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Study Reveals **Preparation Gap** for U.S. Middle School Mathematics Teachers

>> Ike Iyioke

FINDINGS FROM AN international study of middle school mathematics teacher preparation suggest that there is a gap in the way future teachers are prepared in the United States compared to other countries.

"This study suggests that teacher education matters," said MSU University Distinguished Professor William Schmidt. "It is important for us, as a nation, to understand that what opportunities are made a part of those preparation programs are critical not only for those future teachers but for our children whom they will be teaching."

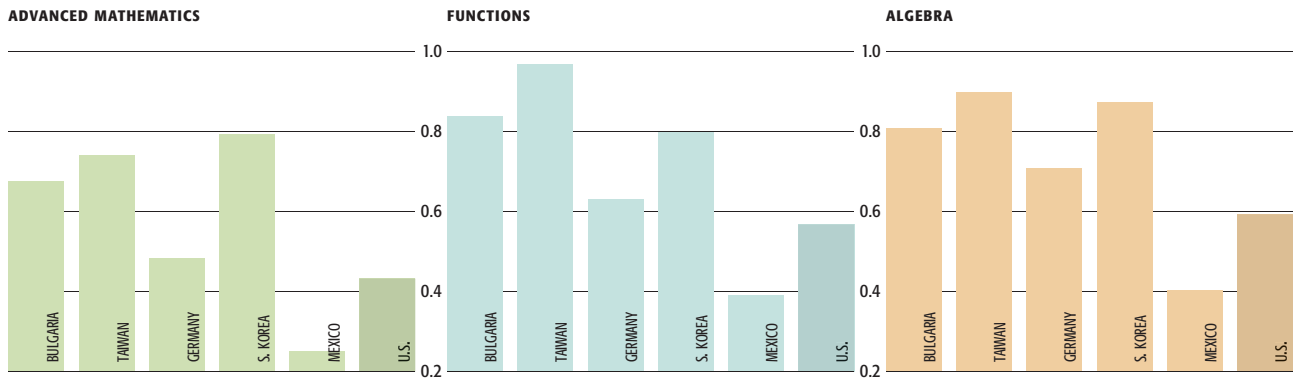
Mathematics Teaching for the 21st Century, or MT21, studied how a sample of universities and teacher-

training institutions prepare middle school mathematics teachers in the United States and five other nations: South Korea, Taiwan, Germany, Bulgaria and Mexico. Specifically, it also explored the preparation, knowledge and beliefs of 2,627 future teachers in those countries.

Researchers, including Schmidt as principal investigator and College of Education Associate Professor Maria Teresa Tatto as co-PI, released findings in December. Their work has been funded by the National Science Foundation.

"In many ways, the beliefs of U.S. teacher trainees reflect things that we would like to see, such as rejecting race and gender in limiting what ▶

Mean Percent of the Topics Covered in the Preparation Program in Each Country



students can accomplish,” Schmidt said. “However, our future teachers are getting weaker training in mathematics and in the practical aspects of teaching mathematics.

“This was especially true when compared with those in Taiwan and South Korea—countries whose middle school students perform extremely well on international benchmark tests. As a result, future U.S. teachers are not well prepared to teach the demanding mathematics curriculum we need for middle schools if we hope to compete internationally.”

Past international research, including the Third International Mathematics and Science Study (TIMSS), also showed low U.S. achievement in math compared to other countries at seventh and eighth grades.

TIMSS indicated that one of the

major factors related to that low performance was a U.S. middle school curriculum that was unfocused, lacking coherence and not particularly demanding or rigorous. The study also showed that the top-achieving countries had the opposite type of curriculum.

So how should we prepare our future teachers to teach a rigorous, coherent and focused curriculum for all children? That question guided the research of MT21.

The project found that institutions in each of the six countries provided learning opportunities for future teachers in mathematics, teaching mathematics and teaching in general, but each differed in the mix of these three areas. However, no country covered only mathematics.

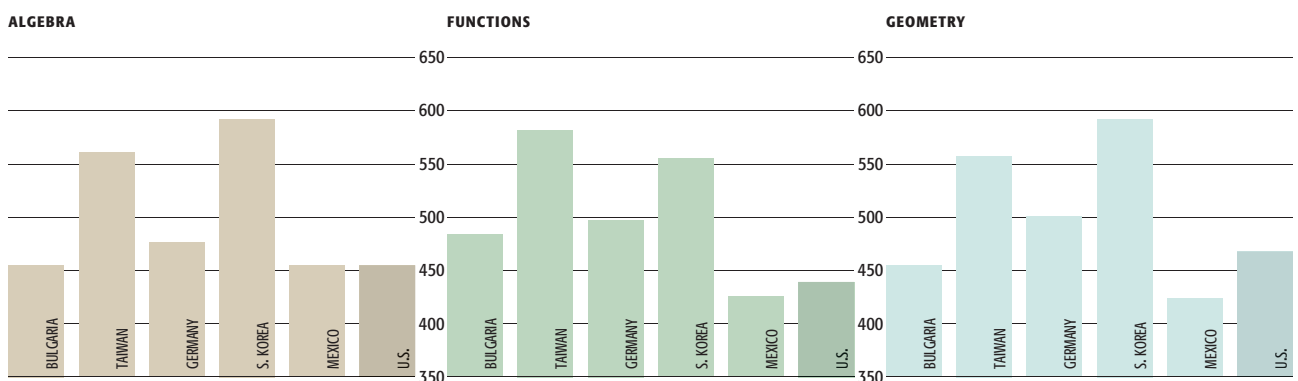
The Taiwanese and Korean future

teachers had more extensive coverage of advanced mathematics content than was the case for those in the United States. U.S. coverage of practical teaching aspects also was less extensive than in Taiwan and South Korea.

Here is a closer look at several of the MT21 findings:

- ✦ Future U.S. middle school teachers’ mathematics knowledge as measured on the MT21 test in institutions studied was generally weaker than that of future teachers in South Korea, Taiwan, Germany and, in some areas, Bulgaria. Taiwanese and South Korean future teachers were the top performers in all five areas of mathematics knowledge.
- ✦ U.S. future teachers in the study

Mean Level Performance on the Mathematics Knowledge Scale Scores Across Six Countries

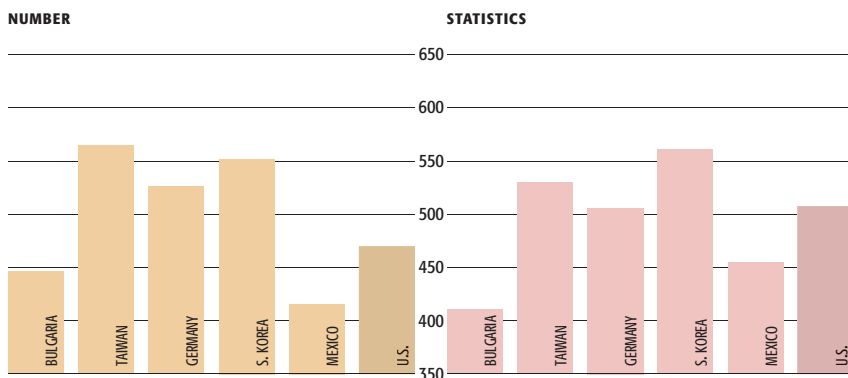


performed at or near the bottom in tests of algebra knowledge (including knowledge of functions), which is the foundation area for middle school mathematics, especially in grade eight.

- ✦ The best area for future teachers in the United States was statistics knowledge, where they performed near the international average.
- ✦ Taiwanese and South Korean future teachers covered about 80 percent or more of appropriate advanced mathematics topics in their training while those in Mexico and the United States covered less than 50 percent.
- ✦ In pedagogy, or the practical aspects of teaching mathematics, the extent of coverage for U.S. future teachers was also substantially less than that provided by Taiwan and South Korea. (The only exception was for general pedagogy, when the extent of preparation in South Korea was less than that in the United States.)
- ✦ Future U.S. middle school mathematics teachers in the study are trained in three kinds of programs:

secondary programs, elementary programs and those that directly prepare middle school teachers.

- ✦ Those that prepare as secondary teachers have a stronger mathematics preparation. Those that prepare as elementary teachers have stronger pedagogical preparation. Those that prepare as middle school teachers seem to have the worst of both of the other programs.
- ✦ More future U.S. teachers prepared in elementary and middle school programs believed that mathematics was rule-based rather than creative and useful.
- ✦ Future U.S. teachers believed that less emphasis should be placed on teaching mathematics skills than future teachers in three of the other countries. U.S. future teachers believed in emphasizing mathematics communication skills more than did the future teachers in all five of the other countries.
- ✦ Future U.S. teachers in the study rejected natural ability, race and gender as limiting how much mathematics students could learn



ABOUT TEDS-M

The Teacher Education and Development Study in Mathematics, or TEDS-M, is an investigation of the preparation of elementary and middle school teachers of mathematics in 19 countries. MSU is the lead International Center for the study with Maria Teresa Tatto, an associate professor of teacher education in the College of Education, serving as international director. Sharon Senk, an MSU mathematics professor, and Jack Schwillie, the College of Education's assistant dean for international studies in education, are co-directors. TEDS-M is sponsored by the International Association for the Evaluation of Educational Achievement (IEA) and funded by IEA, the National Science Foundation and the participating countries.

University Distinguished Professor William Schmidt, also of the College of Education, is the national research coordinator for U.S. TEDS. U.S. costs are covered by grants from the Bill & Melinda Gates Foundation, the Boeing Company, the Carnegie Corporation of New York and the GE Company.

and emphasized more strongly the developmental level of students. This was also true in Mexico and Germany.

A larger investigation related to MT21, the Teacher Education and Development Study in Mathematics, or TEDS-M, is now underway. TEDS-M expands the research to include 19 countries and collects comprehensive data from samples designed to be nationally representative. The study also will look at the preparation of both elementary and middle school teachers. (See "About TEDS-M" box for more information.)

MORE INFORMATION

Get details of the MT21 research report and related studies:

- Teacher Education and Development Study in Mathematics (TEDS-M) <http://teds.educ.msu.edu>
- United States portion of TEDS-M: <http://usteds.msu.edu>
- Third International Mathematics and Science Study (TIMSS), U.S. National Research Center: <http://ustimss.msu.edu>
- Promoting Rigorous Outcomes in Mathematics and Science Education (PROM/SE): <http://promse.msu.edu>
- International Association for the Evaluation of Educational Achievement: www.iea.nl