The Impact of the 4x4 Coursework Requirement on the Demand for High School Math and Science Teachers in Central Texas

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Introduction and Purpose

Researchers, media, and policymakers have long lamented about the shortage of math and science teachers in this country. Indeed, it is not difficult to find numerous reports over the last 30 years that decry the shortage of such teachers. This shortage is caused by a number of factors such as low pay and poor working conditions relative to employment in private industry. Other sources of the shortage include policies such as class size limits and mandated course-taking requirements.

The purpose of this issue of *Implications* is to examine the potential impact of the state's 4x4 coursework policy on the demand for math and science teachers in Central Texas.

Data and Methodology

This study relies primarily data analyses and data sets purchased from the Texas Education Agency that include information on students completing math and science courses, teacher employment as math and science teachers, and class sizes in math and science. Finally, estimates of the demand for additional math and science teachers were made based on analyses of these data sets. See Fuller (2009b) for more details.

Estimated Number of Additional Students

As shown in Table 1, nearly 50% of the students completed at least four years of math courses while only about 38% completed four years of science.

Table 1: Number and Percentage of Students Taking Selected Number of Years of Math and Science Coursework (2007-08)

	Number of Years of Courses Taken			
	0-2	3	4	Total
Mathematics				
#	3,755	4,914	8,211	16,886
%	22.20%	29.10%	48.60%	100.00%
Science				
#	3,969	6,581	6,337	16,887
%	23.50%	39.00%	37.50%	100.00%

Most important for this analysis, over 8,000 students completed less than four years of mathematics and over 10,000 students did not complete four years of science.

Estimated Number of Additional Student Courses

Under the 4x4 requirements, students taking only three math courses or three science courses will be required to take another course. Because not all of the students taking two or fewer years of math or science coursework will follow the 4x4 requirements, the number of students taking zero to two courses is multiplied by two. The results of these calculations—shown in Table 2--provide an estimate of the number of additional math and science student courses that will be required to meet the 4x4 requirement.

Table 2: Number of Additional Student Math and Science Courses Required Under the 4x4 Graduation Plan (2007-08)

Subject Area	# Additional Student Courses		
	1 Course	2 Courses	Total
Math	4,914	6170	11,084
Science	6,581	13162	19,743
Math & Science	11,495	19,332	30,827

Estimated Number of Additional Classes

The number of additional student courses is not particularly useful information. Rather, district policymakers need to know how many additional classes must be offered and how many additional teachers must be hired.

Table 3 provides an estimate of the number of additional classes that would have to be offered. These estimates were calculated by dividing the total number of student courses at each district by the adjusted average class size of courses that would be required under the 4x4 requirement. This adjustment, which is described in the full paper, somewhat compensates for the ability of district's to adjust class sizes. This overall estimate is listed under the "estimate" column.

In order to examine the effect of reducing or increasing class size by one student, Table 3 also includes a column for reducing class size by one student ("est -1") and a column for increasing class size by one student ("est +1").

Table 3: Number of Additional Student Math and Science Classes Required Under the 4x4 Graduation Plan (2007-08)

Subject Area	# Additional Classes Required		
	Est +1	Estimate	Est -1
Math	479	502	526
Science	558	582	609
Math & Science	1,037	1,084	1,136

Regardless of the class size used in the estimate, districts will have to add a substantial number of additional math and science classes.

Estimated Number of Additional Teachers

The final table provides estimates of the additional demand for math and science teachers based on the data in Table 3. In short, the number of additional courses required was divided by the average number of teachers required to teach math and science courses in each district. Again, see Fuller (2009b) for more details.

Table 4: Number of Additional Math and Science Teachers Required Under the 4x4 Graduation Plan (2007-08)

Subject Area	Additional Teachers Required		
	Est +1	Estimate	Est -1
Math	110	114	120
Science	130	139	141
Math & Science	230*	243*	251*

** This number has been adjusted for teachers assigned to teach both math and science.*

Conclusions

As shown in Table 4, regardless of the class size estimate used, districts will have to hire a substantial number of new math and science teachers over the coming years to meet the demand created by the 4x4 coursework policy. To put this number in context, Region XIII school districts hired over 200 new high school mathematics teachers and over 170 new high school science teachers in the 2007-08 school year.

Unfortunately, districts already face a fairly severe shortage of well-qualified math and science teachers and the qualifications of math and science teachers produced in Texas may be declining (Fuller, 2009). Moreover, districts in Region XIII will likely to continue to grow rapidly, thus requiring the hiring of substantial number of additional STEM teachers just to cover enrollment increases. While the lower attrition of teachers due to the recession may temporarily stem the tide of STEM teachers leaving the profession, but historical data suggests this effect will be only temporary.

Thus, unless districts, preparation programs, and the local business community act quickly, these factors may combine to create a perfect storm of rapidly increasing enrollment in math and science, inadequate supply to fill the demand, and a decrease in the qualifications of those STEM teachers produced.

Policy Implications

In order to reduce the attrition of STEM teachers, districts must invest in high-quality mentoring and induction programs.

Districts should consider providing substantial stipends to STEM teachers in order to provide a salary that is more competitive with those in private industry. Even greater stipends should be provided for teachers in hard-to-staff schools.

Much like the UTEACH program at UT-Austin, preparation programs should ensure students spend substantial time in classrooms even before they reach student-teaching.

Businesses should consider providing financial support to local STEM teachers through grants or summer employment.

Local alternative certification programs should ensure that prospective STEM teachers have completed at least a minor, if not major, in math or science before admitting them to a preparation program.

Create a forgivable loan program for teachers from both traditional and alternative certification programs to participate in student-teaching programs and forgive the loan if the teachers complete three successful years of teaching in schools serving large percentages of poor, minority, and/or low-performing students.

Create a regional urban teacher academy where novice teachers can learn to teach poor and minority students with assistance from master teachers.

References

Fuller, E.J. (2009a). Secondary Mathematics and Science Teachers in Texas: Supply, Demand, and Quality. Texas Instruments and Texas Business and Education Coalition: Austin, TX.

Fuller, E.J. (2009b). Analysis of the Impact of the 4x4 Course Requirements in Central Texas Public High Schools. E3 Alliance: Austin, TX.

Guided by an objective data map and a clear community vision, we propose to better align the system components and practices of our regional education system and allocate our investments and services more efficiently to dramatically and sustainably increase educational outcomes within a decade. By doing so, we can increase our global competitiveness and the economic vitality and overall quality of life in our region.

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