

Mathematics Teachers as Professionals

If the educational goals mandated by the Common Core State Standards in Mathematics (CCSSM) are to be realized, the body of teachers of school mathematics must be comprised of highly talented and highly trained professionals. This document is intended as a very brief philosophical piece based on two premises. The first premise is that teachers, like most highly valued professionals, will ultimately have to take charge of their own profession, its norms and its mechanisms of professional progress.

But teachers of mathematics will not achieve this, even in the long term, without relatively massive and sustained support. Our second premise is that CCSSM provides the context and the political opportunity to configure that support.

Like any profession, teachers need leaders from within their own ranks. We believe that small pockets of leadership are already in place, and that a critical mass of teacher-leaders can be gradually built over the next couple of decades. We suggest below some of the qualities that we believe those teacher-leaders should have, framed within the context of the Common Core State Standards in Mathematics. Beyond their intrinsic value, the standards can be used to motivate and accelerate the professionalization of mathematics teaching, helping teachers as they guide their students through the strong mathematical formation laid out in the CCSSM document.

Why do we need complete professionals?

The short answer to this question is that their students need them. Learning a subject is not only about learning numerous facts, representations, and procedures; it is also about learning how those facts, representations, and procedures hang together. With much experience, we gain the ability to navigate a field in an intuitive and automatic way. Advanced knowledge, therefore, includes not only ready access to relevant content and fluid ability to apply it, but also the quality of being “at home” in a subject, in the sense that we can not only maneuver in it without thought, but can also reflect and talk about our knowledge, how it is structured, where it comes from, how we use it and what it all means. Those who have reached this level of understanding are truly called teachers.

There is a level of knowing beyond even this. We reach it when we are not only at home in a complex body of knowledge, but are able to create extensive commentary on what we know and how we know it. We recognize the components of this knowledge as they develop in others' minds and can guide others to levels of knowledge that equal---or even exceed---our own. Those who have reached this level of understanding are truly called master teachers.

How do teachers become complete professionals?

The formation of master teachers requires high-quality and appropriate pre-service training and career-long professional renewal and development that includes:

- continuing to *learn* mathematics and exploring its connections with what one teaches
- continuing to *do* mathematics, that is, trying to figure things out and making mathematical connections
- reflecting on and analyzing one's practice
- becoming a resource to colleagues and the profession. As professionals, teachers need to drive their own professional development. The goal of any professional development program should be to build the capacity *in the school faculty* to be a partner with others in the mathematics community in the design and delivery of professional development experiences.

What are some characteristics of complete professionals?

The goal of professional formation and career-long development is to cultivate teachers who have certain characteristics.

- Expert teachers should exhibit the mathematical qualities and behaviors that are expected of their successful students.
- They are confident and knowledgeable about the mathematics they teach, but they should see themselves not only as teachers but as learners too.
- Their enthusiasm for mathematics is contagious. In the face of all other obstacles, students will meet and exceed our highest expectations when their teachers are doing the same.
- They re-ignite in themselves (or ignite for the first time) a passion for doing mathematics and struggling with hard ideas in order to transfer that passion to their students, perhaps the strongest foundation of all for student achievement.
- When faced with poor student performance, rather than lowering expectations, they recognize that exactly the opposite approach is effective when done with appropriate support, collaboration, and care.

- They recognize that, as in most human endeavors, excellence in mathematics teaching is built on cultivation and maintenance of habits of mind and practice. Teachers also play a key role in building an appropriate culture of learning.
- School culture has a critical effect on what happens in classrooms. When the culture is one of learning, in and outside classrooms, the entire school community becomes a place where growth and achievement for all are commonplace.

An integral part of an effective school culture requires the creation of a mathematical community of teachers and mathematicians, working together on mathematical problems of common interest. Establishing such a culture is one of the most effective means for retaining and attracting highly effective teachers and administrators. Not all students need the same thing, learn the same way, or have the same challenges. The same is true of teachers. So developing a professional culture that is going to be broadly successful must allow for teacher access and participation in diverse ways with different starting points and varying approaches, but with a shared goal of producing teachers who are craftsmen, themselves capable of encompassing the diverse needs and starting points of their students within a shared mathematical framework.

What is a strategy for professionalization?

Identifying, supporting and growing pockets of professional excellence is one of the few viable strategies for a promoting a gradual increase in the level of professionalization of mathematics teachers. This strategy depends on coordinating the expertise and building collaboration between many different professional cultures—school teachers, school administrators, university mathematicians, colleges of education, and teacher professional organizations. All these groups contribute to teacher professionalization but they have different cultures.

Cultures don't coordinate well when they don't meet as equals, and much of what passes for collaboration in mathematics education consists of other groups telling teachers what to do. But there are examples of situations where teachers have the authority to speak and others accord them respect by listening. Achieving this future cannot come about by fiat, but by helping to create and make visible those examples of teacher communities where this ideal is realized, where mathematical and pedagogical knowledge run strongly together, where there is the trust, time, and culture that allows a teacher to observe another as resource rather than judge, or where it feels natural to shoot off an email to another teacher about some question that a student asks in class.

In our experience, successful collaborations among teachers, mathematicians, and educators are built around mathematics itself. Mathematics, rooted in the secondary curriculum but extending well beyond, indeed does create arenas in which “mathematical and pedagogical knowledge run strongly together.”

In short, promoting a gradual increase in the level of professionalization of mathematics teachers consists in making visible, supporting, and growing those examples of professional interaction that resemble professional interaction in other high-status professions.

Pre-service education

A culture of continued learning and collaboration is much more likely to emerge if it is manifest in the pre-service education of teachers. Besides cultivating the mathematical understanding that is uniquely important for those who teach rather than merely use, pre-service education should model effective instructional practices and develop teaching-related skills through deliberate practice, as well as lay the groundwork for professional connections (at the person-to-person level) between the university and the teacher community. Pre-service educators should strengthen teacher networks by promoting communication, mutual assistance, and shared standards. Again there are pockets of such professional excellence that need to be identified, nurtured and made more visible.

Conclusion

Finally, all professions have norms of practice and the status of a profession can often be measured by the rigor and precision of those norms. The craft of teaching is subtle and diffuse, but there should be no less of a canon of knowledge, practices and techniques than there is for doctors, lawyers or skilled craftsmen. The gateways to the profession imposed by these norms should be as rigorous, gradual and well-respected as they are in those other professions.

The Common Core of State Standards in Mathematics can become a historic watershed in the United States in this regard, but only if the opportunity is seized by the teaching profession and by those enablers of the teaching profession with the awareness and resources to create and maintain the necessary support structure.