Executive Summary of
World Class Standards For Preparing Teachers of Mathematics

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As part of an ongoing effort to better understand mathematics teacher preparation in the United States and around the world, the Center for the Study of Curriculum at Michigan State University (in association with the Education Policy Center), is conducting groundbreaking research through our participation in the Teacher Education and Development Study – Mathematics (TEDS-M) and the U.S. TEDS follow-up study.

TEDS-M is a major international study of higher education with close to 23,000 potential future teachers enrolled in the final year of teacher preparation from nearly 900 programs in 17 countries. Through studying the common course-taking patterns in the top ten percent of programs across countries, we were able to identify international benchmarks for high-quality teacher preparation programs at the middle school and elementary level. These benchmarks can be used to inform the quality of mathematics teacher preparation in the U.S.

The continuing TEDS follow-up study, which thus far includes two waves, surveys U.S. participants in the original TEDS study. Approximately 2300 participated in the 2011 follow-up survey. Respondents were asked about their experiences as a teacher since they graduated, which when merged with results from the original TEDS and national school data allows us to examine the long-term influence of teacher preparation programs.

There are three principal conclusions to be drawn from our analysis of the TEDS-M and TEDS follow-up surveys. First, there is a significant relationship between what teachers study in their teacher preparation programs and self-reported preparation to teach mathematics. Previous research has provided strong evidence that opportunity to learn (OTL) – content coverage – has a strong relationship to K-12 educational outcomes. The research presented here suggests that course-taking is also a key factor in teacher preparation (examined in Why Schools Matter, Schmidt et al. 2001) Analysis of the course-taking patterns of the top-performing teacher preparation programs revealed a reasonable consensus about what courses are appropriate for preparing future teachers. For example, more rigorous mathematics content, such as university-level mathematics at the middle school level, characterized the best programs.
Results from the TEDS follow-up studies indicated that these international benchmarks are related to how well prepared teachers say they are after teaching mathematics for two years. Teachers whose course-taking reflected the international benchmarks demonstrated much greater confidence in teaching mathematics topics. The association between teachers’ self-reported ability to teach mathematics and their previous course-taking is quite robust, even after accounting for the student’s background and knowledge. A richer grounding in mathematics content could likely pay tremendous dividends in terms of student learning.

Second, there are reasons to be concerned about the inadequate mathematics knowledge of U.S. teachers, both at the primary and middle-school level. Although some U.S. teacher preparation programs are among the best of the world, the reality is that far too many teachers do not receive adequate mathematics training before they enter the classroom. This is a particular problem in middle school, as roughly three-fifths of such future math teachers graduate from the bottom quarter of teacher preparation programs in the U.S. This is especially disconcerting given the recent adoption of the Common Core State Standards by over forty states. In addition, our analysis reveals that the least-prepared teachers are more likely to be hired by the poorest, most-disadvantaged schools, exacerbating educational inequality. Further, despite the fact that the international primary benchmark only constitutes five courses, only a little over half of future U.S. primary teachers reported taking them.

Finally, the TEDS studies underscore the critical difference between elementary and middle-school teacher preparation in mathematics, a distinction that should be kept clearly in the forefront of researchers and policymakers. Although the basic relationship between teacher course-taking and confidence to teach mathematics is quite similar for primary and middle-school teachers, the overall impact is more muted in the case of primary teachers. Likewise, while the proportion of teachers reaching the benchmark varies wildly across different middle school programs (and countries), there is much less variation at the primary level. The differences between primary and middle-school preparation should be no surprise. Because they are math specialists, mathematics preparation is the dominant focus of future middle school math teachers. Primary school teachers, on the other hand, are expected to be proficient in teaching many subjects, and to do so at a more basic level. The fundamental difference in the content and grade-level focus of primary and middle-school mathematics teachers means that the expectations of teachers and the thrust of policy must be just as different.

For example, we have argued previously that because the U.S. population generally does less well on international K-12 mathematics assessments, American teacher preparation programs are drawing from a weaker pool of future mathematics teachers. To recruit future teachers with the same mathematics knowledge as the average person from Taiwan, the U.S. would have to recruit from the top quarter of U.S. eighth graders (see Figure 2). This is a particular issue in primary teacher preparation, as selection effects appear to play a greater role in influencing primary teacher’s ability to teach mathematics. This may be due in part to the fact that mathematics makes up only a portion of the content teachers are expected to prepare for. As a consequence, improving the mathematics
preparation of primary teachers represents a considerable challenge, one that requires a
great deal of careful study.

Secondary teacher preparation is a different story, in that course-taking patterns
within teacher preparation programs have a stronger relationship with mathematics
knowledge and preparation to teach mathematics. The fact that the majority of future U.S.
secondary teachers graduate from the weakest programs raises concerns about the quality
of middle school mathematics teaching in the U.S. However, the results also point to a
possible remedy: the international benchmark for secondary teacher course-taking
suggests that improvements in the course requirements of teacher preparation programs
might improve the performance of U.S. middle school mathematics teachers, and ultimately
that of their students as well.

Key findings:
• The U.S. is the only country with middle school teacher preparation programs both
  in the international top 10% and the bottom 25%.
• Only one in seven (14%) of U.S. middle school teachers and just over half (56%) of
  U.S. primary school teachers fully meet the international course-taking benchmark.
• 60% of U.S. middle school teachers graduate from the worst-performing programs.
• The least-prepared teachers are more likely to work at the highest-poverty schools.
• Teachers whose preparation included courses in the international benchmark are
  more confident to teach mathematics topics.
• There are major differences in the mathematics preparation of middle school and
  elementary teachers – differences that shape the interrelationship of teacher
  recruitment, preparation, and quality.
• Selection effects appear to play a greater role in primary teacher preparation than
  for middle school teacher preparation.