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Abstract

This policy brief:

- (1) contrasts the proportion of math and science teachers who leave STEM fields within one year, three years, five years, and ten years with the proportion of English or Social Studies teachers who turnover during these intervals
- (2) examines stability of the year-to-year turnover from STEM fields
- (3) describes how teachers who leave math or science teaching assignments move into other STEM assignments, to non-STEM assignments, or leave the public schools of Missouri entirely, and
- (4) describes the rates at which teachers who are still teaching in STEM fields remain in the same school and district, shift to a different school in the same district, and shift to a different school and district.
- 5) contrasts the instability of STEM teachers in the five largest cities of Missouri with the instability of STEM teachers in the rest of the state.

Keywords

teacher turnover, ambient positional instability, administrative records, randomized trials, statistical policy

Disciplines

Education | Other Education | Science and Mathematics Education

CRESP WORKING PAPER AND BRIEFING SERIES

TEACHER CHURN IN MISSOURI'S FIVE BIGGEST CITIES, 2005-2014: A BRIEFING

Jill Bowdon and Robert Boruch

Working Paper/Briefing: API –Missouri1

Center for Evaluation and Research in Social Policy
Graduate School of Education
University of Pennsylvania

The authors would like to acknowledge the contributions of Tom Ogle, the School Data Director for Missouri's Department of Elementary and Secondary Education. Mr. Ogle, who recently retired after collecting more than 20 years of data on teachers in Missouri, provided expert and timely assistance with procuring the data and understanding its structure. The research reported herein has been supported by Grant DRL-1337237 from the National Science Foundation. The views expressed here are those of the authors and not necessarily those of the Foundation.

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ABSTRACT

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Teacher Churn in Missouri's Biggest Cities, 2005-2014: A Briefing¹

Jill Bowdon and Robert Boruch

Introduction

Finding appropriately trained teachers to staff math and science positions is a persistent challenge for many school principals, especially in high poverty areas. Nationally, among public school teachers, 14% of math teachers and 16% of science teachers depart from their position annually. When it comes time to hire new teachers to replace the ones who have left, principals struggle to find certified math and science teachers seeking employment. These and other estimates of instability in STEM fields, and its relation to poverty concentration, have relied on national probability samples in the School and Staffing Survey and Teacher Follow-up Study, (e.g. Keigher and Cross, 2010; Ingersoll and May, 2012; Ingersoll and Perda, 2010).

This brief focuses on ten years of data on the entire population, rather than a sample, of teachers employed in the state of Missouri. The data resource permits tracking teachers' movement within and across course assignments, grades, schools, and districts. We refer to such movements informally as churn and formally as "Ambient Positional Instability" (API).

With such population data, it is possible to use simple descriptive statistics that policy makers can easily understand and use. Furthermore, population data can enhance our understanding of the destinations of teachers and provides the specificity that policy

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makers need to calculate how much human capital is vanishing from their state system annually and over a ten-year span.

This policy brief:

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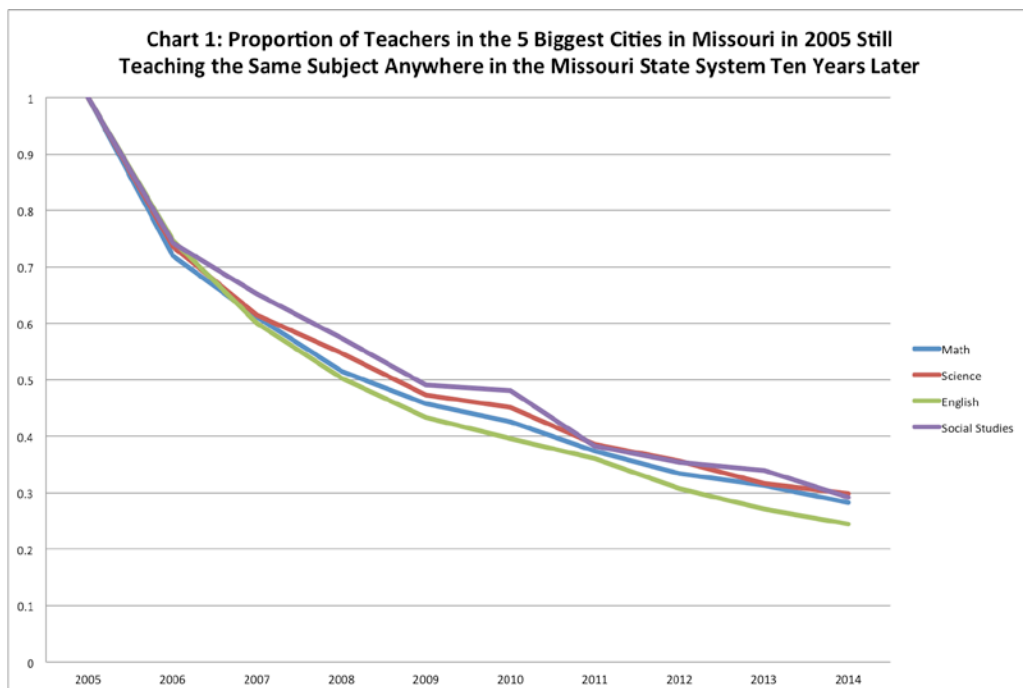
The Data System and Its Contents

This briefing depends on ten years of data from the Missouri state longitudinal data system. The system contains unique teacher identifiers on all teachers in Missouri allowing one to track teachers' employment in public schools and districts and their course assignments over time. We examined the population of middle-school and high-school teachers who worked in the five biggest cities of Missouri: St. Louis, Kansas City, Springfield, Independence, and Columbia. We pay special attention to teachers in these cities under the assumption, supported by some evidence, that urban locations have the

highest rates of teacher instability (e.g. Ingersoll and May 2012). One limitation of these data is that the system does not provide information on teachers who moved into private schools or began teaching in another state.

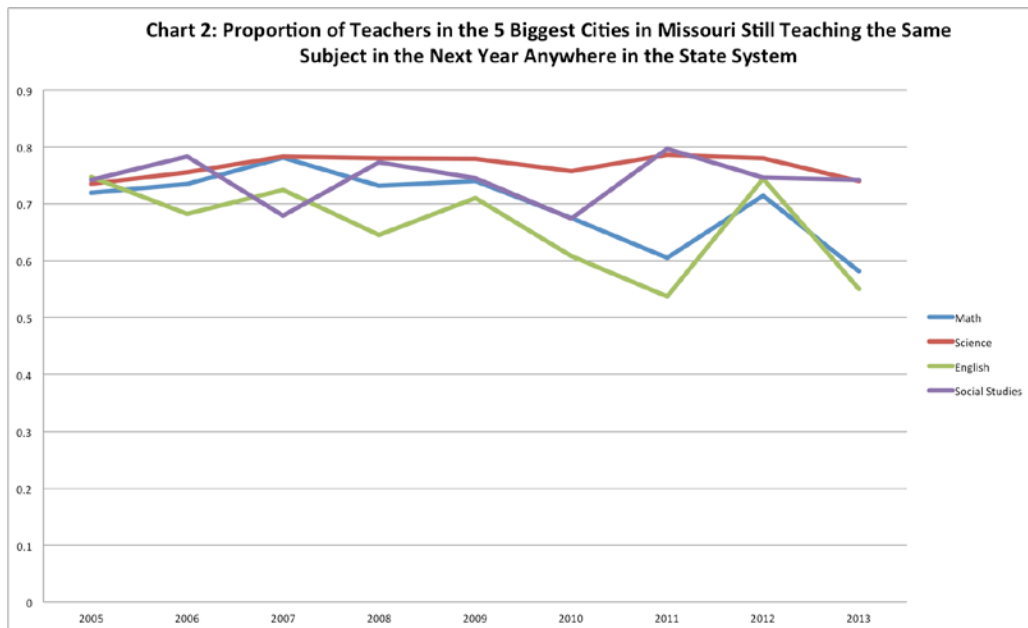
Instability Over a Ten-Year Period

Results, pictured in Chart 1, show that approximately 75% of teachers who were teaching a subject in 2005 in one of the biggest cities were still teaching the same subject in any Missouri public school in 2006. Three years later, in 2008, almost half of the teachers were no longer teaching the same subject. By 2014, after ten years, only about 30% of teachers were still teaching the same subject at any public school in the state. These one-year and ten-year rates of instability in subjects taught were remarkably similar for math, science, English, and social studies teachers.



Year-to-Year Instability

Year-to-year instability of teachers in math, science, English, and social studies can be an important factor in managing human resources in schools. As shown in Chart 2, across all ten years of data, a remarkably stable proportion of science teachers in the five biggest cities of Missouri were still teaching science in the subsequent year: between 75%-80%. From 2005-2009, we also see a stable pattern in the year-to-year retention of math teachers in the five biggest cities: about 75% of math teachers were still teaching math from one year to the next. However, in recent years, the proportion of math teachers still teaching math in the next year has bounced around between 70% and 60%. The fact that we also see this pattern of volatility in the proportion of social studies and English teachers retained from one year to the next in recent years suggests that it might be due to a common cause at the school, district, or state level. Unfortunately, we cannot ascertain the exact cause given these data.



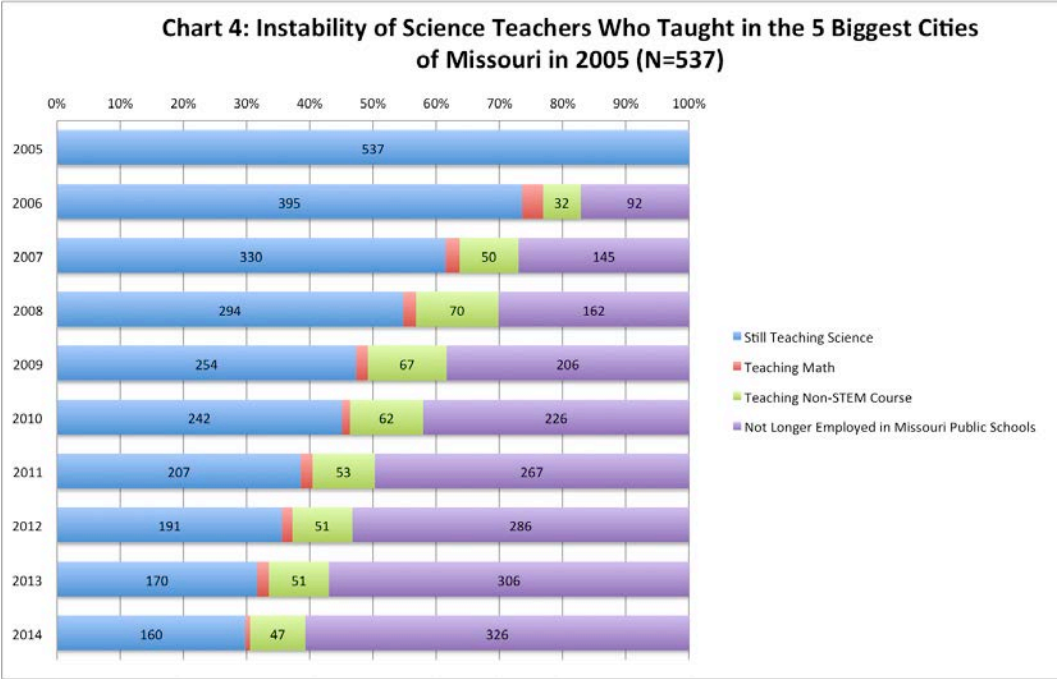
Destinations of Math and Science Teachers Who Moved From STEM

When teachers leave math and science, where did they go? Were they still teaching in the state system? And, if so, were they teaching in a STEM or non-STEM field? Ten years of data were used to examine the destinations of teachers who were no longer teaching math or science.

As shown in Chart 3, of the 581 teachers who taught math in one of the five biggest cities of Missouri in 2005, only 28% were still teaching math anywhere in the state ten years later. The majority of those no longer teaching math had not switched to teaching science (1%) or a non-STEM field (only 12%). Rather, they were no longer teaching in the public schools of Missouri (58%).

Similarly, Chart 4 shows that of the 537 science teachers in the five biggest cities of Missouri in 2005, only 30% were still teaching science in 2014. Less than 1% had switched to teaching math and 9% were teaching in a non-STEM field. Meanwhile, about 61% were no longer teaching in the public schools of Missouri.





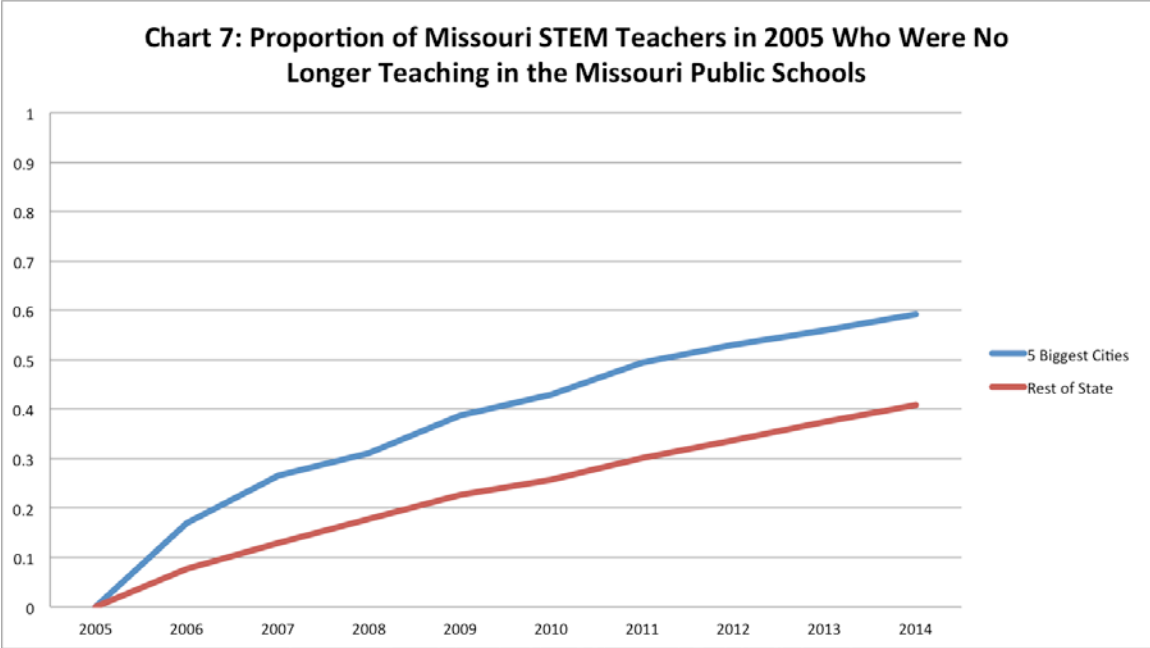
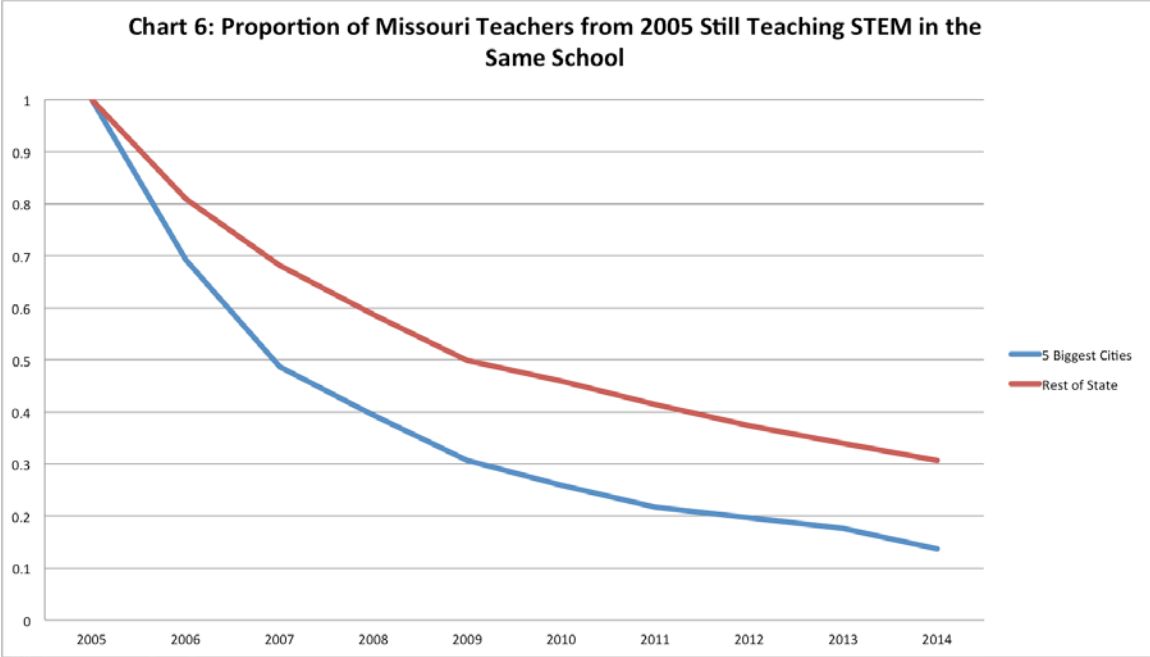
Finally, consider Chart 5, which portrays teacher instability across course assignments, schools, and school districts. Of the 1,149 STEM teachers in 2005, only 157 (14%) were still teaching a STEM subject in the same school in 2014. An additional 10% (115) were teaching STEM in the same school district but in a different school and 6% (76) were teaching STEM in a different school district. Approximately 10% were teaching in a non-STEM field and almost 60% were no longer teaching in the public schools of the state of Missouri.

**Chart 5: Instability Across Course Assignments, Schools, and Districts
Among Teachers Who Taught STEM in the 5 Biggest Cities of Missouri in 2005
(N=1149)**



Instability of STEM Teachers in the Five Largest Cities Compared to Instability of STEM Teachers in the Rest of the State

Schools in the five largest cities of Missouri experienced higher teacher instability than schools in the rest of the state. As shown in Chart 6, after one school year, 69% of STEM teachers who taught in one of the five biggest cities of Missouri were still teaching STEM in the same school but 81% of STEM teachers in the rest of the state (i.e. anywhere but the five biggest cities) were still teaching in the same school. This gap in instability widened over time. After ten years, only 14% of STEM teachers in one of the five biggest cities of Missouri were still teaching STEM in the same school but 31% of those who taught STEM in the rest of the state were. Not only were STEM teachers in the biggest cities less likely to teach STEM in the same school than STEM teachers in the rest of the state, but they were also less likely to be teaching STEM anywhere in the state system of public schools (see Chart 7).



Policy Implications: STEM in the Cities

From the perspective of schools and school districts in Missouri’s five biggest cities, these results are striking if not alarming. After one year, 30% of the math and science teachers were no longer teaching STEM in the same school and district; within two years, less than half of STEM teachers were still teaching STEM in the same school and district.

Instability across schools and districts can be disruptive and costly, even when teachers are still teaching in STEM fields. Central offices and schools must spend money to recruit, interview, and develop replacement teachers annually. When teachers depart from a school, they take the content, pedagogical, and institutional knowledge they have amassed through professional development, mentoring, or classroom experience with them. In the context of this instability, schools attempting to use professional development to improve student learning or school environments will likely fail to create long-lasting changes in teaching practices.

Furthermore, even in cases where the least effective teachers are the ones leaving the profession (Boyd et al. 2008), this year-to-year instability has harmful effects for student achievement (Ronfeldt, Loeb, and Wykoff, 2013). On average, math and science teachers become more effective at positively impacting student achievement as they gain experience (Henry, Fortner, and Bastian, 2012).

Policy Implications: Research and Evaluation

Large-scale randomized controlled trials in school settings have become common over the last decade. Researchers recruit and train teachers within schools to participate in an intervention to improve students' outcomes. When teachers in urban districts vanish from one year to the next, researchers may lose the statistical power necessary to detect an effect of the intervention. It is hard to tell how common this problem is for researchers due to publication bias against studies that fail to find an effect and because many researchers fail to mention how many teachers in their treatment and control conditions have left the school or their teaching assignments within the school. Ideally, with the type of analysis using state longitudinal data contained in this brief, researchers could anticipate the

instability rate of teachers during the design phase of their experiment and plan accordingly.

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