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ABSTRACT

Data about teachers and about the content and methods of teaching are most critical to understanding the conditions of education. Spotty evidence about two recent trends have produced a waft of legislation concerning teacher education, certification, and compensation across the United States. The first consists of data suggesting that the academic ability of those choosing to teach may be declining; the second suggests that the number of prospective teachers will soon be insufficient to meet the demand for new teachers. The data available are inadequate to firmly establish the existence or magnitude of these trends. Projecting teacher supply requires knowledge of at least three sources of potential supply: (1) the number of current teachers expected to remain in teaching; (2) the number of college graduates expected to choose teaching as their initial occupation; and (3) the number of individuals qualified to teach who are currently not teaching but might return to teaching. Data on teaching variables if gathered from teachers sampled in clusters by school and district and, if combined with administrative data on policies and school/student characteristics, would allow analysis of how policy and environmental factors influence teaching practice; how teacher characteristics--including qualifications and experience in the teaching area--influence practice; and how practices change over time. (JAZ)

DATA ON TEACHERS AND TEACHING: OPENING THE BLACK BOXES OF EDUCATION

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This paper was prepared for the Elementary and Secondary Data Redesign Project of the National Center for Education Statistics.

Over the last fifteen years, ever-declining funding for educational research and data collection has left us with many tempting clues but little solid evidence about what is actually occurring in the nation's schools. Annual reports on student test scores from the National Assessment of Educational Progress, the College Board, and individual states and school districts lead predictably to hand-wringing or back-patting on the part of educators and policymakers; but comparable, insightful trend data about the school and classroom conditions leading to these fluctuations is most noticeable by its absence from discourse about policy and practice. It simply is not available.

That we do not have a national ongoing system of educational indicators has become apparent during these last few years of commission reports on the status of American schooling. Armed with evidence of declining test scores, the various commissions have sought to make recommendations for reform based on analyses of the problems which have had to rely on old data, non-comparable data, and noniterative cross-sectional data. The lack of detailed, regularly collected trend data on important aspects of education--school finances and programs, teaching practices and methods, and teacher qualifications and assignments, among others--has forced policymakers and analysts to intuit the causes of educational "problems" (themselves poorly defined) and to infer from these intuitions what steps should be taken in response.

By treating the substance of schooling--what happens between the time that policymakers set budgets and mandates and the time that test companies take their thermometer scores--as a black box, we can never know which one(s) of any number of policy, practice, and environmental factors are producing the effects we applaud or deplore in the all-too-habitual cycle of educational "crisis," reform, disillusionment, and neglect leading to the next wave of crisis, reform, etc. The potential dangers of this approach to educational policymaking are exacerbated by the vigor with which state and local agencies have taken up the challenge to initiate reform, and by the public thirst for numbers to characterize educational progress. Where meaningful, defensible indicators of educational conditions are absent, anything that has been quantified will do, and these (sometimes conflicting) numbers are bandied about with reckless abandon, adding great heat but little light to serious deliberations about reform. The Secretary's wall chart of state comparisons is but one example of data that have been so misused; there are, of course, other less well-known but equally damaging examples.

In this paper, I would like to address two areas of data collection which I believe are most critical to understanding the conditions of education: data about teachers and about the content and methods of teaching. Let me begin by justifying these choices. Some years ago, studies of schooling were dominated by input-output methods, wherein gross measures of inputs (expenditures, class size, number of library books per student, etc.) were regressed on gross measures of outcomes (test scores, years of schooling completed, etc.) to ascertain what "works" to produce educational achievement. The answers were not

clearcut, in part I would argue, because those aspects of schooling that most influence the interactions between students and teachers were ignored. In fact, the main product of this approach was a decade of debate over whether schools had any independent effects on outcomes at all. Nonetheless, these studies stimulated, for a brief time, large-scale data collection on the specified variables of interest, at least allowing examination of possible relationships and knowledge of trends.

For a variety of reasons, perhaps including (but certainly not limited to) the failure of the approach to explain differences in schooling outcomes, detailed information about school resources and expenditures ceased to be available at the national level after the late 1970s. Research efforts since then have focused on school and classroom level variables that seem under certain circumstances to produce changes in student achievement. Two "bodies" of this research have been labeled as "teaching effectiveness" and "school effectiveness" research. These sets of studies point to some generic features of school climate and of teaching behaviors that, in some instances--primarily in elementary schools serving disadvantaged students--seem to be associated with increased achievement on standardized tests of "basic" skills. While closer to the nexus between students and teachers, these studies have still not included in any systematic way the characteristics of teachers or the content of teaching as variables for examination.

I will not treat here the issues related to the validity and generalizability of these studies' results--there is a burgeoning and contentious literature on the subject--but will make two points concerning the implications of this research for data collection: (1) State and local education policymakers are seizing on these results as the basis for policy initiatives (e.g., school improvement programs, teacher evaluation systems based on "effective teaching" behaviors, remediation programs for students who have failed competency tests), yet we have no cross-cutting data sources for estimating the degree to which these "effectiveness" variables are present or absent across schools of various types, much less to examine the claims for their potency; and (2) these and other efforts to understand schools "from the inside out" have been limited by the lack of nationally-representative data about what goes on in schools and classrooms.

Now we find ourselves faced with at least two widely-rumored and much-accepted presumptions about the current state of education: that educational quality has declined and that there is, or will be, a sizable shortage of skilled teachers. Some analysts are even presumptuous enough to speculate that there may be a link between educational quality and the characteristics of teachers and teaching. And some policymakers are developing policies based on these presumptions. It is even possible that a better understanding of trends affecting the characteristics of teachers and teaching may provide some links between the deductive and inductive streams of research which have as yet failed to meet on a common ground. Yet these presumptions and possibilities cannot at present be tested with the kinds of data that are collected in either an iterative or longitudinal fashion across a representative range of students and schools.

The opportunity costs of continued failure to collect data that describe trends in the teaching force and in the substance of teaching, I would argue, are quite large, particularly at this juncture in history. Educational policymaking is increasingly tampering with the "innards" of schools, rather than merely fiddling at the periphery of school operations. Without an ongoing set of educational indicators that describes salient aspects of teaching, we will never be able to understand and reconcile the discrepant findings that result from either "black box" analyses or microscopic examinations of schooling in unique settings. We will consign educational policymaking to its traditional faddism in response to problems that are poorly understood.

THE NEED FOR DATA ABOUT TEACHERS

Spotty evidence about two recent trends have produced a waft of legislation concerning teacher education, certification, and compensation across the states. The first consists of data suggesting that the academic ability of those choosing to teach, and remaining in teaching after a few years, may be declining (Weaver, 1979, 1981; Vance and Schlechty, 1982; NCES, 1983). The second consists of data suggesting that the number of prospective teachers will soon be insufficient to meet the demand for new teachers, and that substantial shortages will result (NEA, 1983; NCES, 1980, 1982). Although this evidence is based on the best data currently available, the data are inadequate to firmly establish the existence or magnitude of these probable trends and are even less adequate to provide a diagnosis of the problem which could assist policymakers in formulating solutions.

Because there are potentially important interactions between the supply and quality of teaching candidates, a proper diagnosis of the reasons for observed or projected shortages is essential for policy formulation. The traditional responses to short supply of job applicants, in teaching and elsewhere, are either to raise salaries to increase the pool of individuals willing to offer their services to an occupation or to lower standards for entry, or some combination of both. The strategy followed depends on the degree to which timely warning of impending shortage allows for policy responses which maintain standards as well as the degree to which existing standards are viewed as useful predictors of job performance. In education right now, it is probably fair to say that there is little agreement on the types of policy responses which will allow maintenance of quality standards in the face of at least spot shortages or on the usefulness of the standards that currently exist. Thus, we see states both tightening and loosening certification and entry standards (sometimes both simultaneously), and making various adjustments in compensation at different junctures in the teaching career with little ability to predict how these changes will affect the supply of teachers or the quality of teaching.

At least two competing theories are now offered for the presumed declines in teacher supply and quality. Weaver (1978,1979), for example, has argued that decreased demand for teachers during the 1970s led to a decline in the quality of supply as schools of education

attempted to maintain enrollments by lowering their standards. If this theory is correct, increased demand should of itself increase the supply of potential candidates, and tighter certification and entry standards should increase quality. In contrast, Schlechty and Vance (1981) argue that expansion of non-teaching employment opportunities for "traditional" prospective teachers has caused a decrease in the supply and quality of teaching candidates, as many have been lured away to other fields with greater financial and nonpecuniary attractions. If this theory is correct, the only way to increase teacher supply without lowering standards (or to maintain standards without further decreasing supply) will be to increase the attractions to teaching.

To test these (or other) theories about how the size and composition of the prospective teaching pool evolves, we need data about how occupational choice decisions are made by college students and how these decisions translate into actual employment decisions after graduation. However, to estimate the effects of various policy alternatives on overall supply and demand we also need to know about the size and character of the reserve teaching pool, the conditions under which its members will offer their services to education, the determinants of teacher attrition, and the degree to which certain teacher attributes or skills are interchangeable when shortages exist in some teaching fields while surpluses exist in others. Models for projecting teacher supply and demand must incorporate not only these kinds of data, but also take into account policy-generated changes in demand and policy-generated definitions of shortages which rest on conceptions of which characteristics of teachers are essential and which are dispensable for filling certain kinds of teaching positions.

The definition of shortage as something more than a count of unfilled vacancies is most essential if we are to move beyond a warm body theory of teacher quality. Although measures which take into account teacher certification or college coursework preparation move us further toward some notion of supply which incorporates a quality dimension, the knotty issues of what knowledge and skills are important to teaching will ultimately require data on teaching practices matched to data on teacher preparation if we are to begin developing an understanding of how policies relating to teacher supply influence the actual content and outcomes of teaching. And, as I have argued above, until we begin to understand what actually occurs in classrooms, we will never solve the riddles posed by incomplete models of school effects which first stimulate and later dampen reform initiatives. Below I propose some of the most essential data collection efforts I believe are necessary to begin sketching out trends concerning teachers and teaching, which might someday lead to answers to perennial policy dilemmas.

Teacher Supply

Projecting teacher supply requires knowledge of at least three sources of potential supply:

1. The number of current teachers expected to remain in the teaching force at a given point in time (the required estimate of attrition is, of course, also a component of projected demand);

2. The number of college graduates expected to choose teaching as their initial occupation. (For long-range projections, we should also consider the proportion of these who are expected to remain in teaching by year X or Y);

3. The number of individuals qualified to teach who are currently not teaching but might return to teaching, i.e., the potential reserve pool.

None of these estimates is simple to derive, and currently available data sources are inadequate for each. To complicate matters further, local or regional supply estimates must take account of in- and out-migration from the labor market area. Field-specific estimates must take account of substitution possibilities among teachers in different teaching areas. Putting aside these additional data requirements for the moment, let us examine how well we can handle the basic task of projecting supply with current information.

The first component, the stock of current teachers minus attrition, ought to be the simplest to estimate and project. However, though the number of current teachers is known, current and prospective attrition rates are not. The most recent estimate of teacher attrition was obtained by NCES in 1969. This estimate of 6 percent has been used ever since in NCES projections of teacher supply and demand.

There are a number of reasons to believe that teacher attrition rates are not static. First, the age composition of the teaching force changes over time; hence, the proportion of the force nearing retirement also changes. In addition, recent data from a number of states and school districts suggest that attrition rates are especially high (50 percent or higher) for inexperienced teachers during their first few years (cf Mark and Anderson, 1985; Grissmer and Darling-Hammond, 1984; Vance and Schlechty, 1982). Thus, the experience composition of the teaching force--also related to the age-distribution--may be an important (and changing) variable. Third, labor market forces in teaching and in the general economy undoubtedly influence turnover. When teaching positions are scarce, temporary exits may be fewer due to expected difficulty in re-entering; when other opportunities are plentiful, career changes are more likely. (These opportunities may also, of course, be more plentiful in some regions of the country and for teachers in certain fields--especially math, science, and computer science--than others.)

Finally, policy variables may influence attrition rates. Incentives for early retirement, for example, became widespread in school districts during the 1970s, when declining enrollments required reductions-in-force. These incentives may now work, ironically, to

produce shortages. Current policy initiatives, such as internships for beginning teachers and merit pay or career ladders for veterans, are intended to influence attrition rates. Perhaps they will.

Suffice it to say that we should expect attrition to change with the shape of the teaching force, with the health of other sectors of the economy, and perhaps even with changes in policy affecting teachers. We ought, then, to be prepared to regularly estimate attrition rates for various classes of teachers as a basis for preparing and modifying projections of extant supply.

As a first step, we need to know the age composition of the current teaching force and attrition rates by age category, so that we can project the number of retirements and early leavers over time. It is important to note that, as new teachers comprise a greater share of the teaching force in the coming years, it will be more important to understand when and why many of them leave, and whether they plan to return. Currently the NCES Common Core Data Set tabulates state counts of full-time equivalent teachers by level, but not by age, experience, or teaching field. The periodic NCES surveys of teacher demand and shortage collect data from a sample of school districts on total teaching positions by field and on vacancies and new hires, but do not allow accurate estimates of attrition. New sources of data must be developed if these information needs are to be met.

While surveys of school districts or schools could be developed to provide estimates of localized turnover rates and probably fairly accurate estimates of retirement, they would need to be supplemented by ongoing surveys of teachers if mobility among districts is to be accurately separated from temporary and "permanent" leaves from the profession--and if reasons for leaving are to be understood.

In addition, both district-level and teacher-level surveys should collect data that will allow analysis of policy factors that might influence both entry and retention in teaching. At a minimum, salary data must be collected from districts (through the CCD and/or other district surveys) that describe the salary range and distribution of teachers across that range in addition to average salaries, which are uninformative for most analytic purposes. Information on retirement plans and other important compensation variables would also be helpful for analysis of attrition rates. Cluster sampling of teachers within districts to establish career paths and plans could further illuminate links to policy variables, especially if these surveys could include information on teachers' views of the policies as they influence career decisions.

The second component of supply, entrants who are recent college graduates, is also problematic. Traditionally, estimates of new teacher supply have been made on the basis of the number of students graduating with degrees in education. Although data are now routinely collected which provide such estimates at the bachelor's and master's degree levels, and these are incorporated into NCES projections, there are problems with using this measure alone to estimate and project new teacher supply.

First, we need to know what proportion of master's degrees granted in education are awarded to persons preparing to teach as opposed to those already teaching. Previous inclusion of master's degree students in estimates of new supply have caused overestimates; exclusion will lead to underestimates of unknown proportions. While in the past, the vast majority of such master's degrees were awarded to existing teachers, this may change as states open up alternative routes to certification for liberal arts graduates and as some teacher education programs move to a 5-year model.

Second, we need to know what proportion of students receiving bachelor's degrees in education actually plan to teach, and how many do so. Prior NCES surveys of recent college graduates have obtained such data; however, they do not provide information about the degree to which failure to enter teaching is due to inability to find jobs or to changes in occupational plans. Clearly such information is needed if we are to understand the real sources of supply.

The proportions of teacher education graduates who do not initially enter teaching vary substantially over time and across teaching fields. In 1976-77, NCES estimated that the portion of newly qualified graduates seeking teaching positions was 77 percent, with only 60 percent ultimately accepting teaching positions. In 1981, the estimate of those seeking full-time positions was 85 percent, with 64 percent ultimately accepting such positions. Differences among teaching fields are also substantial. In 1981, for example, only 30 percent of prospective health teachers accepted full-time teaching jobs as compared to 75 percent of prospective special education teachers (NCES, 1983).

Previous studies have tended to overestimate new teacher supply because of lack of data about occupational decisionmaking both during and immediately after college. One consistent source of overestimates in projections has been the assumption that the teacher production rate is a constant share of the college student population. In fact between about 1970 and 1980, the proportion of college students majoring in education declined by nearly half--from 21 percent to 11.6 percent--and the proportion of college-bound students now planning to major in education is only about 5 percent. Thus, projections of teacher supply must incorporate *trends* in the occupational choicemaking behavior of students. These trend data are useful only if they are understood. To what extent are substantial changes in teacher production rates a response to labor market factors (i.e., a perceived surplus of teachers)? To what extent are they evidence of disaffection with the salaries or other conditions of teaching?

The relationship between educational and occupational plans and actions must be examined at several points in the teacher production pipeline if we are to understand the factors influencing the supply of new teachers: at college entry, choice of major, college exit, and initial occupational choice. As mentioned earlier, the decision to leave or remain in teaching during the first few years is also extremely important. The NLS supplement to be conducted next spring that will

survey all of those in the 1972 sample who ever majored in education or taught (plus a sample of those who might otherwise be classified as prospective teachers) will provide a valuable data source for examining these questions for that cohort of students. NCES should consider adding a small number of carefully-designed questions to the HSB followups of 1980 sophomores and seniors to track their occupational decisionmaking with respect to teaching as well.

The third source of teacher supply--the potential "reserve pool" of teachers--is most difficult to estimate, but may be increasingly important if the number of new college graduates entering teaching continues to shrink. These are individuals who are qualified to teach but who are not currently teaching, either because they, perhaps temporarily, left teaching to raise families or pursue more education, or because they have entered other occupations. Estimating the size of the real reserve pool depends on knowing what proportion of these individuals would consider re-entering teaching under various conditions as well as knowing the annual rates of entry into and exit from the pool. Previous studies have tended to overestimate the annual supplies from the reserve pool since an overprojection of the number of new teachers produced in any year results in an overprojection of the size of the reserve pool in subsequent years and because "attrition" from the reserve pool (into other occupations) is not taken into account. Even with better estimates of annual supply, we will need data that allows us to identify the factors that influence the behavior of exteachers and their relative propensities to seek teaching positions.

There are several possibilities for collecting such data; though each is imperfect, they would provide us more information than we now have. The special NLS survey of current and former teachers will provide some information on the current occupational status of former recruits to teaching and, perhaps, on their plans and attitudes toward re-entering teaching. Since this is a single cohort, though, it will provide limited information on responses to different labor market conditions and on attitudes of later cohorts. Nonetheless, the survey should provide strong indications of the numbers and characteristics of the "potential" reserve pool for that cohort who are in fact firmly committed to other occupations and lost to teaching. Similar followups with the HSB sample would strengthen the analysis of reserve pool behavior. In addition, ongoing surveys of teachers might be designed to solicit personal and job histories from those who have just entered or re-entered teaching and job plans from recent attritees (if they are tracked) or those who have definite plans to leave during the school year. These efforts would help in developing estimates of both entry and exit rates from the reserve pool for different types of teachers and an understanding of the factors influencing these decisions.

Teacher Demand

To estimate and project teacher demand we need to know the number of teaching positions required in a given year (by field and level), and the number that will be filled by teachers currently in the teaching force. The first component, the size of the teaching force, depends at

the most general level on student enrollments and anticipated pupil/teacher ratios, both of which are fairly easy to estimate with existing demographic and school data. Projection errors, though, can stem from at least two sources:

1. Inability to anticipate student enrollment growth due to such factors as immigration (which may cause dramatic increases in enrollment in some regions or localities) or changes in student service patterns, caused by policies that extend public education downward to kindergarten and preschool levels as is occurring now in some states.

2. Inability to anticipate policy-generated changes in staffing patterns, such as those which accompany new forms of service delivery (e.g., the now fairly widespread use of specialists in elementary schools or the possible changes in staff responsibilities that may accompany career ladder plans); or new programs and course requirements for students (e.g., the addition of special education, bilingual education, and compensatory education programs during the 1970s, or the changes in student graduation requirements now being enacted in many states).

These kinds of changes certainly affect the demand for particular types of teachers; depending on how schools manage these changes, i.e., the degree to which they substitute or supplement teachers and services), they affect the total demand for teachers as well.

There are at least two possible means for improving sources of data about these elements of teacher demand. First, it may be possible to include questions about recent policy changes presumed to affect teacher demand in the CCD surveys of state education agencies and in the Demand and Shortage surveys of local education agencies. While officials may not be able to estimate the effects of recent policy changes on teacher demand, the availability of other state- and local-level data about student participation in the relevant courses, programs, or services might allow analysts to do so.

At a minimum, though, collecting such information would allow some gross adjustment of demand projections if used in conjunction with a second source of data: regular reports of teacher vacancies in particular fields *which separate new demand from demand produced by attrition*. The periodic surveys of teacher demand and shortage are not currently designed to provide this information, although the addition of a few questions would allow them to do so. Specifically, the surveys need to ascertain the number of teaching positions (by level and field) authorized for the current year *as compared to* the number authorized and filled in the previous year (now not asked), along with the number of continuing teachers, new hirees, and unfilled vacancies. Adding questions about student enrollment trends and pupil/teacher ratios would also allow much more accurate understanding of the sources of demand.

The second component of demand, the number of continuing teachers, was treated in the previous section's discussion of teacher attrition. One additional observation is important here. The degree to which teachers with different skills and preparation are substitutable when new areas of demand emerge has important implications for assessing both overall and field-specific demand and shortage. Much of the disagreement over current shortage projections stems from lack of clarity on this point.

Teacher Shortage

As an example of how definitions of teacher shortage vary, consider two extreme views of teacher fungibility. On the one hand, if teachers of different backgrounds are always perfect substitutes for one another (e.g., an elementary school teacher can as easily teach high school mathematics and a junior high industrial arts teacher can as easily teach kindergarten), then estimates of total teacher supply and total teacher demand are all that count. If supply equals or exceeds demand, and is projected to continue to do so, there is little cause for concern about shortages. (Obviously, local and regional imbalances in total supply and demand are important and will vary. Some excess in supply is always necessary to force mobility to places with higher demand and to allow quality distinctions to be made in hiring.)

In fact this is the basic approach of most general projections of teacher supply and demand, which further assume that anyone who is teaching (or has taught) can be counted as a teacher, i.e., part of the supply pool, regardless of qualifications. This assumption stems from the lack of agreement about what constitutes qualification to teach, leading to non-discriminating measures for counting teachers that reflect states' and school districts' willingness to hire individuals without standard credentials as teachers when the need arises or to reassign current teachers outside their areas of preparation. These then become part of the teacher pool, and it becomes almost impossible to discern a shortage, since vacancies are nearly always filled somehow with someone. The analogy would be to calculate in the supply of physicians anyone willing to offer his or her services as a doctor, regardless of training or licensure, in an environment where significant bars to this practice did not exist. Thus, the recent surveys of Teacher Demand and Shortage report few "shortages" as measured by unfilled vacancies, while projections based on qualifications to teach have anticipated shortages and surveys of teachers suggest that a nontrivial proportion teach outside their fields of preparation or certification.

At the other extreme, if we assume that teachers are totally non-fungible and that particular preparation--however defined--is essential for successful performance of the job, i.e., that a teacher can only teach those subjects or levels for which they have particular preparation, then supply, demand, and shortage would be assessed much differently. Separate computations of supply and demand by field would be essential, with acute shortages obvious in some and surpluses obvious

in others, and individuals hired or assigned to teach in areas for which they lack the particular qualifications used as a discriminating measure would be eliminated from counts of "legitimate" supply, thus producing measures of latent if not blatant shortages.

Obviously, taken to the extreme these assumptions can become equally nonsensical, and NCES cannot become the final arbiter of teacher quality measures. However, some indication of the degree to which the demand for specific types of teachers is matched with a supply of appropriately-trained teachers is essential for policymakers concerned with teacher supply and quality. Given that there is disagreement about measures of teacher quality, several different measures could be used in data collection efforts that describe the stock of teachers and their teaching assignments. These might include certification in the field(s) taught, college coursework preparation in those fields, and pedagogical preparation. Such indicators would at least allow policymakers to track supply, demand, and shortage according to various definitions of "legitimate" supply. They would also allow some means for reconciling currently disparate estimates and, ultimately perhaps, for examining how school districts' hiring and assignment practices influence other teaching variables of interest.

Although data are not available to demonstrate conclusively how qualifications-related measures of supply and demand would affect estimates of shortages, some sense of the possible magnitude of differences in estimates derived from alternative assumptions can be gained from recent surveys. The 1983-84 NCES estimates of teacher shortage, based on a measure of unfilled vacancies reported by a sample of school districts, indicate overall shortages in the neighborhood of only 1.6 per thousand current teachers, with field-specific shortages ranging from .4 per thousand for reading to 8.8 per thousand for bilingual education (NCES, 1985). This range probably reflects supply as it interacts with the outer bounds of teacher "fungibility" in different fields. That is, a number of individuals might well be viewed as capable of teaching reading, but the potential supply of bilingual education teachers is limited to individuals who are, in fact, bilingual themselves, aside from the application of any credentialing standards.

Applying a different standard leads to quite different estimates of shortage. For example, the same 1983-84 survey provided estimates of the proportion of total and newly hired teachers not certified in their principal field of assignment; these amounted to 3.4 percent of all teachers and 12.4 percent of all newly hired teachers. If we assumed that no certified applicants could be found to fill the vacancies filled by newly hired uncertified teachers and added these 26,300 positions to the count of unfilled vacancies, the estimate of shortages would increase dramatically from 1.6 to over 20 per thousand current teachers. If we further assumed that the positions filled by other teachers assigned outside their fields of certification could not have been filled by certified applicants (for various reasons this becomes a more dubious assumption), the estimates would skyrocket further.

Applying still more rigorous standards yields predictably larger estimates. Since certification is not a perfect measure of preparation,[1] we might want to know what proportion of teachers are teaching classes outside their fields of preparation that might otherwise be counted as evidence of demand or, if unfilled, of shortage. (Again, this requires inferences about hiring and staffing and disallowances of substitutions or economies that are not entirely supportable.) A 1980-81 NEA survey of teachers indicates that 16 percent of all teachers teach some classes outside their field of preparation; and 9 percent spend most of their time teaching "out of field" (NCEA, 1981); the HSB survey indicates that, among high school teachers, 11 percent teach primarily outside their area of state certification and 17 percent have less than a college minor in the field they most frequently teach (Carroll, 1985).

To be sure, we do not know the degree to which such "out of field" assignments are actually inappropriate according to various standards, or the degree to which they impair teaching quality; nor do we know the extent to which the discontinuation of some of these types of hiring and assignment practices would actually influence teacher demand or shortage. Some of these practices are undoubtedly the result of capitalizing on teachers' individual uncredentialed abilities and interests; some result from district attempts to continue to employ senior teachers when demand in their particular teaching fields declines; some are probably supported by inservice training that upgrades the stock and flexibility of human capital. On the other hand, misassignment as a response to teacher shortages may also result in poor teaching in some unknown proportion of instances, and may contribute to teacher stress and attrition.

In order to understand the interactions between teacher supply and qualifications and the effects of qualifications on teaching practice, we need data from ongoing surveys of teachers to supplement the data on teacher hiring and vacancies collected from school district personnel offices. The latter are useful for providing gross measures of shortage and qualifications, but cannot provide details about teachers' characteristics and attributes or about teaching practice. Through the preceding discussion, I have described certain kinds of information needed to understand important aspects of supply and demand that can only be collected from teachers, and must be obtained on a regular basis. Ongoing surveys of teachers such as those launched in the Public and Private School Teacher Surveys of 1984-85, should be designed to collect data on teachers formal qualifications, additional inservice training; teaching assignments and job histories and plans. Furthermore, as described below, these surveys should collect data on teachers' attitudes and teaching practices so that policy-related questions concerning the links between school and teacher variables can be examined.

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[1]The HSB survey of high school teachers, for example, indicates that of the small number (1.7 percent) of high school teachers who have had *no* college courses in the field they most frequently teach, 74 percent are nonetheless certified in that field (Carroll, 1985).

THE NEED FOR DATA ON TEACHING

Currently, very little data are available on teachers' working conditions, their views of school conditions and administrative practices, or on the activities they engage in as part of their instructional efforts. The only ongoing source of information providing trend data on teachers' working conditions, career plans, and views of teaching is collected every five years (since 1956) by the National Education Association, in the Status of the American Public School Teacher surveys. For the first time, the 1985 NCES Public and Private School Teacher Surveys asked questions about teacher qualifications, teaching load and salaries, but there are no comparable questions about career plans and satisfaction with which to test links between working conditions and career decisions. Future surveys of teachers conducted by NCES ought to seek data on all of the these variables on a regular basis so that possible relationships between teacher qualifications, compensation and work load, views of working conditions, and career decisions can be examined.

Still less data are available about what teachers actually do in classrooms, much less how teaching practices relate to teacher attributes or school policies. Though studies of school and teacher effectiveness have suggested a number of policy and practice variables that are important to schooling outcomes, no nationally-representative source of data on these factors is available to examine trends or relationships. The addition of teacher and administrator questionnaires to the HSB student surveys is a commendable start for understanding the experiences of high school students. NAEP's efforts in this direction will also enrich our understanding of schooling processes for the NAEP samples of students, teachers, and administrators. However, the usefulness of these data for various policy purposes is limited by the nature of the sampling frames appropriate to their major purposes.

A tantalizing peek at changes in teaching practices was provided by the major longitudinal studies data on high school seniors reports of teaching methods used in their classrooms. Between 1972 and 1980, students were exposed to writing, student-centered discussions, and project or laboratory work in their public school 12th grade classrooms. More were exposed to individualized instruction and computer-assisted instruction. Unfortunately, the data did not allow further examination of teaching practices or their relationship to teacher attributes or school policies. And, of course, no such data are available for examining teaching practices at other grade levels.

Among the major questions about teaching for which we have no trend data available are the following:

- How much instructional time is available to students and teachers (e.g., length of the school day and school year; duration of classroom periods)?

- How do teachers use instructional time (e.g., amount of time devoted to different subject areas and to different teaching activities such as lecturing, discussion, seatwork, project or lab work, recitation, testing, reading, writing)?

- How much instructional time is lost to "nonteaching" activities (e.g., paperwork, pep rallies, class changes)?

- How much emphasis do teachers place on different instructional tools or methods in classroom and homework assignments (use of textbooks, workbooks, computers, teacher-developed materials, library books, research projects or other problem-solving activities, writing themes, etc.)?

- How do teachers make decisions about what and how to teach district or school policy, textbook coverage, test coverage, personal views of student needs, etc.)?

Data on teaching variables such as the above, if gathered from teachers sampled in clusters by school and district and, if combined with administrative data on policies and school/student characteristics, would allow analysis of how policy and environmental factors influence teaching practice; how teacher characteristics--including qualifications and experience in the teaching area--influence practice; and how practices change over time. It is beyond the mission of NCES to establish how any or all of these variables affect student learning--other kinds of research and data collection activities sponsored by NIE and elsewhere must attend to these questions--but as knowledge grows about important indicators of effective schooling and teaching, NCES should strive to incorporate sources of relevant data in a stable, ongoing system of teacher and administrator surveys that reveal something of what actually occurs in those black boxes called schools.

This effort will require greater amounts of resources than have been available to NCES in recent years. However, the resources required are negligible compared to the millions of dollars expended on the thousands of commission meetings and papers and other activities attendant to reform formulation which sweep the country each time a new crisis in education is declared. Though NCES cannot relieve us of crises and commissions, it can provide a basis for deliberations about problem sources and solutions which might advance the debate, and perhaps eventually break the cycle of educational crisis, reform, disillusionment, and neglect which is repeated with such distressing regularity.

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