Abstract Title Page

Title: The Magnitude, Destinations and Determinants of Mathematics and Science Teacher Turnover

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Abstract Body

Background/context:

Contemporary educational thought holds that one of the pivotal causes of inadequate student performance is the inability of schools to adequately staff classrooms with qualified teachers, especially in fields such as mathematics and science. At the root of these staffing problems, it is commonly believed, are shortages resulting from an inadequate supply of teachers in the face of increasing student enrollments and increasing teacher retirements.

In a series of prior analyses of comprehensive national data, we have not found the data to support this perspective (Ingersoll and Perda 2009a). The data show that there are indeed widespread school staffing problems—that is, many schools experience difficulties filling their classrooms with qualified candidates, especially in the fields of math and science. But, the data also show that these school staffing problems are not a result of an inadequate quantity of mathematics and science teachers produced. The data show that the new supply of qualified math and science teachers has more than kept pace with increases in student enrollments and, moreover, has been more than sufficient to cover teacher retirement losses. Rather, the data document that one of the most important sources of school staffing problems is preretirement teacher turnover—the departure of teachers from their teaching jobs long before retirement. The data show that as an occupation teaching has far higher annual turnover than some professions (lawyers, engineers, architects, professors, pharmacists), about the same as others (police, corrections officers), and less turnover than some lines of work (child care workers, secretaries, paralegals) (see Ingersoll & Perda, 2009b). However, the data also shows that teacher turnover depends on location and focusing on the overall national picture overlooks large variations. The largest source of variation is between different types of schools, even within districts, and these differences are tied to the characteristics and conditions of those schools. While it is true that teacher retirements are increasing, the overall volume of turnover accounted for by retirement is relatively minor when compared with that resulting from other causes, such as teacher job dissatisfaction and teachers seeking to pursue other jobs or careers. Hence, our research suggests that if schools are to ensure that all students are taught by qualified teachers, as NCLB mandates, then they must focus more on improving teacher retention.

Purpose / objective / research question / focus of study:

Description of what the research focused on and why.

The objective of this study is to use nationally representative data to examine the rates, destinations and sources of math and science teacher turnover. There are four sets of research questions we address concerning the departure of mathematics and science teachers from their schools:

1. At what rates do mathematics/science teachers move from or leave their teaching jobs? How do their turnover rates compare to those of other teachers? Have their turnover rates changed over time? What is the magnitude of both math science teacher mobility and attrition?

2. Which types of schools have higher levels of mathematics/science teacher turnover?
3. What are the destinations of mathematics/science teachers who move from or leave their teaching jobs? What proportions of those departing move to other schools, quit to raise families, go to graduate school, go into non-teaching occupations within education (e.g., school administration, higher education, etc) or go into non-educational occupations?
4. Which particular factors, aspects, and conditions of schools and of teachers' jobs are most tied to the turnover of mathematics and science teachers?

Setting:

This study utilizes nationally representative data on teachers, and therefore the setting is the whole United States.

Population / Participants / Subjects:

The data for this study come from the National Center for Education Statistics' (NCES) nationally representative Schools and Staffing Survey (SASS) and its supplement, the Teacher Followup Survey (TFS). This is the largest and most comprehensive data source available on the staffing, occupational, and organizational aspects of elementary and secondary schools.

Intervention / Program / Practice:

The practice under investigation here is teacher turnover and mobility. Assuming a body of evidence can be accumulated regarding the importance of teacher turnover, a related intervention that can be proposed are policies aimed at reducing the amount of teacher mobility. However, it is important to first correctly identify the factors involved in teacher turnover and mobility in order to develop the appropriate policy intervention.

Research Design:

In order to answer the four research questions outlined above, we utilize a number of different analytic strategies. We used descriptive statistics to establish rates of turnover, which types of schools have higher rates of turnover, and destinations of mathematics/science teachers. We conducted an analysis of the cross-location variance of the TFS data on turnover to investigate differences in rates of teacher turnover. Finally, we estimated a series of regression models to examine whether school organizational and working conditions are associated with teacher turnover, after controlling for the characteristics of schools and teachers. In our analyses we used two types of measures of school conditions: (1) school-level averages across the teachers in each school, and (2) teacher-level measures showing the extent to which individual teachers differed from others in their building. In our models, use of the former measures tells us whether particular school conditions on average are related to turnover; the latter measures tell us whether individuals who reported conditions differently than others, were also more or less likely to depart than others.

Data Collection and Analysis:

The Schools and Staffing Survey and the related Teacher Follow-up Survey are collected by NCES. Analyses include descriptive analyses, cross-location variance of the TFS data, and regression modeling.

Findings / Results:

Our analyses show, that after controlling for teacher and school characteristics, a number of factors stand out as important to math science teacher turnover. Among these are: teacher salaries; whether there are adequate classroom resources; the amount of collective faculty input into school-wide decisions, such as those concerning the curriculum, budget, hiring, evaluation, discipline and standards; and the degree of autonomy individual teachers have in their classrooms over such issues as, homework, evaluation, discipline and teaching methods. For instance, holding other factors equal, the data show that in schools where teachers have a high degree of classroom autonomy, the annual predicted probability of turnover is 10 percent. On the other hand, in schools where teachers have a low degree of classroom autonomy, the annual predicted probability of turnover is 45 percent. Likewise, in schools where teachers report that classroom resources are highly adequate, the annual predicted probability of math/science turnover is 13 percent. On the other hand, in schools where teachers report that classroom resources are not adequate, the annual predicted probability of math-science turnover is 22 percent.

The data indicate that over the past two decades public mathematics and science teachers have not moved from or left their schools at significantly different rates from other teachers – a finding that contradicts a number of earlier studies From the late 1980s to 2004, annual rates of total turnover for math science rose overall – 31% for math and 11 % for science – but also fluctuated from year to year during that period.

Where do they go when they move or leave? What are the destinations of mathematics/science teachers who move from or leave their teaching jobs? About half of those departures moved to other schools and about half left teaching. Of those who moved to other schools, almost half entailed cross-school transfers within the same district. Just over half of the migrants went to other districts and 90 percent of these were within the same state. About 5 percent of public school math/science movers went to private schools (this was about half of the reverse flow – those who moved from private to public). Compared to other teachers, mathematics and science teachers were less likely to move to schools in other states, but slightly more likely to move to another district in the same state, and, for science in particular, slightly more likely to move to private school teaching jobs – perhaps suggesting greater teaching job opportunities within the state.

Over half of those who left classroom teaching altogether report that they would consider returning to classroom teaching somewhere, and hence their attrition may be temporary. They also report the most important factors influencing a decision to return would be a salary increase and the ability of maintain their retirement benefits. About one third of leavers are job shifters working in the larger field of education, such as in school administration, or in higher education. While they have left the classroom, they are not a loss of human capital to the larger education

sector. Another 14 percent left to work in an occupation outside of education, just over a quarter of those leaving retired, 14 percent left to care for family members, and 4 percent left to enroll in university or college programs. Interestingly, compared to other teachers, mathematics and science teachers who left classroom teaching, were far more likely to be working in the larger field of education and were slightly more likely than other teachers to be working in a non-education occupation. Science teachers, however, were slightly less likely to be working for private business or industry than were other teachers who left teaching – which somewhat runs against the view that science teachers are more likely to have alternative career options in the private sector than other.

The data also show the flows of teachers out of schools are not equally distributed and that rates of turnover vary greatly among different locations. We conducted an analysis of the cross-location variance of the TFS data on turnover. We found that variation in turnover is significantly greater between schools within states, than between states and, moreover, that turnover is significantly greater between schools than between districts. In other words, the largest variations in teacher turnover by location are those between different schools, even within the same district. We also found that school poverty enrollments, school size, and the urbanicity of the school community were among the school characteristics most correlated with teacher turnover in public schools.

On one end of the continuum lie larger, low-poverty, suburban public schools that have, on average, 8 percent annual math science turnover. On the other end of the continuum lie smaller, rural, high-poverty public schools with double that rate. These data provide support for our theoretical perspective that fully understanding the staffing problems of schools requires examining them from the perspective of the organizations in which they occur. These data raise the questions—why do some schools have far higher turnover than others? What are the sources of teacher turnover?

We estimated a series of regression models to examine whether school organizational and working conditions are associated with teacher turnover, after controlling for the characteristics of schools and teachers. In our analyses we used two types of measures of school conditions: (1) school-level averages across the teachers in each school, and (2) teacher-level measures showing the extent to which individual teachers differed from others in their building. In our models, use of the former measures tells us whether particular school conditions on average are related to turnover; the latter measures tell us whether individuals who reported conditions differently than others, were also more or less likely to depart than others.

Although the measure for advanced salaries has a statistically significant negative relationship with turnover without controls, once other factors are held constant, the coefficient for advanced salaries (the school's highest annual salary on the teacher salary scale) is no longer statistically significant (at a 90 percent level of confidence) for math and for non math/science teachers. However, for science teachers a higher salary is significantly related to a reduced likelihood of departing. An increase in the salary by $1000 is associated with a 16 percent decrease (i.e., $\exp((-0.02)+(-0.16)) = 0.84$) in the odds of science teachers departing.

In schools with lower levels of student discipline problems, turnover rates are distinctly lower for both math/science and other teachers. A one unit increase in average reported student discipline problems between two schools (on a 4 unit scale) is associated with a 32 percent increase (i.e., exp(0.28) = 1.32) in the odds of a teacher departing. Moreover, individual teachers who reported higher levels of student discipline problems than other teachers in their building were themselves more likely to depart. But, notably the effect of school-wide conditions is stronger, about twice the size, than that of individual perceptions.

In schools which provide better principal leadership and administrative support as reported by teachers, turnover rates are distinctly lower. A one unit difference between schools in average reported support (on a 4 unit scale) is associated with a 21 percent decrease in the odds of a teacher departing. Again, as with student discipline, individual teachers who reported more positive levels of leadership support than other teachers in their building were themselves less likely to depart, although that individual effect was again only about half the size of the school-level effect.

In schools where teachers reported that necessary materials, such as textbooks and supplies were available, turnover was lower for all teachers. In this model however, the individual and school-level effects were the same size, suggesting the absence of a contextual effect of a lack of resources. In other words, teachers who had limited resources were more likely to depart, but their odds of departure was not additionally influenced by the availability of resources (or lack thereof) to other teachers in the school.

Schools with higher levels of school-wide faculty decision-making influence have lower levels of turnover. This is one of the strongest effects we found. A one unit increase in reported teacher influence between schools (on a 4 unit scale) is associated with a 23 percent decrease in the odds of a teacher departing. Moreover, whether individual teachers differed in their reports of teacher influence was not related to their turnover. Therefore, this may be entirely an organizational phenomenon reflecting differences in school-wide working conditions.

Schools with higher average levels of individual teachers' classroom autonomy have lower levels of turnover. A one unit difference in reported teacher influence between schools (on a 4 unit scale) is associated with a 37 percent difference in the odds of a teacher departing. This school-level effect is nearly three times the size of the individual effect of autonomy, suggesting a very large contextual relationship. Even more noteworthy is that the turnover of math teachers was even more strongly impacted by classroom autonomy. In fact, a one unit increase in average teacher autonomy between schools is associated with a 70 percent decrease in the odds of a math teacher departing (i.e., exp((-0.46)+(-0.75)) = 0.30). This was by far the single largest effect we found. On the other hand, the significant positive interaction effect for science teachers suggests that, unlike others, classroom autonomy had no effect on the odds of turnover (i.e., -.46 + .47 0).

We also examined the impact of whether teachers participated and found useful two types of professional development: (1) that focused on student discipline and classroom management, and (2) that focused on the content of the subjects taught. School-wide utility of the former type of PD was associated with decreases in turnover for math teachers only, but the effect was large. A one-unit increase in the school-average utility of PD focused on student discipline was

associated with a 39% reduction in the odds of turnover for math teachers. We also found significant effects of the utility of PD focused on the content taught; however, those effects existed only at the individual teacher level, not as organizational effects. Teachers who found content-focused PD more useful had a 10% lower odds of turnover. This effect was even larger for math teachers—those who found content-focused PD more useful had a 27% lower odds of turnover.

Conclusions:

All of this suggests that schools are not simply victims of inexorable demographic trends and that there is a significant role for the management of schools in both the genesis of, and solution to, school staffing problems. The data suggest that improvements in these conditions of the teaching job, such as increased teacher salaries, and enhanced faculty input into school decision making, would all contribute to lower rates of turnover, in turn, diminish school staffing problems, undermine the so-called teacher shortage and, hence, ultimately, aid the performance of schools.

Appendix A. References

References are to be in APA version 6 format.

Ingersoll, R. & Perda, D. (2009). The Mathematics and Science Teacher Shortage: Fact and Myth. CPRE Research Report #RR62. The Center for Policy Research in Education (CPRE). Retrieved March 2009 from http://www.cpre.org/images/stories/cpre_pdfs/math%20science%20shortage%20paper%20march%202009%20final.pdf