

2003

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Recommended Citation

Patrick Murphy, Michael DeArmond, Kacey Guin. A National Crisis or Localized Problems? Getting Perspective on the Scope and Scale of the Teacher Shortage. *Education Policy Analysis Archives*. 2003;11:23

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Articles appearing in **EPAA** are abstracted in the *Current Index to Journals in Education* by the [ERIC Clearinghouse on Assessment and Evaluation](#) and are permanently archived in *Resources in Education*.

Volume 11 Number 23

July 31, 2003

ISSN 1068-2341

A National Crisis or Localized Problems? Getting Perspective on the Scope and Scale of the Teacher Shortage

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Citation: Murphy, P., DeArmond, M., Guin, K. (July 31, 2003). A National Crisis or Localized Problems? Getting Perspective on the Scope and Scale of the Teacher Shortage. *Education Policy Analysis Archives*, 11(23). Retrieved [date] from <http://epaa.asu.edu/epaa/v11n23/>.

Abstract

Despite the considerable attention the popular press has devoted to the question of teacher shortages, there have been surprisingly few attempts to systematically measure the size and nature of the problem. This article attempts to estimate the size and nature of the celebrated teacher shortage of the late 1990s by using data from the U.S. Department of Education's 1999-00 School and Staffing Survey. While limitations of the SASS data do not allow us to directly estimate the absolute size of the shortage, they do allow us investigate its relative impact. An examination of the data shows that the problem was distributed unevenly: urban schools and those with

relatively high populations of minority and low-income students bore the brunt of the shortage; southern and western states had more problems filling teaching slots than other regions did. These findings suggest that state and local officials should keep distributional concerns in mind when they design policies to improve teacher recruitment and retention.

Introduction

Beginning in 1999, concerns about the supply of teachers for the nation's elementary and secondary schools found their way on to the education policy agenda. The headlines at the time told the story: "Help Wanted: 2 Million Teachers," (Note 3) "Districts Step up Teacher Recruiting," (Note 4) "New Teachers are Hot Commodity." (Note 5) The problem appeared to be a crisis. It raised serious questions about the how schools recruited and hired teachers and whether or not they could meet the challenge of the shortage.

As the economy slipped into recession in the fall of 2001, the impending sense of disaster subsided. News coverage noted that the gap was filling in, and the doom and gloom predictions began to recede. (Note 6) Some observers even began to question whether the situation was ever as critical as the public was led to believe. Was there anything to worry about after all?

The question was understandable. At the peak of the reporting on the shortage, there was surprisingly little systematic information about the problem's impact. Policy-relevant data to guide state and local decision makers was particularly hard to find. Instead, the issue was often presented in a dramatic, one-two punch: an anecdote about a school or district struggling to hire teachers followed by dire statistical warnings about the problem's overwhelming national scale. At the time, this impressionistic view of the problem left some decision makers to speculate about the shortage's effect while reviewing their policy options. Today, the residue of this anecdotal formulation makes it hard to pin down what actually happened.

And yet, understanding what actually happened can offer insight into an enduring and critical question: how can we provide an adequate supply of quality teachers for our schools? The importance of this question clearly remains, regardless of the health of the nation's economy.

With that in mind, this article attempts to offer some insight into the reported shortage of teachers that the country recently experienced and to disaggregate its impact. Our general goal is to break down what was characterized as an amorphous and somewhat monolithic issue – *the teacher shortage* – into more meaningful terms for public policy decision-making. We attempt to understand the problem's scale and scope by using the recently released National Center for Education Statistics (NCES) 1999-00 School and Staffing (SASS) data.

This article is arranged as follows. In Section II we provide background on the supply and demand of teachers for public schools. Section III reports findings from our analysis of the SASS data. Here we measure the impact of the teacher shortage across geographic, socioeconomic, and other dimensions. In Section IV we present what our findings imply for public policy. We conclude that, from a

national perspective, it is not very useful to speak of a monolithic teacher shortage. Instead, the SASS data support what many observers have contended for some time: the impact of the shortage is unevenly distributed across schools and school districts. This unevenness suggests that policies designed to improve the recruitment and training of teachers need to focus on distribution issues as well as questions of quantity and quality.

II. Background: teacher supply and demand

Size of the Shortage

Despite considerable media attention, there have been relatively few attempts to quantify a national teacher shortage. One of the more frequently cited figures about the problem suggests that the nation will need to hire 2.2 million teachers over the next decade. This number can generally be traced to Hussar (1999) who, using the same model for three different scenarios, predicted the nation's districts would need to hire between 1.7 million and 2.7 million teachers between 1998-99 and 2008-09. Hussar's model accounted for predicted growth in the student population and included varying levels of teacher continuation, pupil/teacher ratios, and teacher age distributions. It assumed relatively modest increases in the demand for teachers, placing growth rates between 1 and 4 percent per year. A separate analysis by Wayne (2000) produced similar estimates. That analysis concluded that there would be a two to three percent increase per year in the number of teachers needed over the next decade. Both Hussar and Wayne suggest there is and will be a national need of approximately 200,000 new teachers each year for the foreseeable future.

Researchers have conducted similar projections for individual states. The Illinois State Board of Education, for example, estimated that the state would need 60,000 new teachers in the next three years (Banchero and Spencer, 2000). Perry (2001) estimated that California's schools would need as many as 300,000 new teachers over the next ten years.

These figures cannot help but grab the public's attention. They are large, and they conjure up daunting images. Unfortunately, they do not tell us anything about the size or distribution of a possible *shortage*. They merely estimate the future demand for teachers without relating it to any projections regarding teacher supply.

State-level analyses appear to be the only ones to provide both sides of the equation with a few estimating both teacher demand and supply. Estimates from the Florida Education Department, for example, suggested that the state would need about 12,000 more teachers per year *than are projected to be supplied* (Office of Strategy Planning, 2000). If correct, this would be a dramatic situation: over 8 percent of the state's teaching positions could go unfilled. In North Carolina, state education researchers calculated a shortage of more modest proportions, estimating that current demand will outstrip supply by about 2,000 teachers over the next decade. This is less than two percent of the state's elementary and secondary teacher population (NC State Department of Public Instruction, 1998).

Causes of Teacher Shortage

Though national shortage estimates are hard to find, there are many attempts to explain what drives the demand for teachers. At the top of the list of contributing factors is teacher turnover. Given the aging of the teaching force -- the average age of teachers has increased steadily over the past 10 years (Hussar, 1999) -- some see future demand as being driven by a wave of retirees. Others point to pre-retirement attrition. U.S. Education Department statistics, for example, suggest that as many as 9 percent of new teachers quit during their first year of teaching and as many as one-out-of-five teachers leave in the first three years (Yasin, 1999). Some of these teachers leave permanently to pursue a different career; others leave temporarily. These temporary leavers represent significant numbers. Nationally, one-quarter of the teachers hired each year are people who, though not currently teaching, have some prior teaching experience (Wayne, 2000).

There is considerable debate over which factors are behind this pre-retirement attrition. Ingersoll (2001) argues that organizational factors within a school -- low salaries, lack of support from administrators, student discipline issues, and lack of input and decision-making power -- cause teachers to leave their position (or the teaching profession altogether). Harrington (2001) blames the specific shortage of math, science and technology teachers on "a dysfunctional labor market held hostage by poor allocation of resources, disincentives to productivity and, ironically, inequity" (2001: 8). Equal pay for all teachers, he argues, distorts the market for teachers in these technical subject areas. Wayne (2000) maintains that people are more apt to leave teaching for family and personal reasons than because they are dissatisfied with their job. With all of this attention to turnover, it is easy to forget that, when compared to other professions, teaching remains one of the most stable employment choices a recent college graduate can make (Henke, Zahn, and Carroll, 2001).

Besides turnover, two other major factors are behind the increasing demand for teachers. In some regions of the country, districts clearly need to hire more teachers to keep up with growing enrollments. Despite this, when we consider the national picture, enrollment growth does not appear to be a big driver of teacher demand. The nation's public elementary and secondary school enrollment, for example, is predicted to increase by only one percent between 1999-2000 and 2010-11; between 1988-89 and 1999-2000, it increased seventeen percent (Hussar, 2002). The other factor behind teacher demand is class size reduction policies, though it is a phenomenon concentrated in particular states. It comes as no surprise that when states mandate smaller classes, districts need more teachers. In the end, it appears that class-size reduction policies do more to drive the demand for teachers than population growth (Harrington, 2001; Hussar, 1999; Shield et al 2001).

Quantity vs. quality

Despite all of this attention to quantifying teacher demand, many researchers argue that *quality*, not quantity, should be the central focus of any teacher supply discussion. With such a focus, the research is forced to take a more complex look at supply and demand in the teacher labor market (Broughman and Rollefson, 2000).

Barker and Smith (1997), for example, note that the percentage of teachers teaching out of field (i.e. those not holding a major or minor degree in the subject that they teach) is on the rise. This finding suggests there is a teacher quality shortage rather than a teacher quantity shortage. Ingersoll (1997) echoes this sentiment, stating that while many schools report difficulty in finding quality teachers, few have problems just filling positions. This argument for quality, however, assumes that there is widespread agreement on what constitutes a quality teacher (i.e., certification, major in subject area, etc.). Unfortunately, there is at present no such agreement. (Note 7)

Distribution of Teachers

In addition to teacher demand and teacher quality, researchers have looked at the distribution of teachers among different kinds of schools and districts, suggesting that quantity and quality vary across subject areas, geographic regions, and social and economic dimensions.

Math, science, and foreign language teachers often lead the list of high demand subject areas. A Texas study of teacher supply and demand for the 2001-02 school year, for example, found that most districts in the state were able to hire enough teachers to fill their vacancies. The problem areas were secondary level teachers in four subjects: science (3 percent unfilled at the start of the school year), foreign language (16 percent), technology (10 percent), and bilingual/ESL (26 percent) (Sparks, 2002).

Though it did not emerge in the Texas study, special education is also considered a high demand subject area across the nation (Hare, Nathan, and Darland, 2000; Sack, 1999; *The Urban Teacher Challenge*, 2000). In the case of special education, there is evidence of a combined quality and absolute quantity shortage. Boe, et al (1998), for example, found that the percent of special education teachers who lacked full certification ranged from 8-10% in the years between 1984-85 and 1992-93. This was almost twice the percentage of regular education teachers who lacked full certification. Given that the number of children identified for special education has risen over the past 10 years, it would appear likely that that percentage has continued to increase. (Note 8)

Other research has indicated that the impact of quality shortages is distributed unevenly across location and social class. Shields et al (2001), for example, found that the bulk of teacher shortages in California were concentrated in urban, low income, low performing, and minority schools. During the 2000-2001 school year, urban schools had on average 19% uncertified teachers, compared with 9% in suburban and rural schools. Carroll and his colleagues reached similar conclusions about the distribution of teachers in California. They noted that when teachers moved from one district to another, or from school to school within a district, they were likely to move to schools that served fewer minority students and fewer students eligible for free and reduced lunch programs (Carroll, et al, 2000).

Finally, school districts appear to be finding it increasingly difficult to assemble a diverse group of teachers for their schools. Several different sources have identified a shortage of teachers of color as another dimension of the teacher supply

question (Grissmer and Kirby, 1997; Kirby, Berends and Naftel, 1999; Lewis, 1996; The Urban Teacher Challenge, 2000).

The literature discussed above primarily focuses on the demand for teachers. While some information is available about teacher quality and distribution, adding valuable perspective on shortages of certified teachers, those studies are generally limited to state-level data. Finally, it is unclear from any of the research how many districts start the year with unfilled teaching positions and which students those districts serve. The next section uses national data to examine the impact of teacher shortages on district efforts to fill open positions. While data limitations preclude a precise estimate of the shortage, the analysis does take into account distributional issues by measuring the impact of the shortage across different social and geographic dimensions.

III. Calculating Estimates

Over the last 15 years, the U.S. Education Department's National Center for Education Statistics (NCES) has used its Schools and Staffing Survey (SASS) to collect information on staffing and personnel issues in the nation's K-12 schools. NCES's most recent effort, the 1999-2000 SASS, involved a sample of public schools, district offices, teachers, principals, as well as public charter schools. Private schools and Bureau of Indian Affairs schools also participated in the survey. NCES selected the respondents so as to provide a nationally representative database of public K-12 teachers, principals, schools, and school districts (U.S. Department of Education, NCES 2000: 2). Collectively, the survey questions covered a wide range of issues, including: school and district capacity, descriptive demographics, teacher training and experience, salary structures, instructional practices, parent involvement, and the use of technology.

The 1999-00 SASS cycle also included new questions designed to provide information about different aspects of teacher supply and demand (NCES, 2000a, p.3). Though these items fall far short of providing estimates of the size of the shortage, the survey includes two areas of inquiry that can shed some light on these issues. Together they provide a useful backdrop for our work.

First, the SASS asked school districts about how many total teachers they employed and about the timing of their new hires. It is possible to use these questions to estimate the relative share of total teachers that were hired after the start of the school year. This *late-fill rate* provides one, albeit imperfect, (Note 9) indicator of teacher shortages during the 1999-2000 school year across different districts. Second, items in the school questionnaire attempted to assess how hard it was for schools to hire teachers for particular subject areas. Together, these portions of the survey can provide a more systematic, if qualified, picture of the shortage compared to anecdotal accounts found in the media.

Findings: The Scale and Impact of the Shortage

Using the SASS data, an estimated 45,000 (Note 10) were hired after the start of the 1999-2000 school year suggesting that at least these many positions were unfilled in public schools when school began. (Note 11) This figure represents 1.5 percent of the total teaching positions in public schools (based on a national

west, had a late-fill rate of less than 1.0 percent. Iowa represents the limit case, with an estimated late-fill rate of 0.4 percent at the start of the year. Given some minimal amount of personnel shifts at the last-minute, one would expect a certain number of positions to be filled after the start of the school year. The 0.4 percent figure, then, could be considered very close to a zero rate of vacancies.

Subject Field Variation

Beyond the regional variation, observers also have, as noted above, suggested that the need for teachers varies across different subject areas. An examination of the data supports this idea. Although the SASS data does not lend itself to a *late-fill rate* analysis by subject area, the school questionnaire did differentiate by subject area when it asked schools how difficult it was to fill particular positions. Because the survey response options were qualitative (respondents could choose from options like “easy...somewhat difficult...difficult...”) the results, especially those involving comparisons, should be interpreted with caution. (Note 14) Nevertheless, it is possible to identify which subject areas were generally perceived by schools as being the hardest to fill.

Table 1 presents calculated national estimates of the average *difficulty score* schools reported for different subject areas. Special education, foreign language, and English as a second language top the list. Positions in math and the physical sciences were also difficult to fill. Interestingly, schools reported that vocational education instructors, a subject area that does not get much attention in either media reports or academic research, were just as hard to find as special education teachers. At the other end of the spectrum, public schools found it relatively easy to find English, social studies, and elementary school teachers.

Table 1. Difficulty in Hiring of Different Subjects as Reported by Schools*

<i>Subject</i>	<i>Avg. Difficulty Score</i>
Foreign Language	2.28
Special Education	2.19
Vocational Education	2.19
ESL	2.11
Math	2.10
Physical Sciences	2.03
Computer Science	1.99
Biology	1.95
Music/art	1.90
English	1.55
General Elementary	1.39

Social Studies	1.36
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*Where 1=easy, 2=somewhat difficult, 3=very difficult, 4=position never filled.

Source: Calculated from 1999-00 School and Staffing Survey, National Center for Education Statistics, U.S. Department of Education.

A Disproportionate Impact

The literature discussed above also suggests that, in addition to the variation by region and subject, other factors have an effect on how difficult it is for a school or district to fill a teaching position. Using the same definition of unfilled teaching positions discussed above, Table 2 offers estimates of the late-fill rate at the start of the school year for districts in urban, suburban, and rural areas, those with a high percentage of minority students, and the relative percentage of students eligible for free and reduced lunch programs. The data suggest that the challenge of hiring teachers becomes less difficult as one moves away from the central city. The late-fill rate for urban school districts was more than 50 percent higher than that for suburban school districts and twice as high as the figure for rural schools. Another way of looking at the disproportionate impact of the teacher shortage on central city schools is to note that though urban districts account for 29 percent of the teaching positions in the country, they represented 41 percent of the late-fill positions for the 1999-00 school year.

Given these figures for urban schools, it comes as little surprise that the shortage has a more profound impact on schools with relatively high minority student populations and larger shares of students eligible for free and reduced lunch. Table 2 separates public school districts into two categories, those whose student population is comprised of more than 40 percent minority students and those districts where minority students account for 40 percent or less of the population. School districts with high minority populations appeared to have a much more difficult time filling their teaching positions in 1999-00. These districts accounted for less than half (42 percent) of the total teaching positions, but they represented over 57 percent of the total number of late-fill positions at the start of the year. That figure translates into a 2.11 percent late-fill rate, or twice the rate of districts with fewer than 40% minority students.

The findings regarding the minority student population are very similar to those that emerge when one examines the impact of the shortage relative to the socio-economic status of the student population. Using the percentage of students eligible for free and reduced lunch as a proxy, districts with relatively high levels of low-income students found a larger share (1.88 percent) of their teaching positions filled after the start of the year compared to those with fewer low-income students (1.13 percent).

**Table 2. Late-fill Rate by Share of Minority Students, Free/Reduced Lunch Eligible and Location of School Districts
SASS 1999-00**

	Total	Unfilled	Late-fill Rate
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	Positions	Positions	(%)
Percentage Minority Students			
40% or less	1,865,090	19,580	1.05
Greater than 40%	1,207,639	25,508	2.11
Students Eligible for Free/Reduced Lunch			
40% or less	1,693,096	19,211	1.13
Greater than 40%	1,379,633	25,877	1.88
District Location			
Central City	893,067	18,602	2.08
Suburban	1,508,341	20,322	1.35
Rural	671,321	6,163	0.92
U.S. Total	3,072,729	45,088	1.47

Source: Calculated from 1999-00 School and Staffing Survey, National Center for Education Statistics, U.S. Department of Education.

IV. Policy Considerations

In sum, rather than a national crisis, the SASS data show the teacher shortage to be a regional, subject specific phenomenon. Districts in the southeast, southwest, and west had a more difficult time filling vacancies than those in the Midwest and northeast. Foreign language and special education teachers were among the hardest to find, as were vocational education, math, and science teachers. Most importantly, the impact of the shortage is far more acute in lower income, urban districts with relatively high minority student populations. These findings support many of the characteristics of the shortage that researchers found and/or asserted.

While this research adds a national perspective on the problem and a systematic investigation into its various facets, it also illuminates a significant gap that remains in the teacher supply/demand data. It is still not possible to estimate the absolute magnitude of the shortage with any confidence. This problem persists despite efforts by the NCES to add recruitment questions to the most recent survey on school staffing. Though it is helpful to be able to identify the types of schools experiencing the greatest difficulty in hiring, as well as the subject areas in greatest demand, it is still not possible to provide vacancy rate estimates. If policy makers are to design efficient responses to teacher supply problems in the future, information on the scale of the problem is necessary.

From a public policy perspective, the fact that the impact of the teacher shortage problem was so unevenly distributed across schools and school districts suggests a need for targeted efforts to address the problem(s). Policies designed to simply increase the supply of teachers across the board, for example, may shrink the absolute size of a shortage but do little to reduce the relative impact of the problem on poor, urban districts with high populations of minority students. Signing bonuses are an example of such an approach. In the spring of 2001, Governor Jeb Bush proposed a \$1,000 signing bonus for all new Florida teachers. Under the plan, a new elementary teacher in a middle-class, predominately white, suburban school would get the same bonus as someone interested in teaching math to poor, minority students in the inner city. Eager to respond to a looming crisis, the legislature passed the blanket bonus even though it probably would do little to address the schools that were truly struggling to find teachers.

Signing bonuses are not the only example of well-intended efforts that will have little impact on the most important aspects of this problem. Many states have recently invested in expanding teacher training programs as well as accelerating their credentialing procedures. While increasing the number of teachers in the pipeline may eventually address the areas of greatest need, such policies could be more focused. A new program that makes it easier for an individual to prepare to teach social studies at a suburban high school will have little impact. Targeting incentives and support for individuals interesting in obtaining special education, math, or science certifications, however, would be a better use of scarce public resources.

The uneven impact of the teacher shortage, therefore, suggests that policy makers need to be more strategic in their response. Programs designed to increase the supply of teachers as well as provide incentives for them to enter the most challenging schools might be more likely to provide assistance for struggling schools. In short, decision makers need to consider the distributional impact of different human resource policy options.

Finally, it is important to note that the issue of how teachers are distributed across schools remains relevant even in the absence of a teacher shortage. Recent state budget crises – and subsequent cuts in education funding -- appeared to have rendered discussions about teacher recruitment moot. While schools may be recruiting fewer teachers overall, the current situation is likely to bring about a significant shuffling of human resources. Just as the impact of the reported teacher shortage appeared to be uneven, one expects this new crisis to disproportionately hit the schools with the greatest needs. As states and districts wrestle with difficult choices about resource distribution, they should take into account how their choices will affect the distribution of teachers across their schools.

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Appendix

**Estimates of Teacher Late-fill Rates by State
 SASS 1999-2000**

State	Late Hires*	Total Teachers**	Late-fill Rate***
Alabama	922	51,891	1.8%
Alaska	518	9,286	5.6%
Arizona	1,136	47,295	2.4%
Arkansas	286	33,500	0.9%
California	6,896	299,836	2.3%

Colorado	549	44,420	1.2%
Connecticut	646	44,166	1.5%
Delaware	160	8,009	2.0%
District of Columbia	88	5,395	1.6%
Florida	2,974	141,651	2.1%
Georgia	1,831	96,246	1.9%
Hawaii	636	10,735	5.9%
Idaho	70	14,899	0.5%
Illinois	1,977	130,056	1.5%
Indiana	468	61,152	0.8%
Iowa	158	37,823	0.4%
Kansas	257	34,268	0.7%
Kentucky	624	43,341	1.4%
Louisiana	1,216	54,333	2.2%
Maine	161	19,108	0.8%
Maryland	483	51,734	0.9%
Massachusetts	722	80,647	0.9%
Michigan	841	100,752	0.8%
Minnesota	579	63,873	0.9%
Mississippi	551	33,661	1.6%
Missouri	351	66,744	0.5%
Montana	112	11,004	1.0%
Nebraska	149	20,619	0.7%
Nevada	391	19,334	2.0%
New Hampshire	156	16,170	1.0%
New Jersey	1,557	108,809	1.4%
New Mexico	535	20,488	2.6%
New York	3,720	211,724	1.8%
North Carolina	1,509	84,125	1.8%
North Dakota	37	7,878	0.5%
Ohio	649	120,839	0.5%
Oklahoma	904	45,180	2.0%
Oregon	355	31,193	1.1%
Pennsylvania	754	120,522	0.6%
Rhode Island	200	12,899	1.6%
South Carolina	833	46,195	1.8%
South Dakota	67	11,040	0.6%
Tennessee	809	59,317	1.4%
Texas	3,833	266,083	1.4%
Utah	164	23,119	0.7%
Vermont	150	8,885	1.7%
Virginia	1,486	90,181	1.6%
Washington	826	61,943	1.3%
West Virginia	370	20,977	1.8%

Wisconsin	383	61,816	0.6%
Wyoming	39	7,568	0.5%
Total	45,088	3,072,729	1.5%

*Those teachers hired after the start of the school year.

** Teaching positions (“head counts”) NOT full-time equivalents.

***Late-fill rate does not include those teaching positions which were never filled.

Notes

1. This research is part of a larger project on the teacher shortage and how districts have responded. Funding for the project was provided by the Smith Richardson Foundation. The views and opinions expressed here are those of the authors.
2. Patrick Murphy is an Associate Professor of Politics at the University of San Francisco. Michael DeArmond and Kacey Guin are policy researchers at the Center on Reinventing Public Education, Daniel J. Evans School of Public Affairs, University of Washington.
3. *Education Week*, Special series, March/April 1999 (<http://www.edweek.org/sreports/help.htm>)
4. Houtz, J. (21 April 1999) “Districts Step Up Teacher Recruiting” *Seattle Times*.
5. Bradley, A. (9 September 1998) “New Teachers are Hot Commodity.” *Education Week*
6. ([Ed Week article](#))
7. See Hayasaki, E. (10 February, 2003) “Teacher Shortage Abates” *Los Angeles Times*. Page 1.
8. See Darling-Hammond (2001) and Walsh (2001) for differing perspectives on this issue.
9. Boe et.al.(1998) attributes this ongoing shortage of special education teachers to not enough teachers certified to teach special education are entering the field each year and a high turnover rate. Boe, Bobbitt and Cook (1997) note that special education attrition rates were not significantly different than general education attrition rates, indicating that the high turnover rate result from special education teachers switching to regular education, as opposed to leaving the teaching profession all together.
10. Given the wording and structure of the questions, it is not possible to determine precisely how many vacancies a district may have had at the start of the year. The District Questionnaire first asks how teachers were “newly hired” for the 1999-2000 school year. It then asks, of those new hires, how many were hired before the summer break, during the first half of the summer, etc. The final question in this series asks how many were hired after the beginning of the school year. It is this figure that serves as the numerator for the late-fill rate estimate. The reported total number of teachers in the district (head counts, NOT FTE) is the denominator. Not captured in these figures are those teaching positions that went unfilled during the school year. Therefore, the late-fill rate provides a relative measure of the depth of the

shortage but it is likely to understate in absolute terms the total number of teachers that districts had hoped to hire.

11. All estimates presented here were derived using the BRR weighting procedure utilized by the Wesvar 4.0 statistical analysis software as recommended by NCES. This method produced an estimate of 45,088 positions that were filled after the start of the school year, with a standard error of 529 and a coefficient of variation of 1.173 percent.
12. Estimates are based on the public school district data set and do not include the responses from public charter schools.
13. In an ideal world, it would be possible to use the SASS data to estimate vacancies. In the school questionnaire, administrators were asked how difficult it was to fill vacancies across subject areas. Unfortunately, SASS did not ask *how many* positions schools were unable to fill, and it is not possible to estimate the difference between the number of teachers being sought at the start of the school year and the total hired after the year began. Since we are unable to calculate a vacancy rate, the analysis uses the late-fill rate as a proxy for the vacancy rate. Using this proxy assumes that there is a positive relationship between district late-fill rates and the likelihood that schools reported unfilled positions. This relationship was tested by regressing whether a school reported unfilled positions during the year (SASS School Respondents, question 36) against the district late-fill rate, and yielded a positive, significant correlation between the two variables. There is some evidence, therefore, supporting the use of the late-fill rate as a proxy.
14. The calculated estimates can be found in the appendix of this article.
15. The precise wording of the question was, "How difficult or easy was it to fill the vacancies for this school year in each of the following fields?" For different subject areas (e.g., General elementary, mathematics, special education, etc.), schools that had open positions could respond that it was "easy," "somewhat difficult" or "very difficult" to fill the position, or that the vacancy was never filled.

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EPAA is published by the Education Policy Studies
Laboratory, Arizona State University