

# **USING TEACHER SUPPLY AND DEMAND ANALYSIS IN POLICYMAKING**

Regional Educational Laboratory  
Contract #ED-01-CO-0006  
Deliverable #2003-07

*Prepared for*  
Institute of Education Sciences  
U.S. Department of Education  
Washington, D.C. 20208

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November 30, 2003



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This document has been funded at least in part with federal funds from the U.S. Department of Education under contract number ED-01-CO-0006. The content of this publication does not necessarily reflect the views or policies of the Department of Education nor does mention of trade names, commercial products, or organizations imply endorsements by the U.S. Government.

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## **ACKNOWLEDGEMENTS**

Robert Reichardt, a senior researcher at McREL, completed the initial and primary work on the production of this report. He is indebted to the 19 national respondents who provided information through telephone interviews. Further development of the document was completed by Ravay-Snow Renner, an education consultant, and at McREL by Patricia Lauer, principal researcher, and Zoe Barley, vice president of research and evaluation. The author thanks Debra Stuart of the Oklahoma State Regents for Higher Education and Lynn Cornett of the Southern Regional Education Board for reviewing the document and providing helpful input.

## OVERVIEW

The No Child Left Behind Act (NCLB) of 2001 emphasizes the need for highly qualified teachers. More than ever, state policymakers require information about teacher quality that will inform their policy decisions and help them address NCLB requirements. The present study, for example, helps identify the places and the subject areas within the state that have low numbers of “highly qualified” teachers as defined by NCLB. This type of information enables the state to target policy efforts for meeting NCLB requirements. The purpose of this document is to describe a method for producing this information through an analysis of data related to teacher supply and demand.

The first section of this document poses and answers nine questions about teacher supply and demand studies. The second section provides guidelines for data specialists on how to conduct a teacher supply and demand analysis at the state level. The audience for this report includes policymakers, policy data analysts, and education researchers.

The report draws on the experiences of the author and on 19 semi-structured interviews with policymakers, advocates for teacher quality, and consultants who have created or used the results of state and regional teacher supply and demand analyses. Respondents initially were sampled from a list of authors or project managers of regional or local supply and demand analyses that are ongoing or available on the web. From initial interviews, a snowball technique was used to locate other respondents who have produced or used teacher supply and demand analyses. Each interview lasted approximately 25 minutes.

## QUESTIONS AND ANSWERS ABOUT TEACHER SUPPLY AND DEMAND STUDIES

Interviewees were asked how teacher supply and demand analysis was used in policymaking and what aspects of the analysis made it useful. The following question-and-answer format is used to convey the lessons learned by these experts to policymakers in a clear, concise, and useful manner.

### **1. What is the importance of teacher quality, and how does a teacher supply and demand study help to improve it?**

The quality of teachers makes a larger difference in student test scores than any factor other than those related to the student’s home. As a result, improving teacher quality is potentially the most powerful tool that policymakers have for improving schooling and student achievement. (Aaronson, Barrow, & Sander, 2003; Hanushek, Kain, & Rivkin, 2001; Marzano, 2000; Wright, Horn, & Sanders, 1997; Wenglinsky, 2000).

Because teacher quality is developed throughout a teacher’s career, it can be attended to at different career stages (Reichardt, 2001), which include

- pre-service, when teachers are being prepared initially in content and pedagogy;
- recruitment and induction, when new teachers are learning how to apply their skills within the particular district and school context; and
- in-service, when established teachers are building on their experience, improving their skills, and keeping up with research and technology.

At each career stage, different policy levers can be used to improve teacher quality. The quantitative information produced by a teacher supply and demand study can identify problems within a state related

to teacher quality, target the career stage in which they occur, and therefore point to the most promising policy levers and remedies.

Equally important, different levels of the education system — including the state government, universities, districts, and schools — play different roles in improving teacher quality. Teacher supply and demand information can help leaders at each of these levels target their programs and policies to the most significant problems in their particular spheres of influence. For example, universities and their students are particularly concerned about subject areas and regions of the state that will need teachers in the future. Districts are particularly concerned about differences in the qualifications of teachers in schools serving high numbers of minority students and those in schools serving mostly Caucasian students. State policymakers are concerned about sources of supply within a state and whether the preparation and licensure programs are meeting hiring needs within the state.

## **2. What is the purpose of a supply and demand study?**

The main purpose of a supply and demand study is to improve the education of all students by helping policymakers create targeted policies and use resources in targeted ways to ensure that all students are taught by high-quality teachers all of the time. A supply and demand study provides information about the distribution and supply of those teachers and expected changes in patterns of demand, which (1) helps to identify current strengths and weaknesses in the teacher supply, and (2) highlights potential issues related to the future supply and demand for teachers so that these issues can be addressed proactively.

With supply and demand information, state-level policymakers can craft policies to solve teacher quality problems based on *data* instead of *anecdotes*. The information not only helps policymakers identify the most important issues related to teachers, it also helps them to reject policies targeted towards issues that are shown by the data to be relatively minor or misdirected.

Such a databased approach is consistent with NCLB, which requires states to ensure that all children are taught by “highly qualified” teachers, who must

- be fully licensed or certified by the state,
- have earned at least a bachelor’s degree, and
- have demonstrated competence in teaching skills and knowledge of the subject(s) they teach.

Developing a comprehensive database and a supply and demand study that incorporates teacher employment, certification, school, and university data can help improve state capacity to comply with NCLB teacher quality and reporting requirements.

Other groups in the state, such as universities, school districts, teachers, and potential teachers, also can use the information provided by such a study. For example, in Oklahoma, universities provide supply and demand information to students who are considering becoming teachers. This helps the students understand which districts are expected to have vacant positions and in which subjects.

### **3. What types of questions can a teacher supply and demand analysis answer?**

A teacher supply and demand analysis can answer a variety of questions about state-level patterns such as the following:

- Is the state likely to face a shortage of teachers when the baby-boom generation of teachers retires? If so, in which subject areas are these shortages likely to occur?
- What are the major sources of teacher supply in the state?
- What has been the effect of a program designed to improve teacher supply or retention?

A supply and demand analysis also can examine variations in teacher supply patterns within a state to answer the following types of questions:

- Which districts have been most effective in recruiting teachers?
- Are there difficulties in recruiting or retaining teachers in specific types of schools in the state (e.g., poor or rural schools)?
- Are there supply and demand problems, such as recruitment and retention concerns, in schools that have performed poorly on the state assessment?
- Do low-performing schools have high teacher turnover?
- Does teacher turnover vary by subject area taught?

Although there are national data related to teacher quality, a supply and demand analysis provides information that is specific to a state. The state-specific information is more relevant to the needs of state policymakers than national information and ensures that policies respond to the issues actually faced within a state.

### **4. What have been some uses and benefits of teacher supply and demand analyses?**

Teacher supply and demand analyses have been used to inform a number of policies and to examine their outcomes. For example:

- By identifying actual shortages in teacher supply patterns by content area, information from a supply and demand analysis helped legislators to avoid creating costly incentives, such as stipends, for a non-existent teacher supply problem.
- A supply and demand analysis that identified projected shortages in particular content areas helped teacher preparation programs expand their offerings in those areas. It also was useful background information for the development of legislation

supporting teachers who agree to teach in specific subjects and in schools facing teacher shortages. The analysis also provided information to prospective teachers about subject areas and grade levels likely to have the most vacancies.

- By studying teacher shortages related to geography, a supply and demand analysis was used to direct the expansion of teacher preparation programs so that they targeted regional teacher shortages. This type of analysis also helped to target recruitment campaigns focused on out-of-state teachers. In addition, it was used to identify the sources of shortages, that is, whether they were due to too few teacher education graduates, problems connecting graduates with available teaching positions, or problems related to the retention of teachers.
- The data from a supply and demand analysis have been used for a variety of reporting purposes. For example, supply and demand data helped to fulfill the state reporting requirements of Title II of the Higher Education Act and of NCLB. They also were used to provide evidence of need in federal grant applications and as supporting documentation in school funding lawsuits.
- Supply and demand analyses were used to identify incentives for teachers to participate in early retirement programs, to evaluate the effectiveness of pay-for-performance programs in attracting and retaining qualified teachers, and to identify problems in teacher licensure systems, as well as their solutions.

In addition to addressing policy issues, other important benefits of supply and demand studies are increased public awareness about teacher quality and increased requests by policymakers for hard data and evidence to support new policy initiatives.

## **5. What are the benefits of a state-level analysis compared to a multi-state or national analysis?**

A key advantage of state-level analysis is that it identifies issues specific to a given state. To illustrate, a state legislator thought that because on average, across the states, shortages were found in the number of mathematics and science teachers, his state had similar shortages. Therefore, the legislator was pushing for the provision of stipends to mathematics and science teachers. However, the data showed that the state was facing much larger shortages of special education and foreign language teachers. State-level data (compared to national data) can be used to spur, inform, and support state and local policy action.

Another advantage of a state-level analysis is that by conducting a teacher supply and demand analysis, a state can increase its capacity to gather and use evidence in other education policy realms. Policymakers learn to demand, use, and depend on databased evidence in support for policy recommendations from others. At the same time, the data structures and processes that are developed for a teacher supply and demand analysis can improve the capacity of state agencies to create, manage, and analyze data in support of other policy issues. This is particularly relevant to states as they attempt to comply with the requirements of NCLB.

A national or multi-state supply and demand analysis tells state policymakers how their state compares with the nation or similar states. Comparisons with other states can provide an important context for interpreting a state analysis. A multi-state analysis also may examine the labor flow of teachers from one state to another. Unfortunately, multi-state analyses are very difficult to create because they face both

technical and political challenges. The technical issues revolve around the fact that each state has its own data system with a wide variety of data elements and varying definitions. This makes it difficult to identify common variables that have value and meaning across state lines. Other technical problems include privacy issues and developing the capacity to transmit and store data. Politically, it is difficult to compel officials from different states to work together and agree on how data will be used. Moving the analysis ahead requires unanimous agreement among the involved chief state school officers, who are likely to view their state teacher quality issues from different perspectives.

**6. How much does a teacher supply and demand analysis cost and what are possible funding sources?**

The final cost can range from as little as \$50,000 to hundreds of thousands of dollars per state. Actual costs depend on the scope of the analysis and the availability of the data. The first analysis is often the most expensive because computer programs need to be written or tailored to organize the data and format reports. These same programs often can be used in subsequent analyses, lowering costs for repeated examinations of teacher supply and demand patterns.

Sometimes the governor or legislature asks the state to conduct a supply and demand study and attaches an appropriation to the request to fund the study. Often, organizations outside of the state are key partners in conducting teacher supply and demand analyses. For example, regional educational laboratories, federally funded service providers, or foundations often can provide some or all of the funding for a supply and demand analysis.

**7. What are the steps involved in conducting and using a teacher supply and demand analysis?**

A teacher supply and demand analysis uses data that typically are gathered by different state agencies on a regular basis, but must be gathered in one place for the analysis to occur. Thus, the first step is to identify the organizations that have relevant data and obtain permission to gather that data in a central location. Support by high-level policymakers might be needed to obtain this permission.

The second step is to conduct the analysis. State departments might opt to conduct the analysis themselves, but in many cases the analysis is carried out by external organizations. These include regional educational laboratories; regional education organizations such as the Southern Regional Education Board, the Southeastern Center for Teaching Quality, or the Mid-Atlantic Regional Teachers Project; and state-focused education organizations such as the Center for the Future of Teaching and Learning in California.

External organizations can provide the technical capacity, resources, and credibility needed for a teacher supply and demand analysis that can influence policy. They have several strengths as compared to state organizations. External organizations often have greater networking capacity for bringing multiple agencies in a state together. This capacity provides a broader base of support for the supply and demand analysis. External organizations, by virtue of being external to the state government, can lend credibility to the analysis, although this depends on the extent to which an organization has a reputation for being unbiased and politically neutral. To further the credibility of an analysis, state data analysts should review the results. Such a review can help identify technical problems prior to the release of the analysis and can avoid conflicts over technical issues that might eventually serve to undermine the results. For supply and

demand analyses to influence policy, they must be widely regarded as unbiased and accurate. Finally, external organizations often have greater technical capacity and resources than state agencies to conduct the analysis. State agencies often need to outsource these large, occasional projects because of the burden on already overextended staff.

## 8. What factors influence whether a supply and demand analysis is used in policymaking?

There are three key factors that influence whether a supply and demand analysis is used for policy decision making related to teacher quality.

1. The analysis needs to address relevant policy questions that are of critical interest to the policymakers who can make changes.
2. There needs to be a “champion” for the analysis — an influential person who understands the findings and is prepared to help others understand the findings and their implications, and enact needed changes.
3. The information needs to be presented in an organized and clear manner so it can be easily grasped by a variety of audiences.

**Relevance.** The most important factor leading to a study’s use or non-use in policymaking is the relevance to questions important to policymakers. Overall, the analysis should help inform policymakers on how they can improve student learning and/or teacher quality. In addition, the analysis should address the specific questions with which policymakers are grappling, such as the following:

- Is the state likely to face a shortage of teachers when the baby-boom generation of teachers retires?
- Does the state currently have a shortage of teachers?
- Are teacher shortages specific to particular geographic areas, types of schools, or subject areas?
- Do low-performing schools have high rates of teacher turnover?
- What are the causes of or contributing factors to teacher shortages?

To be most helpful to policymakers, the analysis should be written to support policy action rather than to provide background information. The analysis should answer specific questions and draw conclusions regarding what to do (or not to do) to improve the availability of quality teachers.

**Presence of a champion.** The role of the “champion” is to continuously keep the supply and demand evidence in front of those making policy decisions (e.g., governor, legislators, chief state school officer, state school board, professional teaching standards board, school district board, school district superintendent, and teacher preparation programs) and to insist that the facts be considered whenever decisions are made that affect teacher supply, demand, and quality. “Champions” can come from a variety of places. They might be department of education or higher education agency analysts, division or office heads within departments of education or higher education agencies, legislative analysts, or community

advocates for teacher quality. However, regardless of professional or agency affiliation, the “champion” needs access to the network of key education policy stakeholders in the state.

Some other characteristics and behaviors are essential for a “champion” to succeed in having results used in policymaking:

- A champion is able to bridge the technical environment and the policy arena in which the findings will be used. A “champion” is conversant in both technical and policy jargon.
- A champion does not surprise policymakers with the analysis, or use it for political gain, but rather shares the analysis with those who will be affected by publication of the results.
- A champion is politically savvy and knows how to advocate for an issue and influence others.

***Presentation of information.*** Clear presentation of the information generated by the supply and demand analysis is crucial to its successful use in policymaking. An effective model for delivering information is the creation of two documents:

1. A short summary highlighting the key findings and placing them in the policymaking context of the audience
2. A longer technical report providing supporting documentation and details of interest to various audiences

The summary should focus on the key findings of the analysis and specific policy questions, using a few charts, graphs, or tables to communicate the most important results as succinctly as possible. Charts or graphs are often the simplest, most powerful ways to communicate statistical information (Tufte, 1983). Another tool for making the results more meaningful is a real or simulated example, such as a case study of a school or teacher that illustrates what the statistics mean in human terms. The use of real-life examples is often a very effective means for communicating to a non-technical audience.

It is important to place the information in a context that helps users to understand it. One method for providing context is to describe the policy history preceding the findings. In other words, the analyst might describe prior policies that helped to create the situation that the study addresses. Another context is to situate the information within the different stages of teaching career, as described previously (Reichardt, 2001). For example, information from an analysis on the number of teacher education graduates describes data related to the preservice stage of a teaching career.

## **9. What are the barriers to completing a teacher supply and demand analysis?**

Initially, a potential barrier in conducting a teacher supply and demand analysis can be convincing the necessary persons at the state level to have the “will” to proceed with such a study. After this has been achieved and a decision to proceed has been made, there are three main barriers to completing the analysis: (1) privacy concerns, (2) data ownership, and (3) data quality. A supply and demand analysis is based on individual teacher records and higher education student records that contain personal

information. Safeguarding that information is of the highest importance. At a minimum, this requires establishing clear procedures to limit access to personal data and releasing only statistical analyses that do not allow identification of individuals.

**Privacy concerns.** Carrying out a supply and demand analysis requires linking individual records over time and between different datasets. The use of Social Security numbers (SSNs) is the most practical method of linking data records. SSNs allow analysts to link records that are maintained by different agencies and might not share tracking numbers. However, state and federal laws exist (particularly the Family Educational Rights and Privacy Act) that limit the ability to disclose student information and use SSNs in this type of analysis. Ultimately, states will vary in their ability to use SSNs for a supply and demand analysis. If SSNs are not available for linking data over time and across settings, then other data will need to be collected for analyses of teacher retention and mobility.

**Data ownership.** Data ownership is a slightly different issue than privacy. Due to differing and conflicting legal opinions, different agencies are sometimes unable or unwilling to provide the data that the agencies have collected and managed to an outside analyst. It is much easier to gain access to the data when the analysis is supported by persons in positions of authority or responsibility within the agency. In addition, analysts must consider future access to the data because unpopular conclusions may jeopardize their access to similar data in the future.

**Data quality.** The degree to which the data provide accurate or pertinent information about teachers working in a state is an important concern. Poor-quality data can lead to inaccurate results. One prevalent challenge to data quality occurs when data collection methods change over time. For example, over the past 10 years, many states have moved from collecting data manually on paper to electronic and web-based data collection systems, resulting in incompatibility between the data sets from different years. This is particularly the case when the wording of a question has changed. Incompatible data sets limit the ability to analyze changes in teacher supply and demand over time.

## HOW TO CONDUCT A STATE TEACHER SUPPLY AND DEMAND ANALYSIS

This section of this report explains how to use a state's workforce-related databases to examine current excesses or gaps in the teacher or administrator workforce by specialty or location, to forecast emerging trends, and to identify factors that influence distribution. This guidance is designed for data analysts with knowledge or experience in policy analysis, but it is also useful for policymakers and state education administrators who are interested in what supply and demand studies can offer to decision makers.<sup>1</sup>

Information about individual teachers is central to the analysis of teacher supply and demand. In this type of analysis, the main source for individual teacher information is state administrative databases, in particular, those maintained by the state department of education. These data are a common source of information for analysis of state teacher workforces and can provide the most detailed picture of regional and local issues within states.<sup>2</sup>

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<sup>1</sup> See Boe and Gilford (1992) and Haggstrom, Darling-Hammond, and Grissmer (1988) for additional technical information on conducting supply and demand analysis. See the following sources for details on data system requirements for supply and demand analysis: Voorhees and Barnes (2003), Council for Basic Education (2000), Hibpshman (1998), and North Central Regional Educational Laboratory (2000).

<sup>2</sup> Examples of analyses of state records can be found in the following studies: Carroll, Reichardt, and Guarino (2000); Center for the Future of Teaching and Learning (2002); Hanushek, Kain, and Rivkin (2001); Kirby,

Other sources of teacher information also have been used in supply and demand studies, including unemployment insurance records (Reichardt, 2002b), teacher retirement system data, and Bureau of Labor Statistics data (Hare, Nathan, & Darland, 2000; Condliff, 2001). Of course, many state departments of education also use surveys to learn about their teacher workforce.

Most of the analysis involves creating and interpreting descriptive statistics. Formatting and preparing the data for analysis requires relatively sophisticated statistical and/or database software. Knowledge of descriptive statistics, rather than inferential statistics<sup>3</sup>, is typically sufficient for running the calculations in the analysis. Analysts with experience in econometric modeling might decide to use more sophisticated statistical analysis techniques (e.g., multivariate regression, including regression with dichotomous outcome variables) in order to understand subtle relationships in the data, but descriptive statistics are usually sufficient. The analysis report should emphasize meaningful findings, whether they have statistical significance or not.

At the beginning of the study, the analyst should create and carefully maintain a data log. This data log should include information about

- all data sources and definitions used,
- transformations performed on the data, and
- locations of important programs and codes used in formatting the data.

The log allows the analyst to recreate and remember the steps taken to create the final dataset. This is also important for other states to replicate the analysis. The log is likely to grow very long. It is important to date each entry and to use consistent terms throughout the work in order to facilitate searches for particular events and activities.

The supply and demand analysis described here uses existing state data on the teacher workforce in a state. The analysis is designed to identify and describe shortage areas in terms of

- subject areas taught,
- grade levels taught,
- characteristics of students taught (e.g., poverty and minority status),
- geographic region, and
- characteristics of schools (enrollment size, environment).

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Grissmer, and Hudson (1991); Lankford, Loeb, and Wyckoff (2002); Southern Regional Education Board (2001); and Reichardt (2002a, 2002b, 2003).

<sup>3</sup> Many statistical concepts, including confidence intervals and hypothesis testing, do not apply to this type of analysis. These concepts were developed for analyzing samples of a population, while the data used for supply and demand analysis contain information on the entire population (e.g., teachers) working in a state.

Although not illustrated in the current example, if data can be linked longitudinally across years, the analysis also will allow estimates of attrition and transfer rates at the school, district, and state levels. Often this type of analysis can provide additional information on sources of teacher supply to the state. The attrition data, when combined with enrollment projections, can predict future needs for teachers with considerable accuracy.

Producing a supply and demand analysis requires four steps, each of which is discussed in the next sections:

1. Identifying data sources and obtaining the data, which entails identifying the various datasets that are used for the analysis
2. Formatting the data, which involves creating analysis variables useful for conducting the study
3. Linking the data and recognizing the pitfalls of linking disparate data sources and in creating common analysis variables
4. Conducting the analysis to obtain accurate information about supply, demand, and distribution of qualified teachers

### **IDENTIFYING DATA SOURCES AND OBTAINING THE DATA**

This section briefly summarizes data requirements for state and multi-state analyses of teacher supply and demand. It begins with a discussion of data quality, which is followed by a short summary of information on data sources. A more detailed description of the data requirements can be found in Voorhees and Barnes (2003).

As described previously, data quality is a primary concern because poor quality data can easily lead to inaccurate results and conclusions. Data that are used for administrative purposes beyond statistical reporting are likely to be of high quality. For example, in Delaware the state employment dataset is used for payroll purposes. Because the data must be accurate in order for people to be paid, the data are much more likely to be of high quality. States that do not use the employment data for other administrative purposes might still have data editing and verification systems to improve data quality. For example, in Wyoming, district-reported data are compared to data from the previous year and examined for internal consistency. Discrepancies trigger a request to the district to review the data submitted.” Given the importance of quality data to a supply and demand analysis, it is important to ask state data managers how the data are used and how the data are checked for accuracy.

Another challenge to data quality is that data collection methods change over time; for example, shifts occur in the electronic collection and reporting of data and the wording of questions on data collection instruments changes. The end result is that data collected prior to a change may vary from data collected after a change, which limits analyses of trends over time. In the first year that new questions are added to a data collection instrument, the level of inaccurate responses often increases. For example, in 1999, the Colorado department of education asked its teachers a new question about their experience, and an unexpected number of teachers reported having no experience. As a result, that variable could not be used with any confidence to describe Colorado’s 1999 workforce. After 1999, this information was much more consistent with national data and with other estimates of teacher experience in the state, and so the data could be used with more confidence.

The following materials should be collected for each dataset. This information is crucial to interpreting and understanding the data<sup>4</sup>:

- A copy of the form used to submit the data to the state
- A data codebook providing definitions for each variable used in the data set

The data used for a supply and demand analysis need to describe the teachers, what the teachers do, and where the teachers work. In other words, the data need to answer three simple questions about each teacher — who, what, and where.

**Data sources describing the teachers.** Exhibit 1 summarizes data sets that describe the teacher workforce and the types of data each should provide.

**Exhibit 1. Data Describing Teachers in a Workforce**

Data Sources	Information the Data Should Provide
Employment, human resources, or payroll dataset	School where the teacher works Demographics (age, race, sex) Salary Experience Education level Subjects taught
Certification or licensure dataset	Certification or licensure level Licensure test scores Subject-area endorsements Higher education institutions attended
University records	Number of teachers prepared by content area Major Courses taken Preparation program entrance exam scores Licensure pass rates

A supply and demand analysis is based on information about individual teachers (or, in the case of teacher preparation, individual teacher candidates) that is contained in as many as three different datasets: (1) employment records, (2) certification records, and (3) university records:

- Employment records form the backbone of the set of data available for the analysis. They sometimes are referred to as human resources or personnel data and include records of every teacher working in the state. Sometimes these data are used for payroll purposes.
- Certification and licensure records are usually maintained by the office or board responsible for teacher licensure or certification. The language used to describe certification and licensure levels varies by state. At a minimum, the licensure dataset

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<sup>4</sup> The U.S. Department of Education (2001) has published a Staff Data Handbook in an effort to standardize staffing data maintained by states and districts.

will contain information on a teacher’s certification or licensure level and information about the subject areas that the teacher is endorsed to teach.

- University records might be available in some cases. University systems should be able to provide information on the number of graduates trained to teach in different subject areas, which is a key piece of information about teacher supply in the state. In some instances, public university systems also can provide information about individual graduates. Although they are not critical to a supply and demand analysis, university records can provide rich detail about teachers’ preparation that are important for a comprehensive study.<sup>5</sup>

**Data sources describing what the teachers do.** Exhibit 2 summarizes data sources and information on what teachers do.

**Exhibit 2. Data Describing Teacher Assignments**

Data Sources	Information the Data Should Provide
Assignment, employment, human resources, or payroll dataset	Grade levels taught Subjects taught Proportion of time per course or numbers of students taught Extra duties assumed Salary for extra duties assumed

Information about what each teacher does can be found by examining the teacher’s subject-area assignments and grades taught. Sometimes this information is part of the employment dataset, and sometimes states store these data in a separate dataset.

**Data sources describing where the teachers work.** Exhibit 3 summarizes the different types of data related to where teachers work, likely data sources, and the specific information that might be available.

The data on where teachers work provides information about the context in which each teacher works and the factors that contribute to teacher quality. This contextual information can be drawn from multiple datasets that address information about

- the teacher’s students,
- the general environment around the school, and
- the teacher’s specific working environment.

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<sup>5</sup> For an example of analysis using university records, see Podgursky, Monroe, and Watson (2002).

### Exhibit 3. Data Describing Where Teachers Work

Dataset	Data Source	Information the Data Should Provide
Information about Teachers' Students		
Student enrollment dataset	State education datasets	Total enrollment Enrollment disaggregated by race and gender Grades served by a school
Free and reduced lunch dataset (FRL)	State education dataset	Count of free and reduced lunch eligible students
Student assessment scores dataset <sup>a</sup>	State or district education dataset	Average proficiency levels at the school level
Information about the General Environment around Schools		
U.S. Department of Education, CCD	State, USDOE	School locale Household data
County level information	State economic development agency	Unemployment rates Average salaries or incomes
Regional indicators	State education dataset, state economic development agency	Indicators of the region within a state in which the school is located
Population Projections	Universities, state agencies	Information on future expected enrollment
Information about Teachers' Specific Working Environments		
District financial information	State or district datasets	Expenditures
Derived data, manipulated by the analyst to describe the working environment.	State employment and assignment datasets	Average qualification level of teachers at a school Teacher attrition levels

<sup>a</sup> Some states are able to link student assessment data to individual teachers.

At the state level, information about the teacher's students can come from three possible sources — the enrollment dataset, free and reduced-price lunch dataset, and student test score dataset. On occasion, district enrollment datasets also can supplement the student information. Stakeholders often are interested in the relationship between individual teachers and student test scores. An analysis that examines this relationship can provide valuable information about teacher quality. This is particularly the case for value-added analyses that measure the improvement of student test scores over a year (while students are being taught by specific teachers). Unfortunately, most state data systems lack the information needed to conduct such analyses. Value-added analyses require datasets to include links between students and their teachers and are greatly enhanced by a link allowing students to be tracked across years and schools. Instead, states frequently provide information on average test scores aggregated by school, which is insufficient for an accurate estimate of the extent to which individual teachers contribute to student learning. The use of aggregated school scores greatly reduces the ability to provide information about individual teacher quality.

A variety of sources exist for data that address the general environment around the school. In addition to descriptive information about where teachers work, this contextual information allows comparisons of the teacher workforce to be made across different settings. One of the most important data sources on schools is the Common Core of Data (CCD), a database maintained by the U.S. Department of Education. States provide almost all of the data used in the CCD and therefore should be able to access their data for a supply and demand analysis. The CCD also contains information from the Census Bureau including

- the school locale code, which indicates the urbanicity of where a school is located (e.g. urban, suburban, town, or rural<sup>6</sup>), and
- information about the households located within school boundaries, including information on household incomes and education levels.

Information about urbanicity can be important for communicating with policymakers about school conditions. The household information is less useful because it often is out of date as a result of the 10-year gap in decennial census information collection.

County and regional indicators also address the general environment and can be used to understand the labor market for teachers. Regional designations, either by state departments of education or economic development departments, are an effort to identify the local regions where teachers live and work. Economic development departments are often the agencies that maintain each state's data on unemployment and average salaries by county.

Another aspect of the general environment is the change in the area's future student enrollment. Most changes in enrollment can be estimated by using population projections. In many states, local universities or state government agencies develop population projections for each county by student age. Such projections are a good source of information about future enrollment trends, when available; if not, analysts can create their own<sup>7</sup>.

Information about the teacher's specific working environment comes from several sources. District expenditures can be used to examine overall resource levels and allocations, while district-level information about students can be used to understand the extent of other opportunities that teachers have in the district. For example, large districts typically have more opportunities for teacher transfers than small districts. The analyst also can derive information from the employment and assignment data about the school. For example, variables can be created to describe the qualifications of teachers who work in a given school and to identify patterns of teacher attrition at specific schools.

To avoid confusion, it is important that data from one school year not be mixed with data from another school year. Often datasets and their variables are named using the calendar year in which the data were collected. Because school years span two calendar years, an inconsistency can occur in the data. For example, data on teacher and student characteristics (e.g., demographics) usually are gathered in the fall,

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<sup>6</sup> The locale codes do not actually indicate urban, suburban, or rural. There are seven codes, which frequently are collapsed into urban, suburban, town, and rural to facilitate communication between analysts and stakeholders. Often, the locale codes for large city and mid-sized city are combined to create the urban category; the two locale codes for urban fringe are combined to create the suburban category; the town code is used to indicate town; and, the two rural codes are combined to create the rural category.

<sup>7</sup> Projection methods can be found in demography textbooks. There is also an ERIC (#ED199895) document that describes a projection method.

while student assessment data typically are collected in the spring of a given school year. This means that a dataset containing these variables, while spanning one school year, is derived from data collected in different calendar years. Sometimes different years are used to name variables and/or basic datasets. It is important to maintain clear records identifying the year that data represent.

## FORMATTING THE DATA

Formatting the data refers to building the datasets for analyses and consists of two steps:

1. Create a single record for each teacher with all the information necessary for the analysis.
2. Create descriptive variables about schools and districts to be used in the analysis.

Throughout the formatting process, the analyst should continually check the data for errors. This is very time consuming, but it is necessary to ensure the validity of the final analysis. As part of the check, the analyst should generate descriptive statistics (e.g., mean, median, minimum, and maximum) for each of the variables that might be used in the final analysis and examine the statistics to ensure that the values are reasonable. It is not uncommon for a few observations to have out-of-range values that are attributable to data entry errors. For example, if gender data are entered as “1” for female and “2” for male, any other values are data entry errors.

If only a few observations are unreasonable (i.e., less than one percent of all observations), then the analyst should consider making adjustments. How they are changed depends on whether there are any indications of what the correct values should be. Possible adjustments include dropping erroneous values, replacing values with an average, and fixing obvious mistakes such as misplaced decimal points. If between 5 and 10 percent of the values for any one variable seem wrong, then the analyst should consider excluding that variable from the analysis.

Sometimes many obvious errors can be traced to a particular district. In such cases, the variable can be used in the overall analysis, but the data from districts with high error rates should not be included. If a district is dropped from the analysis, it should be noted in the report. All changes, including a list of observations with revised values and descriptions of how the values were revised, should be noted in the data log.

Because districts hire teachers, and colleges and other institutions train teachers, the main unit of analysis in a supply and demand analysis is the teacher. The other option when selecting a unit of analysis is full time equivalent (FTE)<sup>8</sup>, but the use of FTE introduces difficulties in calculating and communicating supply and demand issues to policymakers and other stakeholders. In some of the datasets used for the analysis, there will be multiple records or observations for each teacher. For example, in the certification dataset, there might be a record for every time a teacher changes licensure level or adds a new subject-area endorsement. The assignment dataset might have a different record for every class a teacher teaches. Using individuals as the unit of analysis means that these multiple records need to be combined into a single record.

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<sup>8</sup> FTE is a measure of the amount of time a person works in a job. For example, a full time person works one FTE. If that person teaches half time and works as a principal half time, then that person represents a half FTE working in teaching and a half FTE working in school administration.

**Creating a single record for each teacher.** There are two steps involved in creating a single data record for a teacher:

1. Create a new variable for each different value across multiple observations.
2. Combine all the records for one individual.

As a simplified example, assume that a state has three different licensure levels: (1) probationary, (2) professional, and (3) master. The licensure dataset contains records that indicate the date that a teacher attains a certain level. Each record contains variables indicating the teacher's identity (IDNUM), the licensure level attained (LICLVL), and the date that level was reached (LICDATE). Exhibit 4 shows the records in the licensure dataset for three teachers. In this example, the teacher with ID number 123-45-6789 received a probationary license (prob) in May 1988. In July 1991, the teacher received a professional license (prof), and in August 2001 received a master's license (mast).

**Exhibit 4. Example of Raw Data from a Licensure Dataset**

IDNUM	LICLVL	LICDATE
123-45-6789	Prob	05-1988
123-45-6789	Prof	07-1991
123-45-6789	Mast	08-2001
9876-54-321	Prob	06-1999
9876-54-321	Prof	08-2002
000-00-0000	Prob	07-2001

The first step is to include all the licenses in the teacher's record by creating three new variables, one for each of the three different licensure levels. As shown in Exhibit 5, the three new variables are named PROBAT for probationary licensure, PROFESS for professional licensure, and MASTER for master's licensure. Values for these variables indicate the date that the license was received if the person has earned the license. If the person has not earned that license, the variable value is zero.

**Exhibit 5. Example of Newly Created Variables from Licensure Dataset**

IDNUM	LICLVL	LICDATE	PROBAT	PROFESS	MASTER
123-45-6789	prob	05-1988	05-1988	0	0
123-45-6789	prof	07-1991	0	07-1991	0
123-45-6789	mast	08-2001	0	0	08-2001
9876-54-321	prob	06-1999	06-1999	0	0
9876-54-321	prof	08-2002	0	08-2002	0
000-00-0000	prob	07-2001	07-2001	0	0

The second step is to combine the multiple records into one record for each individual that shows the date the teacher received each of the various licenses. The original raw data are dropped. Exhibit 6 shows the example dataset with records for the three teachers.

**Exhibit 6. Example of Combined Records for Each Individual**

IDNUM	PROBAT	PROFESS	MASTER
123-45-6789	05-1988	07-1991	08-2001
9876-54-321	06-1999	08-2002	0
000-00-0000	07-2001	0	0

Although this is a simplified example, the method can be used with much more complex records. The analyst should always retain the original data, and place the newly created variables in a separate dataset each time significant changes are made to the structure of the data. Should problems arise, then it is possible to return to the original dataset.

Assignment or endorsement variables often can have tens and even hundreds of different values. It is impractical and unmanageable to create tens or hundreds of new endorsement or assignment variables to create individual teacher records. A reasonable strategy is to consolidate the assignment and endorsement variables into a set of approximately 10 to 20 different subject areas. If possible, these categories should be designed to maximize comparability of assignments and endorsements.

Subject areas should be organized for optimal communication with policymakers, so the subjects should be those familiar to the general population. At a minimum, they should include (but not be limited to) the core subject areas noted in the No Child Left Behind Act (NCLB):

- English, reading, or language arts
- Mathematics
- Science
- Foreign languages
- Civics and government
- Economics
- Arts
- History
- Geography

Analysts need to decide which subject areas will be described in their final report and then identify the assignment and endorsement codes in the dataset that fit each subject area. Usually an examination of the codebook for the assignments and endorsements will suggest clear groupings of variables. In some states, this subject mapping exists in the datasets to help ensure that teachers are qualified for the work they do. When creating the subject-area structure for an analysis, the analyst should review it with representatives from the state department of education.

In creating individual teacher records, it is important to record how many courses a teacher teaches in each subject. This is likely to be measured in proportions of FTE spent in each assignment. The proportion of time spent in each subject can be used for two types of analysis. The first is an analysis of the number of teachers working in each subject area, their qualifications, and their attrition rate by subject area. Because the unit of analysis is the teacher, each individual needs to be classified as teaching a single subject. This classification is based on the subject that the teacher spends the most time teaching, which the analyst needs to be able to identify from the dataset. When teachers spend an equal amount of time in two subjects, the analyst must be explicit about the decision rule for how to record the subject taught.

The second use of FTE data is to create compliance indicators for teacher quality. NCLB requires that parents be provided with documentation about each class taught by a teacher who is not “highly qualified” according to the state’s definition. Tracking the FTE in each subject area is the first step in generating NCLB compliance information by organizing information about the subjects taught by each teacher. The next step depends on whether the licensure dataset contains information about the specific criteria by which teachers are considered “highly qualified” in a particular state’s NCLB plan. If the licensure dataset does not include the exact information needed to meet the state’s NCLB definition of “highly qualified,” the analyst can use subject-area endorsement as a proxy for determining whether a teacher is “highly qualified.” Ensuring that the teacher endorsement and assignment categories that are adopted are parallel and thus comparable greatly facilitates the use of endorsements as an indicator of teacher qualification levels relative to NCLB requirements.

***Creating variables about schools and districts.*** The second step in formatting the data involves the creation of categories that describe the schools and districts where teachers work. The categories are used to describe the relationship between teacher characteristics (e.g., qualifications, attrition, and transfers) and school characteristics. Categories should be created with the audience in mind and should be easy to understand and explain. The categories also should place schools in groups that seem relatively similar. The three most common analysis categories are based on school size, proportion of students who are eligible for free and reduced-price lunch (FRL), and proportion of minority students.

Two simple ways to create analysis categories are to use quartiles or to set group cut-points that are based on lay understanding or face validity. Quartiles are advantageous because they create equal-sized groupings of schools, at least in terms of the number of schools. A problem with quartiles, however, is that sometimes quartile ranges are so large that schools within a quartile are not very similar. For example, the quartile ranges for Colorado schools categorized by proportion of students who are FRL eligible are the following:

- Quartile 1: 0–9 percent
- Quartile 2: 10–27 percent
- Quartile 3: 27–48 percent
- Quartile 4: 49 – 100 percent

Because the fourth quartile range is so large, with variations of 50 percentage points possible, the schools in this quartile might have very different proportions of FRL students. As an alternative, schools can be classified based on a clear standard such as the following:

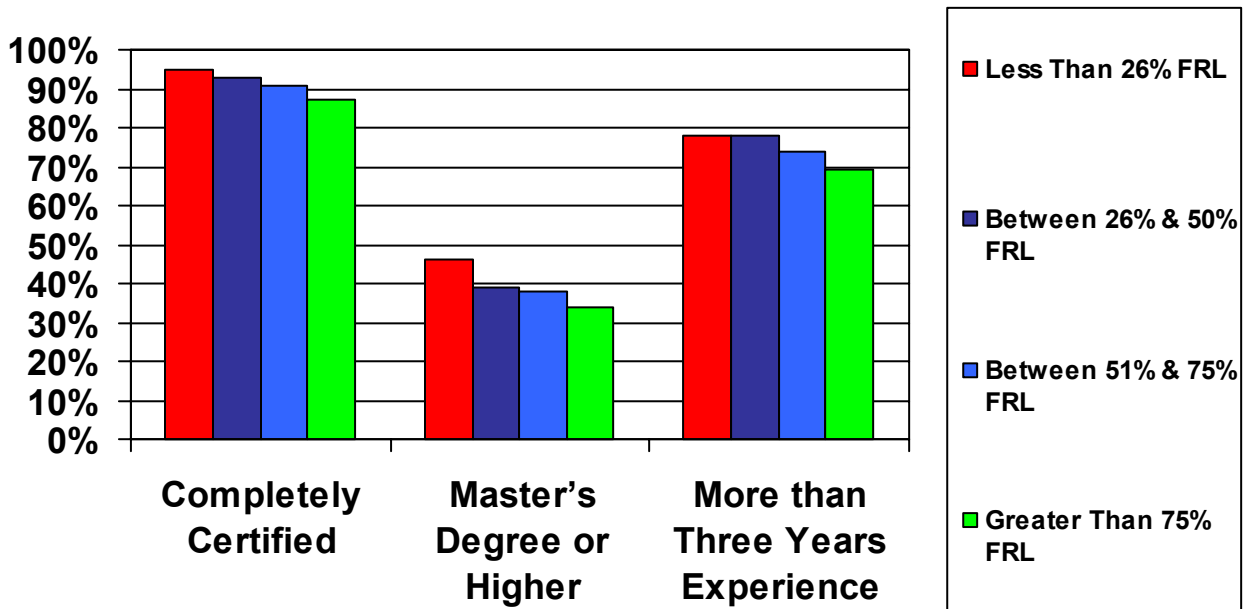
- Group 1: 0 –25 percent FRL eligible
- Group 2: 26–50 percent FRL eligible
- Group 3: 51–75 percent FRL eligible
- Group 4: 76–100 percent FRL eligible

This grouping system is easy to describe, but the number of schools in each group can be very different. For example, Colorado data from 2001 indicate the following distribution of schools when using this grouping scheme:

- Group 1: 708 schools
- Group 2: 483 schools
- Group 3: 279 schools
- Group 4: 108 schools

If this sort of grouping scheme is used, the analyst should explain that comparisons are being made between relatively large groups of schools that have very few students who fit into the analysis category (in this case, eligibility for FRL) with a small group of schools that have many students who fit into the category. In other words, the analysis has been structured to highlight the conditions in poorer schools. Exhibit 7 provides an example of these latter categories in use. The graph shows the relationship between the proportion of FRL-eligible students in the school and the qualifications of their teachers at the state level. Similar analysis categories could be created at the district level.

**Exhibit 7. Colorado Teacher Qualifications by Student Poverty in 2001**



Source: *Teacher supply and demand in the state of Colorado*, 2003, by Robert Reichardt. Aurora, CO: Mid-continent Research for Education and Learning.

### LINKING THE DATASETS

After the different datasets are formatted and prepared, the next step is to link or merge the various datasets together in order to conduct analyses across datasets. The combined dataset will contain information about teachers, what they do, and the context in which they do their work.

Merging or linking two different datasets requires that they share the same set of identification (ID) numbers. For example, to link the teacher employment dataset with the school enrollment dataset, the datasets must have school ID numbers that were created using the same convention. Most states have their own numbering system for schools, as does the federal government.

When choosing the various files to be used in an analysis, it is important that all of the ID numbers are in the same format. This is necessary to merge different datasets successfully. The format can either be numeric or text, but the text format is preferable because it maintains leading zeros in ID numbers (e.g. ID numbers like 007), whereas numeric variables drop leading zeros.

The use of SSNs to link various datasets that contain teacher information is valuable but not without controversy. The analysis requires an ID number that is consistently used within and across education

organizations, such as departments of education, licensure boards, and universities. The SSN is currently the only way to link education data with data maintained by non-education agencies such as departments of labor. Departments of labor can provide unemployment insurance information that sheds light on the movement of teachers into private industry. The SSN also is the only way to link teacher data between different states. The extent to which SSNs are usable for this type of analysis varies by state statute and the interpretation and implementation of federal legislation. SSN use is governed by the Family Educational Rights and Privacy Act of 1974, which requires that any government agency asking an individual to furnish his or her SSN must inform the individual of the following:

- Whether furnishing the information is mandatory or voluntary,
- By what law or other authority the agency is requesting the number, and
- How the information will be used.

Additional information about using SSNs is available on the Social Security Administration website ([www.ssa.gov](http://www.ssa.gov)) and in Cheung (2000).

In some cases an analyst might be tempted to use names (e.g., teachers or school) instead of ID numbers to link different datasets, but this should be avoided whenever possible. Slight differences in text formatting can lead to many errors in the linking process. In addition, some school names are very similar so that several schools can have the same name which can lead to multiple data errors. Also, some teacher names are similar, identical, or have been changed.

This type of analysis draws its power from being able to link disparate datasets. The analysis can use small bits of information that, on their own, provide little value, but together create a whole greater than the sum of the parts. That said, the linking step can be technically challenging. If done incorrectly, it can negate the value of the analysis or create flawed results that mislead policymakers. It is critical that the analyst closely attend to the linking process and continually check the newly created datasets for errors. At a minimum, this means paying close attention to the overall number of variables to ensure that new or duplicate variables are not being inadvertently created through the linking process. When possible, duplicate information in the two datasets being linked should be compared as an accuracy check. For example, if both the HR and licensure datasets include information on a teacher's birth date or race, then the analyst should check for errors in the linking process indicated by individual observations that do not have the same birth date or race.

## **CONDUCTING THE ANALYSIS**

The analysis should be conducted to meet the needs of policymakers and stakeholders. Suggestions for organizing the report to best ensure its use in policy development were presented in the questions and answers section of this document. Several key issues and themes should emerge in the course of data analysis, which can inform the report. The analyst should pay particular attention to the following:

- Differences in teacher qualifications and teacher turnover between schools that serve different student populations (e.g. high- and low-poverty schools, high- and low-minority schools, and high- and low-performing schools)
- Particular subjects or regions with concentrations of poorly qualified teachers, indicating shortages

- Particular subjects or regions with high teacher attrition rates or older workforces, indicating higher potential demand (i.e., future need) than in other regions or subjects

In general, the datasets described in the previous sections support six different types of analysis:

1. Workforce attributes
2. Indicators of demand
3. Indicators of supply
4. Teacher qualification and shortage indicators
5. Forecasts of demand
6. Evaluation of workforce change policies or programs

***Workforce attributes.*** Workforce attributes provide descriptive information about the workforce. This type of information includes numbers of teachers, where they teach, what grade levels they teach, average ages, salaries, student teacher ratios, and subjects taught. This basic information is very important to understanding the scale and scope of the teacher workforce.

***Indicators of demand.*** Workforce data can be used to create indicators of both current and future teacher demand. Indicators of current demand focus on attrition and transfer rates. Indicators of future demand are based on estimates of retirement eligibility. Using information on teacher age and experience, and referencing retirement eligibility rules (which vary by state and sometimes by district), an analyst usually can estimate when a teacher will become eligible to retire. It is then possible to estimate which subjects, regions, and even districts will face higher than expected teacher retirements in the near future.

***Indicators of supply.*** The data can provide some information about the supply of new teachers entering the profession. University data can provide information about the number of graduates by subject area who are qualified to be certified. The workforce data can show how many new teachers began working in the state that year. If workforce data are available over several years, an analyst can calculate how many new hires in a given year have never worked as teachers and how many simply took a break from teaching. The latter is usually related to having children. Linked workforce and university data can show where new teachers are trained and when they graduated; however, these data do not give a complete picture of supply because there are many persons who are qualified to teach who are not working in public education. In addition, some states either export or import a large number of their teacher graduates to and from other states.

***Teacher qualification and shortage indicators.*** The data generally contain four indicators of teacher qualifications: education level, certification level, experience level, and endorsements in the subjects taught. If it is assumed that schools and districts hire the most qualified applicants available, these qualification indicators also can be used to identify potential shortages. Where the workforce is less than fully qualified in an area, the analyst could assume a lack of qualified teacher candidates or that there are holes in the certification rules such as teachers being able to teach one class in a subject outside their certification. It should not be assumed, however, that these qualification indicators influence student achievement because the relationships between teacher qualifications and student achievement are relatively weak (Reichardt, 2001).

**Forecasts of demand.** Analysts can make rough forecasts of teacher demand (i.e., the need for teachers in the future) by using information about the following:

- The number of teachers in the state
- Current and future student population estimates
- Teacher age distribution

Most of these calculations can be done using a spreadsheet. A student-teacher ratio, calculated by using the count of teachers and students, can be used with student population forecasts to calculate future demand for teachers. The example in Exhibit 8 assumes that based on the current student-teacher ratio in year X (not shown) and student population projections for year X + 1 (not shown), the total number of new teachers needed for year X + 1 is estimated at 6,955 (the total cell in column H). Using a count of current teachers disaggregated by five-year age groups (column A), and current teacher attrition by age group (column B), the analyst can estimate the number of teachers lost in X + 1 due to attrition (column C).

The analyst needs to adjust estimates for each year by calculating teacher aging and the proportion of teachers in each age range that will into the next higher age range. For example, if the analyst estimates that 23 is the lowest possible age for a teacher, then there are three possible teacher ages in the 25 and under range — 23, 24, and 25. Therefore, each year approximately one-third (or 33%) of those teachers will move into the 26 to 30 range. For the other age ranges, approximately one-fifth (20%) of the teachers will progress into the next range. These rates are shown in column D and are used to calculate the number of teachers moving up in age range in year X + 1 (column E).

The attrition numbers and move-up estimates are used to identify the number of teachers projected to return in X + 1 in the different age ranges (column F). In the example, 6,506 teachers are projected to return. The difference between this number and the projected teacher demand of 6,955 (estimated in a prior calculation not shown) equals 449 teachers (the total cell in column G). The age distribution of current new hires in year X (not shown) can be used to calculate the likely age distribution of new hires for year X + 1 (column G). Adding the age distribution of returning teachers (column F) to the projected age distribution of new hires (column G) creates a forecast of the age distribution of the teacher workforce in Year X + 1 (column H).

At this point the analyst is ready to estimate the following year's (X + 2) teacher supply and demand forecast using the same method. This forecast is based on the assumption that future teacher-student ratios, teacher attrition rates, and new hire age distributions will resemble current patterns. If possible, the analyst should examine historical data to understand trends that are affecting the current patterns.

**Impacts of workforce change policies or programs.** Program evaluation data can provide information on the impacts of policies or programs designed to change attrition rates or the characteristics of new teachers. For example, if a particular district has implemented a program to reduce new teacher attrition, a supply and demand data analysis can be used to examine whether teacher attrition in that district has changed. If changes are found, the data created for a supply and demand study can be statistically analyzed to see whether the changes were different than expected given the composition of the district's workforce and working environment.

### Exhibit 8. Example of a Teacher Supply and Demand Forecast

	A	B	C	D	E	F	G	H
Teacher Age Groups	Current Teachers in Year X	Current Teacher Attrition Rate in Year X	Estimated Teacher Attrition in Year X + 1	Rate of Teachers Moving Up in Age Range in Year X + 1	Number of Teachers Moving Up in Age Range in Year X + 1	Ages of Returning Teachers After Attrition in Year X + 1	New Hires Needed for Year X + 1 (Demand) <sup>a</sup>	Teachers Working in Year X + 1 <sup>b</sup>
25 and under	195	19.2%	37	33%	52	106	86	192
26 to 30	620	13.3%	83	20%	108	482	102	584
31 to 35	777	8.7%	68	20%	142	675	63	738
36 to 40	845	6.1%	52	20%	159	777	58	835
41 to 45	1190	4.8%	57	20%	227	1065	55	1120
46 to 50	1484	4.8%	70	20%	283	1357	44	1401
51 to 55	1316	8.2%	108	20%	242	1249	27	1276
56 to 60	568	17.7%	101	20%	93	616	12	628
61 to 65	116	35.5%	41	20%	15	153	2	155
65 to 70	14	17.3%	2	20%	2	24	0	24
over 70	1	100.0%	1	0%	0	2	0	2
<b>Totals</b>	<b>7126</b>		<b>620</b>		<b>1322</b>	<b>6,506</b>	<b>449</b>	<b>6,955</b>

<sup>a</sup> The projected age distribution of new hires needed in year X + 1 is based on the age distribution of new hires in year X, which is not shown in the table.

<sup>b</sup> The projected total number of teachers working in year X + 1 is based on current and projected student-teacher ratios, which are not shown in the table.

### SUMMARY AND CONCLUSIONS

This document reflects both published and unpublished experiences of policymakers, data analysts, education researchers, and advocates for teacher quality in using data on teacher workforces to inform policy. The questions and answers about teacher supply and demand analyses suggest that these types of studies are important sources of information on state and regional patterns related to teacher availability and quality. This information is particularly useful given the reporting requirements of NCLB. The examples of previous supply and demand studies demonstrate how the results can be used in making policy decisions. When this occurs, such studies have the potential to raise the public awareness of the need for evidence in policymaking.

The issues discussed in this report also inform policymakers and analysts about practical concerns related to supply and demand analyses, such as the cost of a study and the steps involved. In addition, there are important recommendations on how to conduct a project that will be useful. The analysis needs to be relevant to the current interests of policymakers, and the results need to be described so they are easily understood. Also important is finding a “champion” for the analysis who will make sure the report remains visible in the policymaking arena. Potential barriers to a supply and demand analysis include

privacy concerns, data ownership, and data quality, with the latter being crucial to the validity of the results.

The second part of this report presented basic information on how to implement the four steps of a supply and demand analysis: (1) identifying data sources, (2) formatting and preparing the data, (3) linking the datasets, and (4) conducting the analysis. The explanations for these steps provide information about their execution and cautions regarding errors to be avoided. Understanding these steps and potential errors is useful not only for data analysts but also for consumers of reports on the analyses. It is important that policymakers and education administrators understand the value and uses of supply and demand studies and that they are equipped to ask questions of analysts about the validity of the results.

Supply and demand studies have the potential to contribute to the improvement of education for all children. Understanding the actual extent of the need for qualified teachers at state and local levels is the first step in ensuring that there is a highly qualified teacher in every classroom.

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