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Equity in Mathematics

A guest post by Beth Burroughs, Montana State University

You might have noticed a recent flurry of activity by mathematicians engaged in discussions about the teaching of mathematics. A few examples:

- The Common Vision project is a joint effort of five organizations in the mathematical sciences (AMATYC, AMS, ASA, MAA and SIAM) focused on modernizing undergraduate programs in the mathematical sciences. The Phase 1 report identified common goals from among those organizations and mapped out plans for the future.

- The Association of Mathematics Teacher Educators is currently writing standards for mathematics teacher preparation for grades K-12—expanding the work of the Mathematical Education of Teachers II (CBMS, 2012) by considering entire teacher preparation programs, including mathematical preparation. An initial draft of that report is currently available for review.

- The MAA Committee on the Teaching of Undergraduate Mathematics (CTUM) is embarking on an ambitious guide for the teaching of undergraduate mathematics. Following an initial meeting in October of 2015, CTUM is galvanizing its team to begin writing guidelines this spring.

In the face of all this activity, one might ask, "why now?" Why is there so much attention to the teaching of mathematics? The MAA, among other organizations, has consistently paid attention to undergraduate mathematics, so in some sense, why now is the same as why always. One inspiration for the current interest is the PCAST report of 2012. This report advocated using active learning approaches in the first two years of college across the STEM disciplines, including mathematics. The report caught the attention of mathematics organizations because it suggested that non-mathematicians in mathematics-intensive disciplines should be involved in mathematics instruction; those of us who study the teaching of mathematics disagree that this strategy is the best way to achieve more expertise in teaching undergraduate level mathematics. Despite this questionable recommendation, the calls to increase retention in STEM majors, to decrease the bottleneck in introductory mathematics classes, and to look for ways to increase active learning in teaching of mathematics need our attention.

I propose that there is an urgency to the mathematics community’s attention to the teaching of mathematics, and this urgency comes from the way mathematics has become a gatekeeper to access to STEM fields. The practice of mathematics is a human endeavor: Mathematics is understood through human brains and mathematics learning is transmitted through the social setting of schools. And human biases perpetuate biases and inequity in the discipline.

Two recent articles shed light on how the way mathematics instructors have been teaching mathematics has visible consequences. One is the address by Professor Danny Martin of the University of Illinois, Chicago, to the National Council of Teachers of Mathematics (NCTM), published after its delivery in the Journal of Urban Mathematics Education (2015). This address seems to have missed the notice of many mathematicians--on the surface, it is a specific reaction to the NCTM’s policies as expressed through their publication Principles to Actions. But, I’ll suggest that you can listen to Professor Martin’s words with a broad ear and hear the indictment of how those of us who are in mathematics have institutionalized structures that prevent many--specifically poor students and students from minority backgrounds--from engaging in our discipline. Schools--including universities--systematically reinforce disadvantage. Martin goes further, claiming “the hard truth is that the outcomes and inequities lamented over in Principles to Actions and previous documents are precisely the outcomes that our educational system is always trying to get rid of.”

The second recent article is an interview by Dana Ernst, professor in the Department of Mathematics at Northern Arizona University. He studies the interplay between combinatorics and algebraic structures. Angie Hodge is an associate professor in the Department of Mathematics at the University of Nebraska Omaha. She holds the Dr. George Haddix Community Chair of Mathematics Education. Both Dana and Angie are Project NExT fellows and Special Projects Coordinators for the Academy of Inquiry-Based Learning (AIBL).

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Contact Dana (Twitter) or Angie.
designed to produce.” Martin highlights our community’s lack of action: “equity-oriented slogans, statements about idealized outcomes, and tweaks to teaching or curricular practices within this system do not change this fact.” The text is here. It deserves your attention.

The other article is a meta-analysis published in *Proceedings of the National Academy of Sciences* on the use of active learning strategies in undergraduate STEM disciplines (Freeman et al., 2014). Its conclusion is that active learning strategies improve student outcomes, and it provides a clear call to mathematicians to change how we teach. The article is here.

My guess is you will feel more comfortable reading the Freeman article. You’ll be soothed by the discussion of p-values. I hope you feel distress when you read Martin’s address. The racism and economic disparity in our country is apparent and unacceptable. What responsibility do we bear for this status as mathematicians? It would be easy to dismiss social and economic phenomena as unrelated to our work. We like to think of mathematics as pure and objective, but it isn’t the way we practice it. If we continue to perpetuate teaching strategies that reinforce disadvantage, we’re complicit in societal ills like poverty, racism, and disadvantage. We should not think of equity as something that is somebody else’s responsibility, or that it is a student’s job to advocate for themselves. We should ask, *what can I do?*

I’m committed to these actions:

- Read more about teaching and learning in mathematics. (You can read blogs sponsored by AMS, MAA, or NCTM; practitioner journals like Mathematics Teacher or PRIMUS; or research journals like Journal of Mathematical Behavior or Journal of Urban Mathematics Education). Don’t look for quick fixes; instead, look for opportunities to make changes that welcome more learners to the discipline.

- Acknowledge the bias in mathematics. Don’t complain about students who are unprepared. Instead, assume that some have had an advantage these students haven’t had, and look for ways to give them an advantage in mathematical thinking and achievement.

- Get involved in the MAA’s—or any organization’s—efforts to improve access in mathematics. The MAA has many links and opportunities in the Teaching and Learning section of its web site. The NCTM is pledging to address the inequities that Professor Martin has highlighted and has invited individuals who are interested in addressing inequity in mathematics to signal their interest by emailing change@nctm.org.

Changing how we teach or think about teaching is hard. But mathematicians make a career of doing things that are hard, as long as we think they are important. Changing how we teach is important.

**About the author:** Beth Burroughs is Professor and member of the Mathematics Education Research Group in the Department of Mathematical Sciences at Montana State University. She is chair of the MAA Committee on the Mathematical Education of Teachers and serves on the MAA Board of Governors. She is a PI on the NSF-funded Program Immersion, a collaborative project between George Mason University, Harvey Mudd College, and Montana State University, focused on professional development in mathematical modeling for elementary grades teachers. A 2014-15 U.K. Fulbright scholar, Beth is a former high school mathematics teacher.

**References**


