been suggested as being particularly powerful:

• What impact, if any, do Standards-based curricula have on existing differentials in student achievement (Apple, 1992; Tate, 1995)? Do such curricula reduce differentials? If they exacerbate existing differentials, can this inequity be mitigated, and if so, how?

• “What are the combinations of the readily quantifiable factors and more complex sociocultural dimensions of high quality mathematical experiences?” (This was the meta-question raised by the CNSSD WG, Tate & Lipman, 2003, p. 129.)

• Does the creation of mathematical discourse communities marginalize students whose first language is not English (Secada, 1996)?

• How do different resources allocated to urban, suburban, and rural children differentially affect access, opportunity, and outcome?

• Are various forms of assessment inappropriate (culturally, physically, or otherwise) in ways that prevent educators from understanding what students actually know, and if so, how might we redesign assessments (e.g., Ladson-Billings, 1998; Lee, 1998)?

• Do professional development programs that build on the knowledge that teachers bring (e.g., Franke, Carpenter, Levi, & Fennema, 2001) fully capitalize on, rather than marginalize, as some have documented (Lipman, 1998), the wisdom of teachers of color about their own communities?
• What happens to students’ mathematics learning when taught in culturally relevant ways (Gutstein, Lipman, Hernández, & de los Reyes, 1997; Ladson-Billings, 1995, 1997)?
• How do individuals learn to teach in ways that are culturally relevant, and how can mathematics teacher education programs prepare individuals to teach in culturally relevant ways—especially when the individuals do not share their students’ culture?
• How do families perceive teachers’ efforts to develop critical approaches to mathematics (Frankenstein, 1987) and approaches to knowledge that are oriented toward social change?
• Can children with special needs profit from Standards-based (meaningful and inquiry-based) instruction in mainstream classrooms (i.e., construct all aspects of mathematical proficiency as outlined in the National Research Council report Adding It Up, Kilpatrick, Swafford, & Findell, 2001)?
• To what extent can Standards-based instruction prevent, or at least minimize, the number of children classified as learning disabled or behaviorally disordered? What special instructional adaptations are helpful or even necessary to ensure that such children prosper in a Standards-based environment and develop mathematical power?
• “What do equitable mathematics education classroom practices look like in varied contexts and how do these practices align with the Standards? How do you translate and adapt equitable mathematics practices to new settings? Are equitable practices context dependent?” (Tate & Lipman, 2003, p. 129).

Many of these questions have been studied by researchers both within and outside mathematics education. Although these researchers have made contributions to our understanding, no simple solutions exist. The difficulties in improving the situation make it apparent that the issues are complex and resistant to easy solutions. High-quality research, linked to practice, that makes equity a specific focus of investigation in mathematics education, is needed as much as ever. It can play an important role in both our theoretical understanding of the issues as well as our practical efforts to reduce existing disparities.

USING EQUITY AS A CRITICAL LENS

Even when scholars do not make equity their research focus, they can gain more understanding by examining their work through a “critical equity lens,” because equity concerns exist in any educational endeavor, whether or not they are made explicit. Because of this, researchers who may be focused on a particular area, for

2 Unfortunately, little research has been done on this to date in regard to the mathematical teaching and learning of children with special needs (Jordan, Hanich, & Überti, 2003), and evaluations of Standards-based instruction have been limited in addressing this question. For example, only one study reported in Senk and Thompson (2003) addressed the issue of special education children.
example, the development of children’s mathematical thinking, can look at their work through an equity lens. Consider the research done by the *Cognitively Guided Instruction* project (Carpenter, Fennema, Franke, Empson, & Levi, 1999) in expanding our understanding of how children’s mathematics thinking develops. Even with the general attention and focus on issues of gender bias within the professional development component of the project, project staff were not initially aware that their data held systematic patterns related to gender equity issues. For example, they first concluded, “[w]e did intense observations in each classroom and saw no evidence of teachers treating girls and boys differently” (Fennema, Carpenter, Jacobs, Franke, & Levi, 1998, p. 20). Inequities did not become visible until Fennema and her colleagues used an equity lens to specifically ask the question of whether girls and boys used strategies differently. They learned that girls in grades 1–3 tended to report using more concrete problem-solving strategies in contrast to the boys’ invented, more abstract strategies that suggested deeper conceptual understanding. This raised important research questions related to equity, such as whether the boys’ early strategy usage presaged later differential “success in continuing to learn with understanding” (p. 19), as well as additional questions about the development of students’ mathematical thinking. This example illustrates the contribution that researchers can make to concerns of equity when they use it as a lens through which to examine their data.

Finally, we point out that questions from the category of “equity as a focus of research” might be ones being pursued by researchers primarily interested in them for other reasons. For example, researchers might be investigating students’ learning when using Standards-based curricula or how discourse communities can be created within classrooms as their principal foci, and they could then use equity as a lens through which to examine their research of those questions. We do not wish to suggest that re-examining one’s data in a mathematics education research project from an equity perspective (for example) is the only way to shift the focus. One can also do this by posing entirely different questions that might themselves lead into alternate areas of inquiry. For example, one could study what students learn when using a particular curricular or pedagogical innovation, such as student-initiated projects. A group of students might choose to investigate issues of immediacy and relevance to their lives, such as the mathematics of neighborhood development and displacement. Using an equity lens, researchers might pursue questions about the interrelationship of student engagement, mathematics learning, and issues of community justice—phenomena and interconnections that perhaps had not been part of the initial research plan. Thus, opportunities exist to pursue equity concerns even when equity is not the initial or primary emphasis of the research.

**TRANSCENDING DISCIPLINARY BOUNDARIES**

For researchers to contribute more fully to equity, we may need to break with tradition, expand boundaries, and cross into fields outside mathematics education and outside education. These include—but are not necessarily limited to—sociology,
anthropology, organizational theory, multilingual education, educational policy, critical race theory, feminist theory, multicultural education, critical pedagogy, urban education, and culturally relevant pedagogy. The complexity of teaching and learning, and its intersection with equity and social justice issues, demands more than the narrow confines that any one field can provide. Mathematics educators have recognized the messy, real-world nature of the classroom and have broadened the outlook to include, for example, sociocultural and situated analyses beyond cognitive and psychological ones (Cobb & Yackel, 1996; Lave, 1988; Lerman, 2000). This enlarged perspective has been useful and powerful in unraveling the complexities of teaching and learning mathematics. The time has come to build on these positive developments and further expand our horizons. Specifically, mathematics educators should now take on the task of integrating with our research the consideration of the deep issues and questions embedded in the NCTM’s commitment to equity.

One brief example illustrates this point. The topic of equity includes intriguing, complex issues that we make no claim to fully understand, but we are suggesting that surface-level explanations limited to mathematics education are insufficient. In a forthcoming JRME article, Setati (in press) documents how, in South Africa, mathematics education intersects with language policy in ways that force researchers to look outside mathematics education to understand the complexities. South Africa has 11 official languages, since overturning apartheid and gaining democracy in 1994. It also requires, as official government policy, that teachers consider students’ home language as a classroom resource on which to build understanding and that their home language should be used in the classroom whenever needed. However, in her study, Setati documented that a well-qualified teacher, whose first language was not English, used English as the principal language of mathematics and assessment, while regularly using the students’ home language (which she had in common with students) as a solidarity marker. Thus, English became the language of authority despite the teacher’s knowledge of the policy and her desire for her students to be proud of their home language. Setati’s analysis suggests that there is nothing in mathematics education by itself to explain the teacher’s action, which went against official policy. To understand it, Setati moves outside and employs cultural model tools of discourse analysis (Gee, 1999) to interpret the teacher’s explanations. Setati points out that in South Africa (and elsewhere), English is a language of political power and is independent of governmental proclamation, which are facts known by both teachers and students. Its political status overrides the solid practices known to bilingual educators (Cummins, 1989) that native language instruction is useful and powerful for concept formation. Instead, teachers who are themselves acquiring English are teaching mathematics, in English, to students who are acquiring English! To understand the complexities involved in the teacher’s actions, which belie both official doctrine and informed practice, Setati went beyond the confines of mathematics education.

It is clearly not possible for every mathematics educator to become an expert on discourse analysis, language policy, or bilingual education. However, our knowledge of mathematics education is necessary but insufficient insofar as under-
standing what equity means; how to move toward it in practice; and what the obstacles of a political, programmatic, practical, theoretical, and personal nature are in doing so (Ladson-Billings, 1997). Knowledge outside the field is essential, and genuine collaboration with experienced scholars involved in this research is one way to gain some of this knowledge.

EQUITY AS A VEHICLE FOR SOCIAL TRANSFORMATION

One last set of questions has to do with mathematics itself as a potential vehicle for social transformation. Equity is generally thought of as something to be achieved in mathematics education. But one can also envision equity and social justice as something to be attained through mathematics education (Frankenstein, 1998; Gutstein, 2003; Skovsmose, 1994). That is, evidence suggests that students can develop mathematical power by engaging in rich curricula with knowledgeable teachers under certain conditions (Senk & Thompson, 2003). But there are other goals besides developing these types of mathematical competencies. Questions related to these goals include the following:

• Is it possible that students can develop mathematical power, and at the same time, use mathematics as an analytical tool with which to become socially conscious through investigating aspects of justice that are personally meaningful to them? Can they also then begin to see themselves as historical actors capable of participating in a democracy and shaping their worlds? How might this occur, under what conditions, and what other research questions need to be asked to help us understand the processes involved?

• What knowledge do teachers and teacher educators need in order to support this type of transformative, or “transgressive,” (hooks, 1994) teaching?

• What difference might such efforts make in the lives of students and also in the larger society, in both the short and long term?

CONCLUSION

There is a broader sociopolitical context in which our professional and personal lives are situated. One can, perhaps, study rational number reasoning with little attention to issues of context (although some would argue the lens would then be too narrow). Not so with equity and social justice. In framing questions related to equity, broader contextual factors become central features of the analysis. And the particular historical period in which we live is at least as complex, volatile, polarized, and fast moving as any time in the past. Global processes related to trade, information, finance, energy, resources, borders, immigration, capital flow, labor, the environment, food production, and a host of other issues impact all aspects of our lives in immediate and far-reaching ways.

Each of us has a responsibility to both think about and act on issues of equity. It is often the case that there is an informal “equity advocate” on any team or in a group
working together. Some may leave it to that person to raise equity issues, confident that that person, whose issue equity “is,” will raise it. Although it is important that individuals claim the issue, it cannot be any one person’s responsibility. This is one answer to the key question of what it means for equity to be a core NCTM Principle.

Research impacting mathematics education is increasingly important in the decision making that characterizes the day-to-day work of school district personnel, classroom teachers, and policymakers. In response to these needs, NCTM has adopted as a major goal the linking of research and practice, for example, in convening the Research Catalyst Conference. This commitment couples the goal of helping practitioners understand and use research with that of helping researchers understand and study practitioners’ most critical questions. An equity focus for research is responsive to practitioners’ needs, reflective of NCTM’s longstanding commitment to equity, ideal as a site for linking research and practice, and the right thing to do.

REFERENCES


