

# The Mathematics and Science Teacher Shortage: Wrong Diagnosis and Prescription?

Richard Ingersoll and David Perda  
University of Pennsylvania

**For Further Information**  
[www.gse.upenn.edu/faculty/ingersoll.html](http://www.gse.upenn.edu/faculty/ingersoll.html)

## Sources of Data

Schools and Staffing Survey/Teacher Follow-up Survey (SASS/TFS)  
Integrated Postsecondary Educational Data System (IPEDS)  
Baccalaureate and Beyond Survey (B&B)

## Summary

Contrary to conventional wisdom, the best national data available show that math and science staffing problems are not solely, or even primarily, due to shortages in the sense that too few new teachers are produced each year. The data document that the new supply of mathematics and science teachers is more than sufficient to cover the losses of teachers due to retirement. Rather, the data show that pre-retirement turnover is the driving factor behind math and science teacher staffing problems. Moreover, in turn, the data show that job dissatisfaction is a leading factor behind pre-retirement turnover. The data indicate that improvements in school working conditions are strongly linked to decreases in turnover.

## Research Questions and Data Results

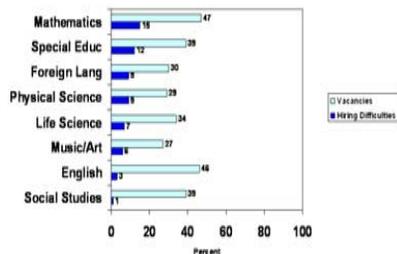
### (1.) What is the magnitude of school staffing problems?

To what extent do schools suffer from hiring difficulties, especially for mathematics and science?

#### Results:

The data show that there are widespread school staffing problems; that is, many schools experience difficulties filling their classrooms with qualified candidates. The data also show that the severity of these problems varies across schools and fields. In 2003-2004, about 1/3 of secondary schools reported they had serious difficulty finding qualified teachers to fill either their mathematics or science openings.

Figure 1: Percent Secondary Schools with Vacancies and with Serious Difficulties Filling those Teaching Vacancies, by Field (2003-2004).



### (2.) Is the supply of new teachers adequate?

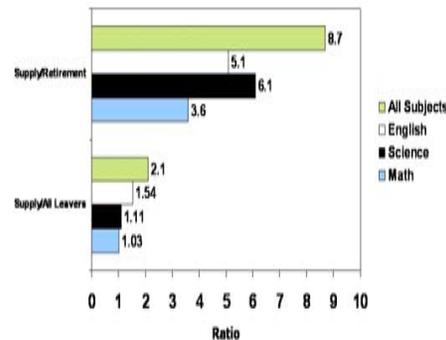
What do the data indicate about the adequacy of the supply of new teachers in mathematics and science, compared to English? Can we empirically evaluate the extent to which there is a supply deficit—a shortage—of new teachers in mathematics and science?

#### Results:

Contrary to conventional wisdom, the data show that the above school staffing problems are not simply due to the production of too few new teachers. During the 1999-2000 school year, about 22,000 newly qualified mathematics and science teachers were produced in the new teacher supply pipeline from preparation programs. This was 2½ times the number of mathematics and science teachers to retire at the end of that same year. When we factor in new hires from the reserve pool of former teachers and delayed entrants, the ratio of supply to retirement is even higher. This finding is further reinforced because our data sources are downward biased and provide underestimates of the new teacher supply.

However, a different picture emerges when we include preretirement losses of teachers—a figure that is many times larger than losses due to retirement and a primary factor driving demand for new hires. Mathematics and science teachers have about the same annual rates of turnover as other teachers. But unlike, for instance, the case of English teachers, the educational system does not enjoy an overwhelming surplus of new mathematics and science teachers relative to total turnover. For the field of English, the supply of new teachers from the pipeline and the reserve pool is more than sufficient to replace all losses, due to either retirement or other reasons. For mathematics and science, there is a much tighter balance between the new teacher supply and turnover. The supply of new teachers from the pipeline and the reserve pool is barely sufficient, with just over one new mathematics or science teacher for each mathematics or science teacher who leaves teaching for retirement or other reasons.

Figure 2: Ratio of the New Supply of Teachers to Retirement Leavers and to All Leavers, by Field (2000)



### (3.) What is the role of teacher turnover in school staffing problems?

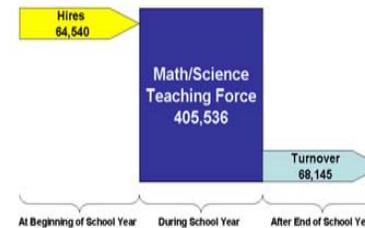
What portion of the demand for new mathematics, science, and English teachers is accounted for by teachers moving from or leaving their schools? What is the overall magnitude of turnover in these fields?

#### Results:

The data indicate that most of the hiring of new mathematics and science teachers is simply to fill spots vacated by teachers who departed at the end of the prior school year. And, most of these departures are not a result of retirement.

Numerically there are large teacher flows in, between, and out of schools each year. Over a half million teachers newly entered schools at the beginning of the 2003-2004 school year; by the following year a slightly larger number moved from or left their schools. In other words, during that period there were over 1 million job transitions, representing almost one third of this relatively large occupational force. Among these were over 100,000 job transitions for mathematics and science teachers alone, representing almost one third of the mathematics/science teaching force.

Figure 3: Numbers of Math and Science Teachers in Transition Before and After 2003-2004 School Year



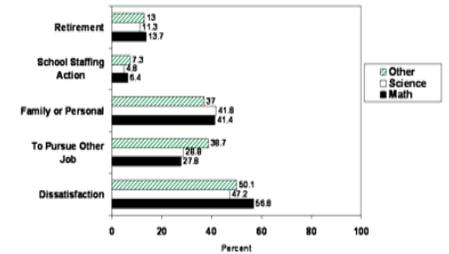
### (4.) What are the sources of teacher turnover?

What are the reasons behind the turnover of mathematics, science and other teachers? What portion of mathematics, science teacher turnover is due to retirement?

#### Results:

The data show there are large variations in turnover within states and large school-to-school differences in turnover. Moreover, these differences are tied to the attractiveness of the working conditions in schools. While less than a quarter of all mathematics and science teachers who left teaching at the end of the 1999-2000 year did so because of retirement, about half of their attrition was tied to job dissatisfaction. The data show that demand for new math and science hires and attendant staffing problems are largely a result of preretirement turnover, and a significant portion of the latter is driven by job dissatisfaction.

Figure 4: Percent Teachers Giving Various Reasons for Their Turnover, by Field (2000-2001)



## Policy Implications

In addition to increasing the quantity of new teacher supply, the data also suggest the need to decrease teacher turnover. The data indicate that a key way to improve teacher retention is to improve the conditions of the teaching job. In our research, we have found that schools with more support for new teachers, fewer student discipline problems, more adequate resources, more effective leadership, and enhanced faculty input into school decision-making—all have significantly lower levels of teacher turnover.

## Next: Research in Progress

### 1). What impact have accountability policies and practices had on the retention of mathematics and science teachers?

Have increases in testing and performance assessment made it more difficult for schools to retain their mathematics and science teachers? On the other hand, has an increased focus on assessment led to improved school leadership and, hence, made it easier for schools to keep qualified mathematics and science teachers? What impact have school accountability provisions, such as those mandated by NCLB, had on the ability of schools to staff mathematics and science courses with qualified teachers, as also mandated by NCLB?

### 2). What impact have teacher preparation, education, and training trends and levels had on the retention of mathematics and science teachers?

How do the retention rates of new mathematics and science teachers coming from traditional teacher education programs compare to those entering teaching through alternative routes and programs? Do new teachers who enter teaching immediately after college have different levels of retention than midcareer switchers? Are there differences in the retention and turnover of new mathematics and science teachers with education degrees compared to those with degrees in mathematics or a science?

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