

When Districts Encounter Teacher Shortages: The Challenges of Recruiting and Retaining Mathematics Teachers in Urban Districts

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ABSTRACT

Policymakers, educational administrators, and the public at large all understand that the quality of the teaching force is essential to improving student achievement. Of particular concern is the challenge of staffing the nation's schools with qualified mathematics teachers—a group that is in short supply. The goal of this research study is to document and understand the nature of this staffing challenge and how central office and building administrators in urban districts are responding to it. This article presents preliminary findings from the initial phase of our study, in which we interviewed thirty administrators in six urban districts in the northeastern United States to find out the extent of their problems in recruiting and retaining new middle- and high-school teachers of mathematics, the approaches they have taken to address these problems, and what has resulted from the implementation of these approaches. In analyzing the interview data, we used contextual analysis to understand each district's experience of recruiting, retaining, and supporting new math teachers, as well as cross-case analysis to understand patterns and themes across the districts.

Our findings suggest that the challenge of staffing urban secondary schools with high quality math teachers is quite complex. The administrators we interviewed painted a picture in which supply is tight, demand is high, and competition with other districts for the best math candidates is fierce. Virtually all of them complained about the overall quantity and quality of the pool of secondary mathematics candidates from which they had to choose. However, we also found three sets of factors that exacerbated the staffing challenge and affected how administrators responded to it: policy factors, organizational factors, and administrators' own views of teacher quality and the unique characteristics urban teachers needed in order to be successful. Together, these factors often: (1) restricted district flexibility; (2) made it difficult to hire early, when the pool was largest and of highest quality; (3) reduced districts' competitiveness in terms of hiring teachers; and (4) reduced the number of candidates who were viewed as acceptable (i.e., the effective supply). Despite these challenges, administrators in the six districts appeared to be able to fill the vast majority of secondary mathematics positions with individuals who fit the "highly qualified teacher" provisions of *NCLB*, although to do so they often had to make trade-offs and compromises in terms of the qualities that candidates held. They were also helped by their own initiatives (discussed in a companion article) to increase the supply of candidates, to provide support to new teachers, and to improve hiring practices.

INTRODUCTION

Policymakers, educational administrators, and the public at large all understand that the quality of the teaching force is essential to improving student achievement, and research supports this common sense notion. In reviewing the literature on the impact of teachers on student achievement, Dan Goldhaber (2002) concludes that “most research suggests that the benefit of improving the quality of the nation’s teaching workforce is far greater than other policy interventions, such as lowering class size” (p. 55). Of particular concern to many policymakers and administrators is the challenge of staffing the nation’s schools with qualified mathematics teachers—a group that is in short supply. Several national reports have pointed to the need to increase the pool of highly qualified mathematics teachers as a way to improve mathematics education and have argued that the United States’ economic competitiveness depends on this (National Academy of Sciences, 2007; Glenn Commission, 2000).

The goal of this research study is to document and understand how central office and building administrators in urban districts in the northeastern United States are responding to the challenge of staffing their secondary schools with high quality mathematics teachers. In this article, we examine how personnel in six districts perceive the challenge of attracting and retaining quality math teachers, and some of the dilemmas they face. In a companion article¹, we discuss the combinations of policies, programs, and practices they employ to address this challenge. These two articles present preliminary findings from an ongoing study.

Our findings suggest that the challenge of staffing urban secondary schools with high quality math teachers is quite complex. The administrators we interviewed painted a picture in which supply is tight, demand is high, and competition with other districts for the best math

¹ Working Title: “How Urban Districts Respond to the Challenges of Recruiting and Retaining Mathematics Teachers.”

candidates is fierce. Virtually all of them complained about the overall quantity and quality of the pool of secondary mathematics candidates from which they had to choose. However, we also found three sets of factors that exacerbated the staffing challenge and affected how administrators responded to it: policy factors, organizational factors, and administrators' own views of teacher quality and the unique characteristics urban teachers needed in order to be successful. Together, these factors often: (1) restricted district flexibility; (2) made it difficult to hire early, when the pool was largest and of highest quality; (3) reduced districts' competitiveness in terms of hiring teachers; and (4) reduced the number of candidates who were viewed as acceptable (i.e., the effective supply). Despite these challenges, administrators in the six districts appeared to be able to fill the vast majority of secondary mathematics positions with individuals who fit the "highly qualified teacher" provisions of *NCLB*, although to do so they often had to make trade-offs and compromises in terms of the qualities that candidates held. They were also helped by their own initiatives to increase the supply of candidates, to provide support to new teachers, and to improve hiring practices.

REVIEW OF LITERATURE

Is there a Shortage of Math Teachers?

In a recent working paper, Richard Ingersoll (2006) summarizes his analysis of data from the 1999-2000 NCES Schools and Staffing Survey (SASS) and the Teacher Follow-up Survey (TFS), by stating that:

The data show that the supply of newly prepared math and science teachers is small relative to that of fields such as English. As a result, while the supply of new math and science teachers is sufficient to cover the losses of teachers due to retirement, unlike the field of English, the supply in math/science is not sufficient to cover pre-retirement losses of teachers due to dissatisfaction.

In the same article, Ingersoll reports that in 1999-2000, “62 percent of secondary schools had job openings for math teachers and about 42 percent of these indicated that it was very difficult or impossible to fill these math openings—representing about 26 percent of all secondary schools” (p. 13). This was four times higher than the percentage of secondary schools that found it difficult to fill English openings. In its 2007 survey of university directors of career services and school of education administrators, the American Association for Employment in Education identified twelve fields with “considerable shortage,” the top five of which were mathematics (#3) and four special education areas. Thus, math positions do appear to be more difficult to fill than positions in other subject areas. This was corroborated, in our study, by district personnel who often mentioned the abundance of candidates for other positions compared to the scarcity of math candidates.

The Nature of the Staffing Challenge

Various explanations have been offered as to why school and districts are having difficulty recruiting and retaining quality teachers, and, in particular, quality teachers in mathematics and other high-need subject areas. Some point to the level and structure of teacher pay (Ballou & Podgursky, 1997; Hanuskek, 2001; Odden & Kelley, 1997). The traditional single salary scale, which rewards teachers solely on the basis of educational level and years of teaching experience, does not vary pay to reflect the relative supply and demand of teachers in various subjects. The inability of districts to offer competitive salaries to individuals with strong math backgrounds and who have many career options is viewed as a major problem. Thus, according to this perspective, insufficient pay and incentives are the cause of inadequate supply, and a number of proposals have been offered on how to solve this problem (including increasing

pay for shortage positions, offering hiring bonuses or housing allowances, or granting districts flexibility in placing teachers on the salary schedule).

Another supply-side perspective holds that universities and colleges are producing insufficient numbers of individuals with strong enough mathematics backgrounds to teach math. Some policymakers and analysts in this camp argue for strengthening mathematics teacher education and providing incentives for math students to enter teaching (National Academy of Sciences, 2007). Others take a more deregulatory approach and promote the expansion of alternate routes to certification to increase supply (Thomas B. Fordham Foundation, 1999).

Other researchers and observers, such as Ingersoll (2001), focus more on demand factors. Ingersoll has demonstrated that high levels of teacher turnover play a major role in teacher shortages by increasing demand (or keeping it high). This, he argues, is tied to organizational factors, since many of the reasons teachers leave schools or the teaching profession are related to working conditions, principal leadership style, and lack of support—though salaries and compensation, of course, are also important (Ingersoll, 2001; Smith & Ingersoll, 2004; Johnson & The Project on the Next Generation of Teachers, 2004). Support and working conditions are particularly important, because teachers' career decisions are motivated by both extrinsic and intrinsic rewards (Johnson & Birkeland, 2003; Liu, Johnson, & Peske, 2004; Lortie, 1975), and their ability to obtain the latter are heavily influenced by the conditions that they find within their school and district. From this perspective, greater emphasis should be placed on retaining teachers by improving the support and working conditions in the districts that hire them.

Organizational issues also arise in the area of hiring and human resource systems. Some blame seniority-based transfer rights that are part of the collective bargaining system for hampering districts' ability to hire qualified teachers in shortage areas (Levin & Quinn, 2003). Others, such as Liu and Johnson (2006) and Neild, Useem, & Farley (2005), point to the ways in

which districts organize hiring and the effect that hiring systems have on the matches between schools and candidates. Poor hiring systems may lead to mismatches, which later lead to dissatisfaction and turnover. Many analysts, including those above, point to dysfunctional personnel practices and late hiring as problems that hinder the recruiting and retaining of talent, and argue that improving hiring practices is a key to raising teacher quality.

Administrators' attempts to improve hiring practices, however, occur within the context of federal, state, and district policy. Harris, Rutledge, Ingle, & Thompson (2006) find that principals' hiring decisions are often influenced by external policy constraints, especially those related to teacher certification and tenure. Thus, understanding the role that policy and local context play in districts' attempts to address the math teacher staffing challenge is important.

Over the past few years, there appears to be a growing research consensus around a number of points pertaining to the challenge of staffing US schools with high quality teachers. First, teacher turnover is a main contributor to staffing shortages (Ingersoll, 2001), and, thus, schools and districts need to focus as much on retention (i.e., reducing their demand for new teachers) as on recruitment (i.e., increasing supply). Second, teacher labor markets are quite local in nature. Shortages of high-quality teachers are most pressing in urban, low-income districts, and, as Boyd, Lankford, Loeb, & Wyckoff (2005) have found, teachers seem to have a preference for teaching close to where they themselves grew up (or in similar areas). This may put urban districts at a competitive disadvantage for candidates. Third, patterns of teacher migration also work against poor, urban schools and districts. Teachers tend to migrate away from teaching poor, low-performing, and "minority" children (Hanushek, Kain, & Rivkin, 2001; and Lankford, Loeb, & Wyckoff, 2002) and toward more affluent and homogeneous schools. Fourth, incentives and compensation matter, but so do working conditions (broadly defined) and support (Johnson, 1984; Ingersoll, 2001; Liu et al, 2004; Lortie, 1975).

Although existing research has identified key patterns within teacher labor markets, we do not yet have a clear sense of what drives or accounts for some of these patterns, how they play out in individual districts, or how they apply to the mathematics teaching force in particular. In order to improve our understanding of the school staffing challenge, we need to go beyond describing what is happening to understanding why.

In the initial phase of our study we examined these issues in the context of six urban districts' attempts to recruit and retain secondary math teachers. Our study takes an organizational approach to examining the challenge of attracting and retaining quality math teachers in urban schools and districts. We began the study by trying to understand (a) how central-office and school-based administrators viewed and understood this challenge, and (b) what measures they were taking to address it. We were particularly interested in how various organizational structures or individual assumptions might influence districts' ability to recruit and retain math teachers.

Our study's focus on individuals' perceptions and assumptions, as well as district organization, is important. Although economic models and quantitative analyses of teacher data are important and can identify some key patterns in teacher behavior, it is also important to peer into the "black box" and understand how organizational arrangements and individual assumptions might mediate the behavior of individuals in a very particular type of market.

DATA SOURCES AND METHODS

Sample

In the initial phase of our study, we interviewed thirty administrators in six urban districts in the northeastern United States to find out the extent of their problems in recruiting and retaining new middle- and high-school teachers of mathematics, the approaches they have taken to address these problems, and what has resulted from the implementation of these approaches.

Letters of invitation were sent to the superintendents of the approximately 30 districts in the Northeast that have student populations of 15,000 or more and that have high proportions of low income students. Given the difficulty of getting districts to agree to participate in any study, we did not turn away any districts that granted us permission to study them. However, the sample was purposive; in selecting the districts in which the initial interviews would take place, we were conscious of building a sample that contained urban districts of various sizes and that were situated in a variety of geographic settings. As the first group of districts agreed to participate in the study, we specifically targeted other districts that would round out our sample. We anticipate conducting interviews with administrators from other districts in the future.

The Districts

The six districts that are discussed in this paper include two that have approximately 15,000 students (Armstrong² and Calloway), three that have between 25,000 and 35,000 students (Basie, Dorsey, and Gillespie), and one that has more than 50,000 students (Ellington). In all of the districts but Calloway, students of color comprise the majority of students and at least 65 percent of the students receive free or reduced-price lunch. See Table 1.

Table 1: District Information

	Armstrong	Basie	Calloway	Dorsey	Ellington	Gillespie
Student Population	15,000	25,000	15,000	35,000	> 50,000	30,000
District Demographics	% White	35	20	65	15	15
	% Afr.-American	50	30	< 5	65	45
	% Hispanic	10	45	30	20	30
	% Asian/other	< 5	< 8	< 3	< 3	10
% English Language Learners	< 10	20	< 10	< 10	20	< 10
% Free-reduced lunch	65	70	35	80	75	70
Per pupil expenditures (\$)	12,000	15,000	10,000	15,000	15,000	20,000

Note: Figures provided have been rounded to protect the identity of the districts. Yearly per pupil expenditures are for 2004-2005.

² Throughout this paper, pseudonyms are used in place of the actual district names. Names of great jazz musicians were used as the pseudonyms.

The six districts are located in four states and are diverse in terms of their geographic settings. Armstrong, Basie, and Gillespie are small- to mid-sized urban districts that are part of larger metropolitan areas. Calloway and Dorsey, in contrast, are more isolated geographically and are not in areas dominated by a much larger district. Finally, Ellington is a large urban district at the center of a large metropolitan area.

Data Collection and Analysis

In each district, we interviewed the mathematics supervisor, the director of personnel and human resources, and three principals (usually two high school and one middle school).³ The semi-structured interviews took place between June 2006 and March 2007, and each lasted between 45 minutes and 1 hour 15 minutes. Most were conducted over the telephone, though a small number were conducted in person. All but one of the interviews was audio-taped, and for each interview we created a detailed document that included both verbatim transcriptions of some of the administrators' responses and paraphrases of others. Paraphrases and verbatim quotations were clearly distinguished in the summaries. Unless otherwise indicated, all quotations in this paper are verbatim. We also administered questionnaires to the mathematics supervisors and human resource directors to collect basic information about the districts' mathematics teaching force.

In analyzing the interview data, we used contextual analysis to understand each district's experience of recruiting, retaining, and supporting new math teachers, as well as cross-case analysis to understand patterns and themes across the districts. As a first step, we read through

³ The individuals we interviewed held a variety of administrative titles. To maintain anonymity and confidentiality, we are referring to those interviewed by certain generic titles – such as human resources director, math supervisor, and principal – even though these titles do not always match individuals' actual titles within their district. For instance, administrators who held the titles assistant superintendent of human resources, director of personnel, executive director of human resources, etc., are all referred to as “human resources director.” In one district, two individuals participated in the HR interview, and one is referred to as “assistant HR director.” In districts that had more than one math supervisor, we interviewed the supervisor(s) in charge of secondary mathematics.

the interviews and created narrative case studies of individual districts to help us understand the data in context and to identify relationships between different elements of the administrators' experiences within a particular district. This process also helped us identify emerging themes in our data and to set up the next part of our analysis. This involved analyzing the interview data by coding and sub-coding based on themes that emerged in the case studies, from the interview data itself, and from the research literature. We then engaged in an iterative testing process, moving back and forth between the themes/hypotheses we had identified to the interview data and the case studies. We also created matrices (Miles & Huberman, 1994) to summarize data and facilitate cross-case comparisons.

Study Limitations

Our study has certain limitations. We studied a small sample of districts located in a particular region of the country.⁴ These districts agreed to participate in our study and might represent districts that are particularly well organized and open to scrutiny, though we do not possess any information suggesting that this was the case. Our study also relies on administrators' accounts—their descriptions of policies and practices, and their estimates, recollections, and informed opinions. These accounts may not fully or accurately represent some of the practices of their districts or may be based on limited information. However, we have no reason to believe that the people we interviewed were not knowledgeable or candid about their districts' practices and policies; indeed, we found them to be very knowledgeable about the issues that we were discussing with them and very willing to share with us their experiences, their frustrations, and their challenges. Moreover, we strengthened our findings by triangulating

⁴ The Northeast and Mid-Atlantic are regions that suffer from a “considerable” shortage of math teachers (American Association for Employment in Education, 2007), compared with the more severe shortages that can be found in other, more rapidly growing regions, such as the Far West and Southeast.

data between the multiple interviews within each district, and using later interviews to clarify ambiguities that arose in earlier ones.

Given the nature of our sample and our data, we do not make any claims that our findings generalize beyond our sample. However, we do believe that our data provide a significant window into understanding and appreciating the challenges and efforts at the district level, and they do allow us to engage in theory and model building as well as point to some promising directions for practice and future research.

FINDINGS

Our findings about the staffing challenge are organized around a number of themes: (a) the tight supply, strong demand, and fierce competition for teachers; (b) the role of geography in the hiring challenge; (c) the impact of educational policies on hiring; (d) the effects of district organization on hiring; (e) administrators' views of necessary teacher qualities; and (f) the need for administrators to compromise on teacher hires.

The Surface View: Tight Supply, Strong Demand, Fierce Competition

Our respondents uniformly saw recruiting and retaining quality math teachers as a significant challenge. Administrators often reacted strongly to our initial open-ended question regarding whether finding and hiring good math teachers was a challenge that their school/district faced. As a high school principal in Armstrong put it:

That is about the biggest understatement that I've ever heard [*Laughs*] It is a *huge* problem. And, really, the word "challenge" isn't even sufficient. In fact, we are still trying to hire people even as of the time I am speaking with you [in November].... It's a huge, huge issue for us.

At the surface level, central office and building administrators collectively painted a picture in which supply was tight, demand was high, and competition for the most highly qualified math candidates very fierce.

Supply. A shortage of qualified candidates was almost always the first thing that administrators mentioned when asked about the factors that made finding and hiring math teachers a challenge. Many administrators echoed the Calloway math supervisor's view that "there just don't seem to be many math education majors out there." Human resource directors, mathematics supervisors, and building principals all bemoaned the small pool of math candidates from which they had to choose. As Basie's math supervisor put it, "I don't feel that we have the choices we would like to have." All but one of the districts received two or fewer applications per secondary math opening; the remaining district received three applications per opening.

Respondents had a variety of explanations or hypotheses for the limited supply of secondary math candidates. However, their general explanation was that there were too few math majors to begin with, and that few of these math majors were interested in teaching. Many principals felt that they labored under the additional burden of counteracting negative stereotypes about the challenges of teaching in an urban district. A middle school principal from Armstrong described the difficulty of attracting candidates to his district:

Challenge? It's almost impossible!... Armstrong is a very, very unique place. It's urban but it's not a big, big city. We have our share of problems....It's not that bad. But the image that is out there, it scare[s] people from coming in.

According to a few administrators, middle school openings were particularly difficult to staff. Math educators, in their experience, often preferred to teach high school rather than middle school. As Armstrong's director of human resources put it:

We have even greater difficulty hiring math teachers for our middle schools. If people are interested in our district, and they are interested in being math teachers, they usually want

to be math teachers at the high school level. Even more difficult for us is finding *highly qualified* math teachers for our middle schools.

Basie's human resources director concurred, stating that "middle school is the hardest to try to find."

The supply of potential math teachers was further limited by the frequently expressed perception that many otherwise "qualified" teachers did not have the additional qualities that they needed in order to be successful in urban classrooms. For example, the math supervisor in Dorsey noted that few candidates "have any experience working in an urban district, for example, through student teaching." This is discussed in more detail in the section on "Administrators' Conceptions of Teacher Quality."

Demand. Although the small candidate pool seemed to be the first thing that came to administrators' minds, demand factors were also mentioned. Each of the districts needed to fill between 13% and 23% of their secondary math positions in each of 2005-2006 and 2006-2007. (In general, the larger districts in our sample replaced a higher proportion of their teachers each year than the smaller districts.) The administrators were most likely to point to retirements, increases in the number of math classes taught (due to higher enrollments or increased requirements), family leaves, and dismissals (involuntary terminations) as the main factors driving their need to hire these large numbers and proportions of math teachers. Although there is a perception that many teachers voluntarily leave urban schools for suburban schools, our interviewees were somewhat less likely to mention voluntary departures as a major driver of demand, though this certainly played a role. Overall, only in three of the six districts (Basie, Ellington, Gillespie) did administrators feel that teacher turnover was a major challenge. In two others (Armstrong and Calloway), administrators felt that they did not have a retention problem

and were doing a very good job keeping teachers once they hired them; and in the remaining district (Dorsey), administrators' perceptions about retention were somewhere in between.

Some administrators distinguished between retention and turnover. As the secondary math supervisor in Ellington put it:

I don't think we have a problem retaining people we want to retain. We have a problem with turnover, but I'm not sure we have a retention problem, and that's a very important distinction that is seldom made. When we find good teachers, they stay with us, with the possible exception of the kind of life changes that everybody has. But we have very few math teachers that we lose who we think are terrific and go off to someplace else because they don't like us.... Generally speaking, the ones we want, we keep. The larger problem is people that we're marginal on or worse, and they're marginal on us... [people] that, in our heart, we never really believed in, or who, truth be told, never really believed in.

It is noteworthy that although this district had been replacing more than a quarter of its secondary math teachers each year, this administrator did not see the district as having a retention problem.

In part, this was because he defined retention in terms of keeping the teachers they really wanted to keep, and in terms of keeping teachers who were perceived as keepable (i.e., who were leaving for reasons that the district might be able to influence). Two of Ellington's administrators appeared to view some of the turnover as inevitable because many of their new hires were graduates of local universities but were not local to the city, and many of them could be expected to leave the district eventually and return to their home communities.

In some districts, demand was also driven by policy and organizational decisions, which we discuss later in the paper.

Competition. Administrators described fierce competition for math candidates, and saw this competition as limiting both the number of applicants they received as well as their ability to convince applicants to accept job offers. Competition took two forms: external competition with other districts and internal competition between schools within the same district.

The administrators we interviewed frequently mentioned competing with other nearby districts for math candidates. Everyone was looking for math teachers, they told us—urban and suburban districts alike. Most administrators saw themselves at a competitive disadvantage, particularly in terms of the salary and benefits that they could offer. As a middle school principal in Gillespie observed, “We’re competing with other districts. Other districts offer more in terms of the contract—they offer more benefits, more money, or bonus money—particularly for math and science teachers.”

Principals and central office administrators frequently described losing their most highly qualified candidates to other districts. For instance, Armstrong’s high school math supervisor described being unsuccessful in landing any of his top four math candidates: “I’ve actually recommended four candidates for hiring, who have taken jobs in other systems. They were obviously the most qualified, and now we’re sort of going down to step two and are still trying to fill three positions that are vacant.” Dorsey’s math supervisor also mentioned the urgency that inter-district competition caused, saying that “the sooner you can act and get people signed to contracts, the better off you’ll be. Otherwise, they’ll latch on to other districts.” Given these experiences, it is not surprising that a good portion of the recommendations that administrators had for improving their district’s success in recruiting and hiring math teachers centered around increasing salaries and benefits (such as tuition reimbursement), granting flexibility in negotiating salaries, or offering bonuses for shortage subjects.

One possible indicator of the fierceness of the competition was that eight administrators in our sample described candidates’ renegeing on their job offers—i.e., breaking contracts that they had already signed—in order to accept teaching jobs elsewhere. For instance, one Armstrong high school principal explained that:

They sign the contract... [So], we're not looking anymore; we think we're all set. And, then, a week before school opens, they say, "Oh, you know what? I accepted a job somewhere else." What I wish is that superintendents would band together and say, "We will not do this to each other." But everyone is like vultures, and so the person gets stolen [from] underneath you.

Although we do not have a good sense of how prevalent this scenario is—our impression is that it isn't too common—it does suggest that candidates know they have the upper hand in the market, i.e. that they are in high demand and have many options.

The other type of competition that administrators (usually the principals) described was competition among schools within the same district for math candidates. One Gillespie principal explained, for instance, that, "As a principal, you're in competition with other high school principals because everyone is given the same list. The candidates might be interviewed by all [of the] principals, so it might be whichever one they are offered first. If a principal puts in a hiring request, the one that gets submitted first to HR would get the position [filled]." Similarly, a high school principal in Dorsey observed that for math, as well as other subjects, "it's very, very competitive with other schools in our district trying to get quality teachers hired."

As we talked to principals, we began to hear about these sorts of situations and revised our interview protocols to ask specifically about internal competition and how it was managed and adjudicated, if at all. This issue of internal competition was related to how centralized or decentralized the hiring process was within a district. Although decentralized, or school-based, hiring has the advantage of allowing principals to choose teachers who would best fit their schools, it also creates the possibility for intense competition between schools within the same district. We found some evidence to suggest that such hiring systems might disadvantage certain schools and lead to staffing inequities. In other words, the schools within a district that had the highest-need student populations, that were seen as the most challenging places to work, or whose principals were least adept at hiring might have a difficult time getting good math

teachers. Most of the districts did not seem to have adequate procedures in place to ensure that staffing inequities would be avoided or at least minimized.

The Role of Geography

Administrators' comments about supply, demand, and competition were often sprinkled with references to geography. They frequently mentioned geographic location as a factor in explaining their district's situation vis-à-vis the math staffing challenge. Location influenced the pool of applicants available to them as well as the competitive dynamics they faced. Relative isolation could be both a blessing and a curse. So could being part of or near a major metropolitan area. Across the six districts in our study, we saw three distinct district experiences related to geography.

Life on the Urban Fringe: Armstrong, Basie, and Gillespie. Three urban districts in our sample were situated inside or on the edge of the greater metropolitan area of a much larger city. What this meant was that they often competed for math teachers with both a much larger urban district at the center of the metropolitan area and nearby suburbs and towns that were usually more affluent. As an administrator in Basie explained, "We're in competition with very high ranked school districts [nearby]. Those districts also need math teachers.... Not only do we find that teachers who are highly qualified go to these districts, but we lose our own teachers to them." The districts to which he was referring often paid considerably more. One high school principal in Basie mentioned that "a young man just took a \$17,000 pay increase to go up the line."

The districts on the urban fringe lost candidates not only to suburban districts but also to the larger urban district nearby. An Armstrong high school principal put it most succinctly when she said that even when they find candidates who do want to be in urban education, "we have to

compete directly with [named district], and that breaks us because [named district] outpays us huge—and they even do a signing bonus.” She mentioned that they try to compete in terms of nonfinancial factors, but this has had only moderate success: “We try and provide a lot of attractive features to people in terms of scheduling and classes and mentors, and all that, but the bottom line is that...they have choices, and money often is the variable that helps them make the [choice].”

Gillespie’s situation was somewhat similar to those of Armstrong and Basie, but the district is situated much closer to the center of the local metropolitan area. It directly abuts the large city dominating the local region, and the districts on its other sides are also quite urban in character. Gillespie’s experience points to one of the compensating advantages of being part of a larger metropolitan area: an attractive location and a larger potential supply of candidates. The local region contains many universities, is a commercial hub, and is a magnet for young people. A recruiter for Gillespie mentioned that when talking to candidates from out of state, she “plays up” the proximity to the large city and all that it has to offer. The district also tries to sell the diversity of the city of Gillespie as well as the nearby large city.

Stand-Alone Urban Districts: Calloway and Dorsey. Two districts in our sample were more isolated than the districts discussed above. In many ways, what Calloway and Dorsey experienced was the reverse of what the “urban fringe” districts did. Isolation meant they were relatively shielded from competition from other districts, and they had a less transient teacher population. While they certainly competed with nearby suburban districts for math teachers, administrators tended not to describe the same sort of competitive frenzy as did the administrators in districts located in larger metropolitan areas. Many of the teachers they hired had local roots and were not likely to leave the region, and, overall, both districts reported being relatively successful in retaining teachers. As one Calloway principal explained about his school:

We don't get a lot of teachers who, after a year or two, say, "You know, this just isn't for me. I'm going somewhere else; or I'm leaving teaching; or I'm going to another school." Once they're here, they pretty much, as we like to say, get infected with the [name of school] spirit.

The challenge facing these districts tended to be with the overall supply of potential math teachers. Both districts plumbed local labor pools and tried to develop strong working relationships with local colleges and universities. They also recruited out of state and even in Puerto Rico. Yet there was some question in the minds of administrators about whether recruiting from far away was worth the expense. Dorsey's math supervisor observed that her district "struggles with bringing people in from a distance. That has not been successful...Our rate of bringing people in from other cities was not good at all." And referring to the cold climate in the Northeast, she added with a bit of lighthearted sarcasm, "I don't know why they wouldn't ever want to come to sunny, tropical Dorsey."

Life in the Center: Ellington. The largest district in our study, Ellington, is the commercial and cultural center of a large metropolitan region. Being a large urban center meant having many universities that drew students from far and wide. However, according to Ellington's secondary math supervisor, the pool of certified math majors was still too small. He explained:

The majority of our hires are not Math Ed majors....The schools just are not graduating that many... And the other factor...is that a substantial number of folks who come to Ellington area institutions of higher education are not local to Ellington, and many of them return to their home states or communities and work there.

Thus, the large supply of young, highly educated individuals was somewhat of a mixed blessing, because this population was also mobile and transient. This applied both to districts such as Ellington that were the center of a major metropolitan areas, and districts such as Armstrong, Basie, and Gillespie that were located on the edge of these areas.

Policy Factors

A number of policies appeared to influence the nature of the staffing challenge facing administrators, as well as how they responded to the challenge. These included *No Child Left Behind (NCLB)*, alternative certification programs or accelerated routes to teaching, and an increased reliance on state budgets for educational funding (as is the case for many urban districts). Four administrators also mentioned early retirement incentives as a factor driving retirements and increasing demand for new math teachers.⁵

NCLB. The highly qualified teacher (HQT) mandates of *NCLB* required that, by the end of the 2005-06 school year, all teachers of core academic subjects must: (1) hold a bachelor's degree; (2) obtain full state certification, which could be alternative certification; and (3) demonstrate subject-matter competency in the core academic subjects taught. Most of the districts in our study were in the midst of a one-year extension that the federal government had provided to several states that had showed sufficient progress towards meeting the mandates of *NCLB*.

The HQT mandates of *NCLB* affected the work of administrators in a number of ways. First, the HQT requirements restricted the supply of candidates and also reduced administrators' flexibility in hiring. As one Calloway principal put it,

With *NCLB*, we can get docked if we don't have highly qualified teachers, which wasn't the case, you know, 10 to 12 years ago. We've lost out, to a certain extent, on some people that I think were going to make great teachers or maybe already are teachers but just in a different [certification] area. But that's part of what we have to put up with and we have to work through. It's been frustrating for me at times, but, in the long run, I understand that the goal of the district is for everyone to be "highly qualified."

In most cases, administrators would not consider candidates who did not already have iron-clad certification. Some of the effects of this response to the *NCLB* mandate were rather subtle. For

⁵ Three out of the four states in which the participating districts were located had passed early retirement incentives in recent years.

instance, in the past, administrators might hire a teacher whose certification status was not entirely in order but whom they expected would soon be fully certified. This might include:

- teachers who held certification in another state and were in the midst of applying for in-state licensure through reciprocity agreements,
- teachers who were already certified in another subject but who were just a course or two away from receiving a math endorsement, or
- students graduating from teacher education programs who had yet to pass their state teacher exams.

Now, however, administrators shied away from or completely avoided making these types of hires. Asked whether the requirements of *No Child Left Behind* had, in any way, affected how she approached the hiring of new teachers, Dorsey's human resources director replied:

Absolutely. You could criticize it or you could laud it, but we believe very firmly that we need to follow requirements of *NCLB*. I won't bring in a person in on a contract if they're not certified—will not do it. I know when they are taking their test; we're waiting for people to get that final score, sometimes. There is nowhere to go but there. We just don't see how we can operate if we're not doing the mandate.

In the past, the district "used to have a cadre of people" who served as substitutes because they were missing something in terms of their certification. If a position ended up being unfilled by the end of the summer, she and the Dorsey principals would often turn to this group to fill the position for the year. This past year, she ended this practice.

Licensure was a major preoccupation of administrators and of human resource directors in particular. Asked what characteristics and background factors were most important in hiring a math teacher, Armstrong's director of human resources responded, "Licensure, licensure, licensure." Ellington's assistant director of human resources explained that, "the whole highly qualified requirement is really changing the mentality and changing the way we're recruiting."

By this, he meant that his office was emphasizing to principals that they needed to ascertain the certification status of a candidate early on in the recruitment hiring process.

A second way in which *NCLB* affected districts was by raising the specter of having to replace current math teachers who, under the policy, were no longer considered “highly qualified.” This was especially an issue for the middle schools, where some math teachers were currently teaching under general K-6 or K-8 certificates and did not hold subject-area certification. The middle school math supervisor in Gillespie described a training initiative that the district had put in place to help current middle school teachers get certified in mathematics, without which the district’s situation would be more dire:

If a lot of our teachers were not pursuing the middle school math cert[ification], then there would be a mass exodus from 6, 7, 8, and then we’d have a massive shortage. Since a lot of them are doing that and they are getting ready, that’s going to cut down on the need to hire.

Alternative Certification. The urban districts in our study were located in states that had alternative certification programs, which increased the supply of math candidates available to schools and districts.⁶ Although, in general, administrators greatly preferred hiring teachers who had traditional preparation, they often had no choice but to hire alternatively certified teachers. Of the six districts, Armstrong and Gillespie relied the most on alternatively certified teachers; approximately 50 percent of Armstrong’s new math hires came from this source, and between 25-40 percent of Gillespie’s did. Ellington also hired a fair number of teachers without traditional preparation, including candidates from the district’s own alternative certification program. Some administrators did feel, however, that many of the alternatively certified math teachers were only capable of teaching the curricula in the lower grades (i.e., Algebra and Geometry at the high school level), and that few had a deep enough knowledge of content or

⁶ One state in our study had very loose requirements for getting a provisional teaching license: teachers could receive it just by holding a bachelors degree and passing a state literacy and content-area exam.

pedagogy to teach the more advanced math topics. According to this view, then, alternatively certified teachers were not perfect substitutes for traditionally certified teachers.

Increased Role of State Funding – Over the past decade, state and city governments have come to play a bigger role in contributing to or actually setting district budgets. Urban districts, in particular, tend to receive a higher proportion of their funding from these sources, since they are often the recipients of compensatory education funds or, in some cases, have been taken over by the state. As a result, urban districts may be disproportionately affected by delays in state or city budgets which can, in turn, negatively affect their hiring timetables. Basie’s math supervisor described the problem:

Our funding does not come from direct voter property taxes.... Instead, it is determined by City Hall, and what we receive from the state, and what we receive from grants. And this has an impact on teacher contracts, and who is hired, and when they are hired. I know that in other school districts, notices go out in the newspaper starting in January.... We’re just beginning to interview candidates [in June], and we’ll probably be doing that up until two days before school begins.... And that’s because there is a delay in settling the budget.... These are all [factors] that have an impact on the hiring of good math teachers.

A principal in Dorsey had a similar observation. He reported that staffing decisions could not be made until the state budget was set. When the budget was on time, he could usually start interviewing candidates in February or March. However, sometimes the state legislature did not finalize the budget until April or May.

Organizational Factors

Organizational decisions, structures, and processes also shaped the challenge and affected administrators’ ability to respond to it. These organizational factors fell into two areas: instructional decisions and hiring processes.

Instructional decisions. Districts’ decisions regarding how to organize instruction impacted the number and types of teachers they sought. For example, some districts and

individual schools responded to pressure to raise math scores on state assessments by reducing the size of math classes or by having struggling students take two math classes simultaneously. This obviously increased the number of math teachers that they needed.

The creation of new instructional leadership roles also contributed to the need to hire math teachers. For instance, Armstrong created two new instructional leadership roles—one based in the schools and one based in the central office—as part of the district’s improvement strategy. These positions were filled by experienced math teachers from within the district, whose schools then had to hire replacements.

The district’s choice of math curriculum could also have an impact on the staffing challenge. Different curricula placed different demands on teachers, which influenced the qualities that administrators looked for in candidates. For instance, Armstrong’s middle school math supervisor, whose district used the *Connected Math* program, explained that:

The fact that we’ve moved to a standards-based type program makes it a little more difficult, because the level of expertise that we need for people is even greater. They need to have a great deal of flexibility in their thinking, and a great base of content knowledge in order to function well in a standards-based classroom.

Thus, Armstrong and most of the districts in our study faced a double challenge. Not only did the districts need to hire more middle school math teachers within a shortage context, they also needed teachers with a greater skill set in order to implement a reform math curriculum at the middle school level.

The Organization of the Hiring Process – According to respondents, the timetable of the hiring process played a significant role in their ability to attract and land desirable candidates. Many administrators felt their districts were relatively successful in hiring quality candidates if and when they were able to hire early. However, when, as more often was the case, they hired late, they lost many of the best candidates to other districts. As time passed, the pool shrank in

both quantity and quality. Dorsey’s math supervisor explained that, “If we’re going to hire some math teachers we have to hire them early, because by the time you get to August 1st, the pool is very, very small.” A Calloway principal agreed, stating that, “If you’re trying to hire someone in mid-August, the best candidates will already have jobs.” Unfortunately, several of the districts were still trying to hire math teachers in August. Basie and Gillespie, in particular, hired quite late.

Several factors contributed to the late hiring, two of which have already been mentioned elsewhere in this paper: delayed budget decisions and, to a lesser extent, candidates’ renegeing on signed contracts. In addition, veteran teacher transfer provisions in the district’s collective bargaining contract sometimes slowed down hiring, although this did not have as much of an impact as we expected.

Despite the fact that the excess and transfer system⁷ is often pointed to as a main constraint on districts’ ability to hire whom they want and to do so in a timely manner, very few administrators in our study, when asked, saw this as a significant factor. Only in Basie did the need to accommodate seniority-based transfers play a major role in delaying hiring; there the district was obligated to complete three rounds of internal postings before candidates from outside the district could be considered and hired. In two other districts, Dorsey and Ellington, the transfer process did slow down hiring, but its impact had been greatly reduced over the past few years. In the three other districts, administrators said that they were in no way contractually bound to honor a veteran teacher’s request to transfer schools or change positions. Thus, across

⁷ The transfer system refers to a system in which teachers already working in the district can request a transfer to another school that has an opening. The excess system refers to the system by which tenured teachers whose positions have been eliminated (either due to changes in enrollment or in academic programming) are placed in new positions since they have guaranteed employment in the district. These two systems may be linked or may operate separately. Also, districts vary in terms of the role that seniority plays in determining whose transfer request gets approved or where “excessed teachers” are placed.

the six districts the seniority system appeared to have a rather limited impact on administrators' capacity to hire quality math teachers.

Delays also resulted from the length of time it took for the human resources office to make and finalize job offers. District human resource (HR) offices varied in their ability to make a speedy offer once a school decided it wanted to hire a certain candidate. The smaller urban districts tended to be a bit nimbler than the larger ones. Not surprisingly, HR directors and principals often had somewhat different perceptions of the responsiveness of the HR office, though all seemed to recognize the need to move quickly to hire teachers in shortage areas such as math. Principals were often frustrated by how long it took to finalize a job offer and get the contract signed and approved. A principal in one of the larger districts explained:

The process takes too long. It can take anywhere between 2-3 months.... It has to go to Board meetings in order to be approved. If it doesn't make a cut-off for the Board meeting, it gets extended to the next Board meeting the following month. It can be delayed. And then so many associate [superintendents] have to sign the recommendation [to hire]. It's a long process. Sometimes you lose candidates that way, too.... People get discouraged; they don't want to wait that long.... They get offered other positions.

In contrast, in one of the smaller districts, one middle school principal described a relatively nimble response from the central HR office after being informed about a desire to hire a candidate: "With math people, they [complete the paperwork] pretty quickly, because they know it's important. They have made offers that afternoon." The efficiency of human resources offices thus seemed important to principals' ability to hire the candidates they wanted.

The length of the work-year for principals also seemed to influence hiring activity. In at least two districts, Armstrong and Basie, principals were not contractually obligated to work through the summer. They left for the summer a few days after the teachers left, and returned a few days earlier than the teachers returned. If they were not able to fill a position by June—as was likely the case in both districts—then they sometimes waited until the week before school

started to fill it. Earlier hiring seemed to depend on principals' willingness to come to school over the summer on their own time to interview candidates; it is reasonable to assume that those that did were more likely able to hire suitable candidates, while those who waited were more likely to have a greater challenge.

Finally, the division of labor and decision-making authority between individual schools and central office also appeared to affect principals' efforts and how they experienced the challenge. The organization of the hiring process influenced the amount of initiative principals could take on their own, the amount of communication and coordination that had to occur between HR and individual schools, and the amount of internal competition among schools for the best math candidates. Some districts managed the tension between centralization and decentralization quite well and reaped its benefits (e.g., benefiting from efficiencies while also providing principals with flexibility and autonomy), while in other districts the tension often resulted in bottlenecks and delays that hampered the hiring process.

Administrators' Conceptions of Teacher Quality

Administrators' own conceptions of what it means to be a high quality candidate and what it takes to teach mathematics successfully in an urban setting also contributed to the challenge, for their list of desired characteristics and criteria was quite long and very difficult for any one individual to meet. To start off, an ideal teacher candidate would have to be certified, have been prepared in a university-based teacher education program, already have teaching experience, and have classroom management skills, a deep understanding of math content, pedagogical content knowledge, and pedagogical skills such as the ability to promote active learning in classrooms as well as the ability to differentiate instruction. In addition, administrators appeared to have a set of extra characteristics or background factors that they saw

as necessary for successful teaching in *urban* schools. These included a commitment to urban education, interpersonal skills (including the ability to communicate and relate to urban children), a background in urban education (including an understanding of the lives of urban children and experience growing up or working with children in urban settings), and certain personal skills and dispositions that would enable the teacher to handle working in an urban district. These dispositions included persistence, flexibility, and what one administrator referred to as being “low maintenance”—i.e., having the willingness and strength to do one’s job despite the hurdles and indifference presented by the district bureaucracy. None of the respondents actually mentioned all of these characteristics in one breath. However, they often mentioned a significant subset of them.

The Hiring Dilemma and the Need to Compromise

In reality, urban administrators rarely found individual candidates who had what one referred to as the “whole package” of necessary and desired qualities, particularly in the shortage context. They had to reconcile their perception (and the likely reality) that teaching in urban districts was much more difficult than teaching in suburban districts and required a longer list of skills, abilities, and experiences, with the reality that they often had fewer teachers to choose from. If they held out for the entire list of desired criteria, they might be on an impossible quest and they might be further shrinking their effective supply of candidates. However, if they did not ensure that a candidate had enough of what it took to reasonably succeed, they would likely be in the situation, quite soon, of having to replace the individual and rehire for that position (either because of voluntary departure or dismissal). One high school principal in Basie found himself caught in a revolving door. He was fully aware that, because of the small candidate pool,

Some of the people who I am getting now, in an attempt to hire people and fill gaps, are not making it past the first or second year because of performance. So, what I am being

forced to do is to hire and bring in candidates or teachers who are less qualified than they need to be. Consequently they can't do the job and are let go after a relatively short period of time.

Administrators thus often found themselves in the position of having to compromise and make difficult tradeoffs in hiring math teachers. Sometimes these compromises could be quite wrenching. When there was a great shortage of candidates and/or it was near the start of the school year, finding any certified teacher often became the sole focus. As a high school principal in Armstrong described,

The challenge is when it is late summer and we just can't get anybody for an empty position, and we are desperate enough to hire a less than qualified teacher. I've had to say, "Are we this desperate?" I grew up here and I picture those kids in their classroom and look at their faces and think, "This is not fair!" Even if it does not happen often, even if it happens once, it is once too many, because it is not about statistics, but about the students whose education will have been stolen away from them by this less than qualified candidate.

It should be noted that in the *NCLB* context this comment refers to a teacher who on paper is "highly qualified," but from the principal's perspective is still not qualified to teach her students.

How Administrators Approached Compromises. When we asked administrators how they made these difficult tradeoffs in hiring math teachers, their responses often reflected their views of teaching quality, in terms of the characteristics they saw as most important for successful urban teaching, the characteristics they saw as ascertainable from an interview or other data sources, and/or the characteristics they felt they as an individual and organization could most easily compensate for by offering training and support. For instance, Armstrong's middle school math supervisor explained that she would choose a candidate who was slightly stronger in classroom management skills and more experienced, but who was weaker in math knowledge, over a candidate who was slightly stronger in math knowledge but weaker in classroom management. As she put it, "If you don't have management [skills], it doesn't matter how much content knowledge you have." In deciding whom to hire, she bet on classroom

experience and management skills in part because she saw an orderly and positive learning environment as an important prerequisite for effective teaching and also because she felt the district could compensate for a lack of content knowledge by providing support and training. Implied in her response was her view that classroom management and interpersonal skills were harder to “teach” to teachers than math content.

Toward a Conception of Teacher Quality as an Organizational Characteristic. Our findings about administrators’ views of teacher quality and the compromises forced upon them by the realities of teacher shortages are perhaps our most interesting. Other researchers, such as Harris et al. (2006) have also documented this need to compromise. However, from what we learned from interviewing administrators, we are starting to develop a new framework for understanding teacher quality as an organizational and not just an individual characteristic. We might conceptualize teacher quality as stemming from the interaction and alignment between the individual teacher (their skills, knowledge, dispositions, and experience), the teaching technology (embodied in the curriculum as well as the instructional models and scripts), and the structure, norms, and practices of the organization. Changes in one of these three areas have implications for the others.

In Armstrong, for example, we saw how the adoption of a reform as opposed to a traditional math curriculum had implications for the specific skills and abilities that a mathematics teacher needed to have. Armstrong’s middle school supervisor placed such an emphasis on classroom management in part because the type of investigatory mathematics her district’s curriculum promoted worked best with a more fluid, student- centered classroom environment. Creating such an environment was difficult and, she believed, required strong classroom management skills. Thus, in this case, the “teaching technology” that a district utilized had implications for the profile of a qualified or high quality teacher. The skills, knowledge, and

dispositions it takes to successfully teach one type of curriculum can often be quite different from what it takes to successfully teach another type.

We also saw some examples of how organizational structures and practices could support quality teaching and affect the profile of what constituted an acceptable teacher candidate. Organizational structures play a role in terms of how the job of teacher is defined and what sorts of organizational and social resources are in place to support the teacher, and this also has implications for the skills and dispositions that individuals need to have in order to teach successfully. For example, if the school builds a positive culture and has strong school-wide procedures that make classroom management less dependent on individual teachers, then perhaps administrators might reasonably trade off classroom management skills for deeper subject matter expertise in their hiring decisions.

What we are suggesting is that teacher quality may reside in or be built into various parts of the system. The skills, knowledge, and dispositions that individual teachers have are certainly essential components of instructional quality, but so are a school and districts' curriculum and pedagogical approaches, as well as their organizational structures, norms and practices. In addition, the alignment between the districts' approach to teaching mathematics, the types of teachers it hires and develops, and how its schools are organized and run may play a big role in determining teaching effectiveness. Our emerging theory seems consistent with Stigler and Hiebert's (1999) view that school improvement should focus not so much on teachers as on teaching. By this they meant that we should focus not so much on individual teacher characteristics but on the prevailing instructional scripts and techniques that they use. These scripts, in a sense, are part of the teaching technology. We extend their argument to say that it is not just the teachers that are important, but the teaching and the organization.

SUMMARY AND DISCUSSION

The challenge of staffing urban secondary schools with high quality math teachers is quite complex. As we fully anticipated, the administrators we interviewed painted a picture in which there was tight supply, high demand, and fierce competition with other districts for the best math candidates. Virtually all of them complained about the overall quantity and quality of the pool of secondary mathematics candidates from which they had to choose. However, we also found a number of additional factors that shaped the nature of the staffing challenge facing individual districts, as well as how administrators viewed and responded to it.

We found, for instance, that districts' experiences of the staffing challenge appeared to relate to geography. Geography appeared to determine the pool of math candidates available to districts and the competitive dynamics they faced. It also appeared to be related to the transience and mobility of the labor pool. Obviously, geographic location is not something that district leaders can change. However, understanding one's geography and local context might help policymakers and administrators determine which recruitment, hiring, and retention strategies make the most sense for them—e.g., how much they should invest in recruiting from far away versus how much in developing local sources of teachers.⁸

We also identified a number of policy factors that shaped administrators' experiences and their work. It is clear, for instance, that *No Child Left Behind* was having an effect, and that districts were responding quite strongly to the legislation's teacher quality mandates. *NCLB* appeared to reduce the supply of hireable candidates and to reduce administrators' flexibility. Districts concentrated on finding and hiring certified candidates (even if they had specific uncertified candidates who they thought would be successful teachers). Whereas *NCLB* restricted

⁸ For researchers, our findings raise the possible relevance of Merton's (1957) classic distinction between "locals" and "cosmopolitans" in terms of understanding teachers' career decisions or in terms of understanding how districts' human resource efforts might have to be different to address the different orientations of these two groups.

the supply of math candidates, the presence of alternative certification programs increased the supply. However, administrators greatly preferred to hire traditionally prepared and certified candidates, when possible.

We also found that the increased dependence of some urban school districts on state funding clearly affected their ability to hire math teachers. State budget delays made it difficult for districts to determine staffing levels and delayed the teacher hiring process. In one state, the largest urban districts (but not other districts) were even precluded, by law, from proposing emergency school budgets to be voted upon by local taxpayers in the event of a state budget delay or shortage. These findings suggest the need for policymakers to revisit some of the unintended consequences of their legislation.

Districts in this study did not seem to have as much of a problem with retention as we had anticipated. Indeed, most of the districts administrators indicated that they were able to retain the teachers that they wanted to keep, and primarily had a problem because they had hired teachers who were unable to succeed in an urban math classroom. Their problem with retaining math teachers was more turnover of unqualified teachers than loss of qualified teachers to the suburbs. Districts in or near large metropolitan areas, whose universities attracted students from other locations, found that when they hired recent graduates, they often left after a few years to return to their home communities.

We found that organizational decisions, structures, and processes both contributed to staffing challenges and affected administrators' ability to respond to them. Decisions on how to organize instruction influenced the numbers and types of teachers administrators sought to hire. For example, decisions to reduce the size of math classes, to have low performing students take two math classes simultaneously, and to promote math teachers to newly created instructional leadership roles, all increased demand for math teachers. In addition, districts that adopted

reform curricula sometimes found that teachers who had the additional skills needed to teach math using those curricula were harder to find. More generally, according to the administrators interviewed, urban math teachers needed skills beyond those required of math teachers in general, and that narrowed the pool of math teachers who had the potential to be successful in urban districts.

The organization of the hiring process also shaped administrators' ability to meet staffing challenges. Although district human resource practices were sometimes constrained by policy factors, there was a great deal that HR offices could do to improve how they and the individual schools recruited and hired math teachers.

Categorizing these factors in terms of whether they pertain to geography, policy, or organization is useful, because it helps practitioners, policy makers, and researchers understand at what levels certain factors are operating and where interventions might productively be targeted. In other words, it can help locate responsibility for various conditions, and distinguish between the factors that districts and administrators have direct control over, the factors they may need policy makers to help them address, and the factors that they may simply need to be aware of, such as geography, even though they have no opportunity to modify them.

As we discuss in the companion article, our findings also suggest that organizational decisions do matter. Although districts and schools are certainly affected by broader economic and demographic factors that are very powerful, what we have found suggests that the decisions and actions taken by district and school-based administrators can have an effect, and perhaps a major effect, on the recruitment and retention of math teachers. The administrators we interviewed had considerable agency.

Districts and administrators adopted a number of different strategies for coping. In each of the six districts, we found practices and reforms that held promise, and we heard about some

recent improvements that helped make the situation better than it otherwise would have been. These strategies fell into four broad categories that are discussed in detail in the companion article.

I. Increasing Local Supply. Some districts attempted to increase their supply of teachers by developing partnerships with local colleges, whereas others focused on growing their own math teachers by initiating programs that would lead to certification.

II. Flexibility in Pay and Incentives. In all but one of the districts, administrators had managed, “despite the ... rules and bureaucracy of the organization”, to increase the competitiveness of their compensation packages.

III. Providing Supports for New Teachers. Districts provided a variety of support program to new math teachers. In at least two districts, administrators attributed their relative success in retaining teachers to their comprehensive support programs.

IV. Improving Human Resources Practices. Although districts operated under many constraints, they reported making changes that allowed them to start the hiring process earlier, process applications more efficiently, improve communication between schools and district officials, and extend job offers on a more timely basis.

An important finding of this study was that the district personnel were very aware of the challenge of attracting and retaining high quality math teachers, took it very seriously, and seemed to be working diligently to develop policies and practices that would help them meet this challenge. In at least five of the six districts, progress was being made, and a number of promising practices have been instituted. Indeed, despite the challenges that they faced in hiring math teachers, each of the districts succeeded in filling virtually all of their openings with “highly qualified” math teachers. This finding was interesting and surprising. However, some of these teachers were hired with the expectation that, although they were “qualified” according to

NCLB, they might not be able to succeed as urban math teachers; administrators were well aware that “highly qualified” did not necessarily mean “high quality.” It was also interesting that the administrators felt that math teachers needed additional qualities to succeed as urban math teachers, and they felt that they were generally able to retain the teachers that they wanted to retain.

Finally, our findings suggest that viewing teacher quality as residing solely in individuals may limit the options available to districts, administrators, and policy makers. Rather, it might make better sense to look at teacher quality as stemming from a complex system in which teachers, instructional policies, and organizational structures interact with one another. Although administrators and policymakers should continue to work to increase the supply of candidates through offering incentives or training their own teachers, and improve their human resource practices so that they can hire the best available candidates, districts should also consider how they can build quality into other parts of the system. Administrators might ask themselves, “Given the local pool of teacher candidates and what skills are most and least prevalent, and given my math curriculum and its pedagogical approach, what characteristics are most important for me to select for (i.e., emphasize and make a prerequisite for hiring), and what characteristics might I be able to give less weight to, because our schools have structures in place to compensate for or remediate teacher weaknesses in this area?” Or looking at it from a different perspective, they might ask, “How can the district and individual schools create organizational structures and resources or establish norms that support and/or compensate for skills and knowledge that are in short supply among the local pool of candidates?” Answering such questions may reduce the burden of trying to find the perfect candidates, who may not even be out there.

REFERENCES

- American Association for Employment in Education. (2007). Educator supply and demand in the United States. Columbus, OH: American Association for Employment in Education.
- Ballou, D., & Podgursky, M. (1997). *Teacher pay and teacher quality*. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.
- Boyd, D. Lankford, H., Loeb, S., & Wyckoff J. (2005). The draw of home: How teachers' preferences for proximity disadvantage urban schools. *Journal of Policy Analysis and Management*, 24 (1), 113-132.
- Glenn Commission (2000). Before it's too late: A report to the nation from The National Commission on Mathematics and Science Teaching for the 21st Century. Jessup, MD: U.S. Department of Education.
- Goldhaber, D. D. (2002). The mystery of good teaching. *Education Next: A Journal of Opinion and Research*, Spring(1), 50-55.
- Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2001). *Why public schools lose teachers* (Working Paper 8599). Cambridge, MA: National Bureau of Economic Research.
- Harris, D. N., Rutledge, S. A., Ingle, W. K., & Thompson, C. C. (2006). Mix and match: What principals look for when hiring teachers and implications for teacher quality policies. Manuscript submitted for publication.
- Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, 38(3), 499-534.
- Ingersoll, R. & Perda, D. (2006). What the data tell us about shortages of mathematics and science teachers. Paper presented at the NCTAF Symposium on the Scope and Consequences of K12 Science and Mathematics Teacher Turnover, Racine, WI, October, 2006
- Johnson, S. M. (1986). Incentives for teachers: What motivates, what matters. *Educational Administration Quarterly*, 22(3), 54-79.
- Johnson, S. M., & Birkeland, S. E. (2003). Pursuing a "sense of success": New teachers explain their career decisions. *American Educational Research Journal*, 40(3), 581-617.
- Johnson, S. M., & The Project on the Next Generation of Teachers. (2004). *Finders and keepers: Helping new teachers survive and thrive in our schools*. San Francisco: Jossey-Bass.
- Lankford, H., Loeb, S., Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis* 24(1), 37-62. Hamilton Lankford, Susanna Loeb, and James Wyckoff.

- Levin, J., & Quinn, M. (2003). *Missed opportunities: How we keep high quality teachers out of urban classrooms*. Washington, DC: New Teacher Project.
- Liu, E. & Johnson, S. M. (2006). New teachers' experiences of hiring: Late, rushed, and information-poor. *Educational Administration Quarterly*, 42(3), 324-360.
- Liu, E., Johnson, S. M., & Peske, H. G. (2004). New teachers and the Massachusetts Signing Bonus Program: The limits of inducements. *Educational Evaluation and Policy Analysis*, 26(3), 217-236.
- Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.
- Merton, R. K. (1957). *Social theory and social structure*. Glencoe, IL: The Free Press.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage Publications.
- National Academies of Sciences, National Academy of Engineering, and Institute of Medicine. (2007). *Rising above the gathering storm: Energizing and employing American for a brighter economic future*. Washington, DC: National Academies Press.
- Neild, R. C., Useem, E., Travers, E. F., & Lesnick, J. (2003). *Once & for all: Placing a highly qualified teacher in every Philadelphia classroom*. Philadelphia, PA: Research for Action.
- Odden, A., & Kelley, C. (1997). *Paying teachers for what they know and do: New and smarter compensation strategies*. Thousand Oaks: Corwin Press.
- Smith, T., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, 41(3), 681-714.
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: The Free Press.
- Thomas B. Fordham Foundation. (1999). *The teachers we need and how to get more of them: A manifesto*. Washington, D. C.: The Thomas B. Fordham Foundation.