Problem Solving in School Math: Mathematicians' Work, Rigor, and Social Justice

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Holly Brewster's "Problem Solving as Theorizing" sets out to and succeeds in accomplishing its major tasks: to expose the current problem-solving focus in school math as unduly rote, reductive, mechanized, and strangely distant from the work that mathematicians actually do; and to make the case that turning to the work of mathematicians is one way to get beyond the problematic problem-solving paradigm in school mathematics. Two more tasks of Brewster's are to establish that the school math she is calling for is consonant with democratic education and that this brand of democratic education can, or even will, lead to increased social justice. These claims are trickier to assess and after a brief discussion of her important critique of problem solving, I will consider Brewster's ideas in light of the democratic and social justice mathematics education movements and how all of this relates to more mainstream mathematics education.

Brewster establishes that we shouldn't have much work to do to construct a school mathematics experience that is in line with the needs of our democratic society. In some ways, this seems a more important insight than the attack on problem solving — although I agree that problem solving's tendency toward a tailored sort of educational experience is part of the problem, thus the two issues are not unrelated. Brewster is not the first to make the case for making school math more closely resemble mathematicians' work, but what she adds to these efforts are reasons for *why* reconciliation is needed. According to Brewster, it will help overcome the malaise caused by the problem-solving paradigm, it will foster skills and tendencies conducive to democratic life, and it will strike a blow for social justice.

Brewster laments that school math lags behind other content areas in its recognition of context. Why is this? She provides a quick description of other ways of thinking about the nature of mathematics but space prohibited deep study of troubles endemic to adopting them. It seems reasonable that absolutist thinking tends toward the antidemocratic, but the case of mathematics knowledge and skills is an interesting one. Mathematical knowledge *is* very durable, certain-seeming, and possessing taken-as-given mathematical knowledge does provide certain kinds of power and ways of acting on the world. Brewster's math-as-cultivator-of-democratic-sensibility argument is one promising way to confront the absolutist argument. It especially can help to get beyond dualisms that arise when Freire-inspired critical mathematics education is also considered (more on this in a moment).

Another praiseworthy initiative of Brewster's is her particular attempt to sell us on the potential of focusing on work of mathematicians to improve school math. She is not the first to make this move and her version adds to this tapestry. It's fascinating that this area can be seen as a front in the culture wars and that, by virtue of

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rewster's non-absolutist stance, she will be seen, by some, as an opponent of rigor and a foe of all that is traditional, good, and possibly holy. This is a shame for a number of reasons, not the least of which is that one could read her effort as providing a way beyond the dead end that the culture wars gloss on mathematics education has led. Brewster's mathematical activity brings us the human, contingent, and empowering parts of mathematics and her choice of focusing on professional mathematicians' activities ensures that there will be rigor. One disturbing consequence of the math wars is that those who care about social justice have been pitted against, and branded enemies of, rigor. Brewster's way out of this situation seems very promising.

That said, it's not a stretch to point out that there are probably antidemocratic sensibilities built into the world of professional mathematicians. Furthermore, the "real" problems of mathematicians are, no doubt, not universally lively to our students (but I concede that they could be livelier if students were allowed to engage with them as mathematicians do). My suggestion is that Brewster consider ways to broaden the appeal of her math-as-mathematicians-do-it approach. My tack has been to adopt a more Deweyan approach, wherein inquiries undertaken by the students come from legitimate issues, concerns, and interests in their lives, whenever possible. I have also used the work of professional mathematicians to support the social and group aspects of democratic mathematics education. The difference is one of emphasis, as I advocate starting with the interests of the students and Brewster seems to start with the work of mathematicians. We both undertake this work with the hope that math class will be a place where students learn to appreciate and harness the power they have to act on the world.

This brings me back to my earlier claim that the traditional school math experience does, for some, provide a certain sense of power and ability to act on the world, namely those who excel in the system (some even become mathematicians, engineers, statisticians, economists, and so on). Mathematics as an absolute endeavor is incredibly powerful. Brewster's turn toward the work of professional mathematicians is a good one given this fact, as it leads to legitimate claims of rigor. My Deweyan-progressive turn toward building mathematical knowledge and skill on a foundation of student experience is more likely to run afoul of concerns about rigor (although this need not be a problem if done well — always the trick with Deweyan pedagogical approaches).

While Brewster's community-of-mathematicians turn leaves her in a good position regarding rigor, her interest in social justice as at least *an* end of mathematics education threatens to dampen any enthusiasm her idea might generate among mathematician types. My initial efforts to link mathematics with anything human and/or social, and particularly to link school math to social justice, proved very unnerving to some mathematicians. The following is taken from a mathematician blog and is a direct response to my earlier work on math and social justice. I suspect Brewster could experience similar reactions:

> To see (social justice) used in the context of mathematical education sends shivers down my spine.
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> [I]f there's one thing I'm sure of, it's that mathematics has nothing to do whatsoever with justice, or for that matter, with any aspect of the physical world. Sure — physicists and

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> engineers have used mathematical tools with great success to build scientific theories and neat gadgets. But math lives in its own separate Platonic world and we mere mortals can only hope for an occasional peek inside.[1]

Brewster's bid to improve mathematics education will be, I believe, more likely to meet with success if it is labeled democratic rather than social justice math. Consider Alan Schoenfeld's link between math and our societal roles: "In short, the mathematical skills that will enhance the preparation of those who aspire to careers in mathematics are the very same skills that will help people become informed and flexible citizens, workers, and consumers."[2] This connection is key not just for the political and public relations related issues that make democracy an easier sell than social justice. There exists another crucial tension: instead of the traditional-reform math wars dualism, this one resides mostly within the reform camp. There's a split between math reformers who want better ways to teach and learn mathematics with no end in mind beyond increased mathematics ability and achievement and those who see social justice (or, possibly, democracy) as the appropriate end of school math (or school *anything*, for that matter). Eric Gutstein's Freire-inspired mathematics education project comes to mind here. His *Reading and Writing the World with Mathematics* defines the contemporary mathematics education and social justice movement.[3] His project involves helping poor, urban youth simultaneously use school mathematics to better understand the socio-cultural and political realities that explain their station in life and employ mathematics to act on and improve this world, all while succeeding in the traditional game of school. While there is certainly much to appreciate about Gutstein's work, there are questions about whether the tensions between the cultivation of Freirian critical consciousness and succeeding at the traditional game of school are too great to overcome.

Swirling around this are difficult questions about what kind of school experiences are the kind that students need most.[4] Andrew Brantlinger, a student of Gutstein's, reported on his effort to teach critical mathematics to poor children of color. A group of his higher achieving students were very vocal about the belief that the community-oriented social justice work going on in their class was not the best use of their time. Once a student remarked that "we're wasting time studying things that doesn't belong in this class."[5]

While Brewster's community of mathematician-focus might not satisfy some Freirian types, her way of thinking blends the empowerment at the core of Gutstein's work with the mathematical rigor that interests back-to-basics types and reformers interested strictly in higher math achievement. Looking at all of this from a philosophical vantage point, Brewster's democratic-community-of-mathematical-inquirers approach has the potential to account both for the mathematical absolutist's focus on the stability and trustworthiness of mathematics as well as the constructivist's highlighting of the contingent and human facets of mathematical knowledge. As such, her ideas have much promise to serve as a strong base for meaningful mathematics pedagogy.

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1. Aryeh Kontorovich, "Transgressing the Boundaries: Toward a Non-Hegemonic Feminist Mathematical Theory," *Absolutely Regular* (blog), January 15, 2007, http://absolutely-regular.blogspot.com/2007_01_01_

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archive.html. This blog is merely one involving graduate students and professors in mathematics/mathematics-related fields. That said, their discourse (specifically sparked by my attempt to consider the moral dimensions of mathematics) drew what I would classify as a reasonably predicable response in light of both the history and philosophy of mathematics as well as in light of the ongoing math wars.

2. Alan Schoenfeld, "Reflections on an Impoverished Education," in *Mathematics and Democracy: The Case for Quantitative Literacy*, ed. Lynn Steen (Princeton: National Council on Education and the Disciplines, 2001).

3. Eric Gutstein, *Reading and Writing the World with Mathematics: Toward a Pedagogy for Social Justice* (New York: Routledge, 2006).

4. Andrew Brantlinger, "Between Politics and Equations: Teaching Critical Mathematics in a Remedial Secondary Classroom," *American Educational Research Journal* 50, no. 5 (2013): 1050–80.

5. Ibid., 1074.

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