Core Problems

Out-of-Field Teaching Persists in Key Academic Courses and High-Poverty Schools

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The Education Trust

TO THE POINT

- **The highest rates of out-of-field teaching appear in high-poverty and high-minority schools, the very schools where students desperately need good teachers.**
- **Out-of-field teaching is rampant even in disciplines in which shortages do not exist and in states with a surplus of teachers for available vacancies in all fields.**
- **Although out-of-field teaching in core subjects is unacceptably high, the problem is especially acute in secondary school mathematics classes.**

Far too many secondary school teachers have neither an academic major nor state certification in the subjects they teach. The problem is especially prevalent in middle grades and in mathematics classes. What's worse, the highest rates of out-of-field teaching appear in high-poverty and high-minority schools. Often, the problem occurs simply because of poor planning or administrative convenience. State and district leaders can follow the promising practices outlined in this report to improve teacher quality, especially in high-poverty schools.

Core Problems

Out-of-Field Teaching Persists in Key Academic Courses and High-Poverty Schools

BY THE EDUCATION TRUST
with analysis by Richard M. Ingersoll

Teachers cannot teach what they do not know. Research tells us that middle school and high school teachers with demonstrated knowledge of their subject areas produce stronger results with students, especially in mathematics and science.[1] Yet through no fault of their own, many teachers are just a chapter ahead of their students in the courses they are asked to teach.

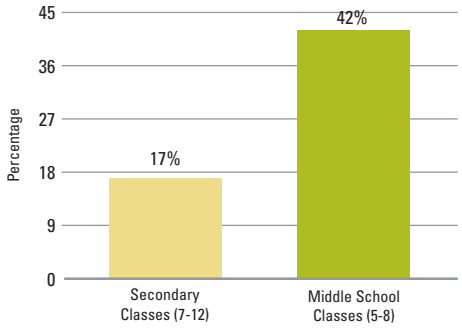
The best data available to assess teacher assignments come from a national survey the U.S. Department of Education conducts every few years, the Schools and Staffing Survey (SASS). One reason this source is so good is that the data come from teachers themselves—rather than from officials who, frankly, may want their schools to look a little better than they are. The Education Trust, in partnership with University of Pennsylvania Professor Richard M. Ingersoll, analyzed SASS data from 2003-04 (the most recent survey) to examine out-of-field teaching in core academic classes at the secondary school level (grades 7-12).

The SASS data show that in secondary schools across the country, far too many teachers have neither an academic major nor state certification in the subjects they teach. The problem of out-of-field teaching is especially prevalent in middle grades (grades 5-8) and in mathematics classes. What's worse, the highest rates of out-of-field teaching appear in high-poverty and high-minority schools, the very schools where students desperately need good teachers.

Our analysis shows that significant work remains to be done to eliminate out-of-field teaching and guarantee that low-income and minority students have teachers with demonstrated knowledge of their subject areas. In crafting the No Child Left Behind Act, Congress tried to direct more attention and energy to this problem by requiring "highly qualified"[2] teachers in all core academic classes and by ask-

Out-of-Field Teaching Is Far Too Common, Especially in Middle Schools

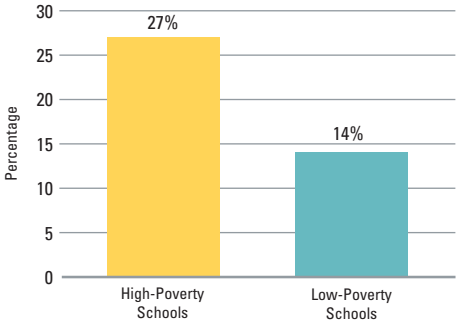
Percentage of Classes Taught by Teachers With Neither Certification Nor Major



Source: Analysis of 2003-04 Schools and Staffing Survey data by Richard M. Ingersoll, University of Pennsylvania, 2007.

Out-of-Field Teachers Are Found More Often in High-Poverty Than in Low-Poverty Secondary Schools

Percentage of Classes Taught by Teachers With Neither Certification Nor Major



Source: Analysis of 2003-04 Schools and Staffing Survey data by Richard M. Ingersoll, University of Pennsylvania, 2007.

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ing district and state leaders to attest that low-income and minority students are not taught disproportionately by out-of-field teachers. It seems clear from the data, however, that needed changes are not occurring rapidly enough to make a difference in student achievement.

This report provides an overview of available data, profiles some promising approaches, and suggests questions state and district leaders should be able to answer.

HOW WE APPROACHED THIS ANALYSIS

For the purposes of this analysis, we define "out-of-field teachers" as those possessing neither certification in the subject they have been assigned to teach nor an academic major in that subject. In our analysis of math classes, we classify as "in-field" those individuals who hold a major in a mathematics-related academic area, such as engineering or physics, or a subject-area education degree, such as mathematics education. Secondary classes include those organized by department in grades 7-12.

We were particularly interested in whether the problem of out-of-field teaching is more acute in classes in high-poverty and high-minority schools. In this report, "high minority" refers to schools with 75 percent or more minority students. "Low minority" refers to schools with 10 percent or fewer minority students. "High poverty" refers to schools with 75 percent or more students who are eligible for free or reduced-price lunch, while "low poverty" refers to schools with 15 percent or fewer students from low-income families. These percentages roughly correspond to the top and bottom quartiles of all schools in the United States.

Because we wanted a better understanding of out-of-field teaching for students in middle grades, we also include in our examination fifth-grade and sixth-grade teachers from schools where instruction is organized by department—that is, where teachers can be identified as teaching a specific subject such as math or science.

WHY DOES OUT-OF-FIELD TEACHING OCCUR?

Teachers are not to blame for out-of-field assignments. Sometimes the problem is rooted in state or local teacher shortages or inadequate preparation of available teachers. But it turns out that out-of-field teaching is rampant even in disciplines in which shortages do not exist and in states with a surplus of teachers for available vacancies in all fields.[3] Often, the problem occurs simply because of poor planning or administrative convenience.[4]

The following facts illustrate the extent of the problem:

- **In secondary schools (grades 7-12):**
  One in six classes (17.2 percent) in the core academic subjects (English, mathematics, social studies, and science) has an out-of-field teacher.
- **In middle grades (grades 5-8):**
  About four in ten (42 percent) core classes are assigned to out-of-field teachers (this only includes schools where classes are organized by department).
- **In high-poverty schools:**
  More than one in every four core classes (27.1 percent) has an out-of-field teacher, compared with only about half as many classes (13.9 percent) in low-poverty schools.

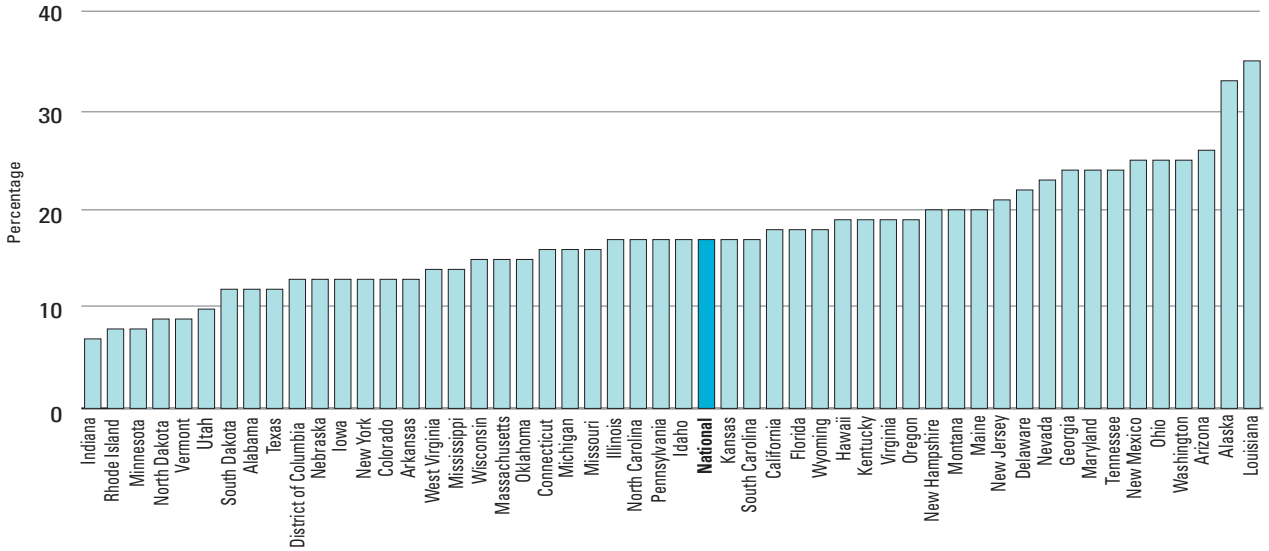
WIDE VARIATIONS EXIST IN STATE-REPORTED AND TEACHER-REPORTED DATA

Some states do a better job than others in reducing out-of-field teaching. For example, Washington and Massachusetts are demographically similar but have big differences in the rates of out-of-field teaching. In Massachusetts, teachers in about one in seven classes (14.7 percent) lack an academic major and in-field certification in that subject; in Washington, the figure is one in every four classes (25.3 percent). The chart below shows the disparities among the states.

To comply with the No Child Left Behind law and other federal regulations, states must inform the U.S. Department of Education annually about the qualifications of their teachers. The document they submit, called the "Consolidated State Performance Report," must include the percentage of core academic classes taught by highly qualified teachers in all schools, and the information must be disaggregated by the degree of school poverty.[5] To determine whether discrepancies exist between state-reported and teacher-reported data about teacher qualifications, The Education Trust compared the Consolidated State Performance Reports with the Schools and Staffing Survey. In some instances, we found big differences between state-reported percentages of classes taught by highly qualified teachers and SASS data on the percentages of teachers with in-field certification.

For example, Ohio reported that 93 percent of core academic classes were taught by highly qualified teachers, yet the Schools and Staffing Survey suggests that only 62.5 percent of classes were taught by teachers with certification in the subject assigned. The discrepancy in the numbers suggests that out-of-field teaching may be more prevalent

Percentage of Core Secondary Classes Taught by Teachers With Neither an Academic Major Nor Certification in the Subject



Source: Analysis of 2003-04 Schools and Staffing Survey data by Richard M. Ingersoll, University of Pennsylvania, 2007.

than the state reports. Appendix A contains a state-by-state look at the two data sources on teacher quality.

OUT-OF-FIELD TEACHING IS ESPECIALLY ACUTE IN MATHEMATICS

Although out-of-field teaching in core subjects is unacceptably high, the problem is especially acute in secondary school mathematics classes and truly alarming for low-income and minority students who stand to fall further behind their more affluent and white peers.

- Twenty-two percent of all mathematics courses in secondary schools are taught by a teacher with neither state certification nor an academic major in mathematics or a math-related subject such as engineering, physics, or math education.
- Low-income students are assigned out-of-field teachers in mathematics at more than twice the rate of their more affluent peers. Four in ten mathematics classes (40.5 percent) in high-poverty secondary schools are taught by out-of-field teachers. In schools that serve the fewest low-income students, the figure is less than half that—16.9 percent.
- Minority students are assigned teachers who lack the qualifications to teach mathematics at twice the rate of white students. In secondary schools that serve mostly African-American and Latino students, 30.3 percent of mathematics classes lack qualified teachers. In schools with relatively few minority students, the figure is 15.5 percent.

These patterns help explain why Latino and African-American twelfth-graders have the same skill levels in mathematics as white eighth-graders.

Three reasons the figures for out-of-field teaching in mathematics are especially problematic:

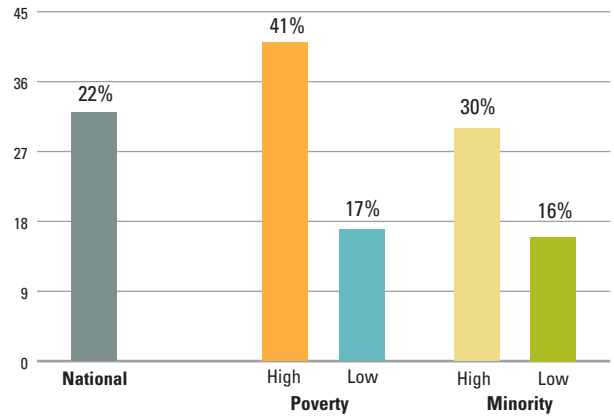
- **Research suggests a strong link between teachers' knowledge of mathematics and student achievement.** Secondary school mathematics teachers who have a bachelor's or master's degree in mathematics are more likely to produce higher student achievement than their colleagues who lack such degrees.[6] Similarly, teachers who are certified in mathematics are more likely to promote higher student mathematics test scores.[7]

What's more, a 2007 report from the Urban Institute used teacher data from North Carolina and demonstrated that a teacher's credentials measurably affect student achievement and predict higher student achievement—particularly in algebra and geometry. In the study, teachers certified in the subject they were assigned had eight times the impact on student achievement as did reducing class size by five students.[8]

- **Student success in mathematics is among the most reliable predictors of success in college and the workplace.** Students who successfully complete Algebra II as their highest math course in high school are more than five times as likely as students who only complete Algebra I to attain a bachelor's degree.[9] Individuals with bachelor's degrees can earn substantially more each year than those who have earned only a high school diploma. Experts believe the difference over the course of a person's working life may amount to a million dollars.[10]
- **National and international data show that our students lack the math knowledge and skills to compete globally.** More than 40 percent of twelfth-grade students scored below basic—the lowest ranking—in math on the 2005 National Assessment of Educational Progress—the most recent test for which data are available.[11] And on the most recent international assessment, the 2006 Programme for International Student Assessment (PISA), 15-year-olds in the United States ranked behind their peers in 21 industrialized nations—the same position as three years earlier.[12] Of the 29 countries that participated in PISA in both 2003 and 2006, the United States ranked 24th in mathematics both years.[13] Such figures should come as no surprise, considering the high rate of out-of-field teaching in mathematics classes in this country—a relatively unusual phenomenon in other developed countries.

Nationwide, secondary school mathematics classes are taught far too often by out-of-field teachers. For students in high-poverty and high-minority schools, access to highly qualified teachers remains even more elusive.

Percentage of Classes Taught by Teachers With Neither Certification Nor Major



Source: Analysis of 2003-04 Schools and Staffing Survey data by Richard M. Ingersoll, University of Pennsylvania, 2007.

Failure to prepare, recruit, and assign skilled and competent teachers to high-poverty, high-minority schools denies students critical resources, perpetuates achievement gaps, contradicts our democratic principles, and threatens our economic vitality.

America can do better than this—*much better*.

Part of the solution is to make sure all high school students take rigorous mathematics courses, as do their counterparts in other countries. More than half the states already are headed in that direction, reporting that they have increased, or plan to increase, course-content requirements linked to graduation eligibility. Eighteen states and the District of Columbia now require students to complete a greater number of advanced mathematics and science courses than in the past.[14] And 13 states have adopted the American Diploma Project's recommendation that all students complete Algebra II.[15]

But the impact of these changed policies will be seriously compromised if states and districts cannot ensure that these courses are taught by teachers with a strong grounding in these subjects.

CONCLUSION

To improve students' achievement levels, our schools must give more students the high-quality teachers they need—instructors with a strong grasp of the subject matter who are prepared to ramp up classroom instruction and rigor.

Failure to prepare, recruit, and assign skilled and competent teachers to high-poverty, high-minority schools denies students in these schools critical resources, perpetuates achievement gaps, contradicts our democratic principles, and threatens the economic vitality of our nation. To eliminate the problem of out-of-field teaching for low-income and minority students, policymakers and educators need to affirm two commitments: (1) that an adequate supply of effective teachers with the appropriate subject-matter knowledge is available to all schools and (2) that qualified teachers are assigned to teach all low-income and minority students.

Promising Practices

These profiles that follow describe various local, state, and national programs aimed at improving the quality of teachers, especially in high-poverty schools.

SETTING GOALS

Some Universities Are Doing Their Part

Colleges and universities must do a better job of providing more knowledgeable and better-trained teachers. A few institutions are leading the way.

UTeach is a comprehensive program that attracts math and science majors from the University of Texas at Austin's College of Arts and Sciences to teach in Texas schools. The program supports these individuals with pre-service preparation, scholarships, advisers, and mentors. In the last ten years, UTeach has prepared more than 400 math and science majors to teach, 85 percent of whom entered the classroom. Of those teachers, almost half (45 percent) teach in schools with more than 40 percent minority students.[16] Recently, UTeach was awarded $125 million to expand the program to other campuses across the country.

The University of North Carolina System and the University System of Georgia have set specific annual targets for the number of teachers they produce and for specific subjects. These benchmarks align with state and district projections of teacher needs and enable the public to hold the universities accountable for results.

At the University of North Carolina, administrators have pledged to more than triple the number of teachers in mathematics, science, and special education and for middle grades. For example, one goal is to increase the number of credentialed math teachers from 109 annually in 2002-03 to 366 annually by 2010.[17] By 2005-06, the system already had doubled the math teachers prepared annually to 227.[18]

In 2005, the University of Georgia set a goal of 7,000 new teachers in 2010, up from 3,157 in 2004, with a special focus on preparing more teachers in math, science, and other high-need subject areas. In only the second year of the initiative, the university increased the number of teachers it prepared by 52 percent. Of the system's graduates, 79 percent were hired to teach in public schools. More recently, the University System Academic Advisory Committee in teacher education—which includes the deans of the colleges of arts and sciences, education school deans, and the academic vice presidents of two-year institutions—set a goal to meet 80 percent of the state's need for new teachers by the year 2020. Since 2002, production has increased by 44 percent. According to system leaders, the goal seemed unattainable—until officials considered goals for individual campuses and departments, when the numbers then seemed achievable to all involved.[19]

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USING INCENTIVES TO ATTRACT TEACHERS: Denver Public Schools and Guilford County (North Carolina) Public Schools

Denver has implemented a differentiated compensation program called "ProComp" to reward effective teachers who teach in hard-to-staff subjects or traditionally hard-to-staff schools.[27] In the program's first year, 586 more teachers applied for positions in hard-to-staff schools than in the previous year.[28]

Schools in Guilford County, North Carolina, serving the Greensboro area, initiated an incentive program called "Mission Possible" in an effort to provide the best teachers to the students who most need them. At 30 schools with the highest needs, Mission Possible provides recruitment bonuses ranging from $2,500 for elementary teachers to $10,000 for algebra teachers. In addition, bonuses for high student achievement range from $2,500 to $4,000 a year. High school math teachers can earn up to $18,000 in additional pay for teaching at a Mission Possible school. In the first year of the program, applications for such math positions increased from seven to 174.[29]

DISTRICTS GROWING THEIR OWN: Boston and Chicago

The Boston Teacher Residency Program and Chicago's Academy for Urban School Leadership (AUSL) are examples of programs that no longer rely solely on local colleges to provide teachers. School leaders in the two cities implemented district-based teacher-preparation programs when the local colleges of education proved unable to provide adequate numbers of effective teachers in specific subjects and schools.

These programs—called "teacher residency programs" because they are based on the medical school model of training new doctors within the context in which they will practice—place teacher candidates with accomplished mentor teachers within the district for an academic year before assigning them their own classrooms.

In the five years since its inception, the Boston Teacher Residency Program has prepared 150 teachers, more than half of whom teach math and science in middle schools and high schools. By the end of 2007-08, the program had prepared 80 additional teachers. The program boasts a 90 percent retention rate of its graduates as teachers in the district.[21]

In Chicago, the AUSL runs a teacher-residency program in collaboration with National-Louis University and the University of Illinois at Chicago. The program has recruited and prepared 198 teachers in the past six years—all of whom work in high-poverty, low-performing schools.[22] The program boasts a 91 percent retention rate for these teachers. In February 2007, AUSL was awarded $10.3 million from the Gates Foundation to expand its work, including adding three new turnaround schools and preparing 90 more teachers during the 2008-09 school year.

> The program aims to examine the growth in learning among students taught by graduates of the state's teacher-preparation programs and to hold the programs accountable for their contribution to each graduate's ability to "grow" student learning.

STRATEGICALLY RECRUITING MATH AND SCIENCE TEACHERS: Teach For America and The New Teacher Project

Traditionally, school districts have been way too passive in recruiting teachers. Even as district leaders clamor for teachers in specific subject areas or decry the lack of teachers prepared to be successful with their students, districts rarely operate in a proactive way to recruit prospective teachers for particular subjects or assignments.

We can learn from the work of such national organizations as Teach For America and The New Teacher Project, both of which have proved it is possible to recruit individuals with strong content knowledge in math and science to teach in high-poverty and high-minority schools. In fact, many individuals specifically seek these placements.

Teach For America places high-achieving individuals in the nation's highest poverty classrooms.[23] The New Teacher Project works with school districts and states nationwide to recruit, select, train, and hire exceptional teachers.[24] These organizations appeal to prospective teachers' strong sense

of mission and desire to do something meaningful and incredibly challenging. For example, in 2008, The New Teacher Project posted the following recruitment advertisements in New York City's subways: "You remember your first-grade teacher's name. Who will remember yours?"

In 2008, 16 percent of Teach For America's 3,800 recruits had graduated with a major in mathematics, science, or engineering.[25] In 2006-07, The New Teacher Project's creative recruitment strategies and dogged pursuit of individuals with strong content knowledge yielded 3,105 new teachers to teach in 15 cities, 86 percent of whom taught in so-called hard-to-staff subjects such as math and science, and 84 percent of whom were assigned to Title I schools.[26]

MEASURING RESULTS OF TEACHER PREPARATION

Louisiana Stands Out

Louisiana has been a national pioneer in assessing the impact of teacher-preparation programs. Since 1999, under a unique partnership between the Louisiana Board of Regents and the Board of Elementary and Secondary Education, the state committed to overhauling all teacher-preparation programs, in public and private institutions alike. The program established four phases of redesign: planning, implementation, impact, and growth in student learning.

The fourth phase—"Effectiveness of Growth in Student Learning," also known as the "Value-Added Teacher Preparation Assessment"—is a dramatic departure from the past and holds the most promise for the future. Its purpose is to examine the growth in learning among students taught by graduates of the state's teacher-preparation programs—including traditional and alternative routes—and to hold the programs accountable for their contribution to each graduate's ability to "grow" student learning. In late 2007, researchers in Louisiana announced their findings:

At 30 schools with the highest needs, Mission Possible provides recruitment bonuses ranging from $2,500 for elementary teachers to $10,000 for algebra teachers.

- First, the pilot was successful. According to an evaluation of the program: "It is possible to implement a system that measures the effectiveness of specific teacher-preparation programs based upon the achievement of students taught by new teachers who graduated from those teacher-preparation programs."[20]
- Second, some of the programs were producing new teachers whose ability to affect student achievement compared favorably with that of their more experienced colleagues. In fact, three programs produced new teachers who were more effective, on average, than veteran teachers in one or more content areas.
- Third, the impact of the teacher-preparation programs varied—even within programs. For example, in some instances, a program produced new teachers in one subject whose effectiveness compared favorably with that of more experienced teachers, while in another subject, the program's graduates lagged their more experienced counterparts.

Questions for State Leaders to Consider

1. How does the supply of available teachers match the needs in our state? What do the numbers look like by field, subject or discipline, geographic region, and school level? Have there been changes over time?
2. If we have shortages in some areas, have state policymakers or higher education leaders set clear goals for the state's colleges and universities to increase production? Is there support for colleges to reach those goals? Do they face consequences if they are unable to do so?
3. What have we done to increase the number of teachers entering through alternative routes, especially at the secondary level where real-world experience can be so useful? Have we removed unnecessary barriers to entry? Do our alternative-route teachers receive high-quality training before they begin teaching? Do they receive adequate support during their first two years? Are we providing support for districts that want to "train their own" through high-quality teacher-residency programs?
4. What do we know about the quality of teachers produced by different teacher-preparation programs, both traditional and alternative? Are we evaluating teacher-preparation programs based on the effectiveness of the teachers the programs produce? What are we doing to grow our best programs and improve, shrink, or close those that are producing weak teachers?
5. What does our data tell us about differential access to quality teachers in our high-poverty and high-minority schools? Are students in these schools more likely to be taught by inexperienced teachers or teachers without demonstrated content knowledge in their fields?
6. What is our state's plan to eliminate inequities in who teaches whom? Are we monitoring the data and tracking disparities in access to high-quality teachers between districts? Do superintendents know we expect them to eliminate inequities? What resources—either monetary or expertise—have we provided to help them succeed? How do we know if they are succeeding?
7. Have we analyzed the data to see if certain districts experience especially high turnover rates? Is there a plan in place to identify such districts? What is the plan to offer more support to these districts and schools?
8. Have we taken steps to link teacher and student data so that schools and districts can move beyond looking simply at proxies for effectiveness—such as credentials or experience—and look at who actually is improving student learning and who is not? What is the plan for ensuring we are assigning effective teachers to the students who most need them?
9. Does our state require teachers to earn master's degrees? Is there any evidence that teachers with master's degrees are more effective in the classroom? Does our state reward teachers for earning certification from the National Board for Professional Teaching Standards? Do we have evidence that teachers who take advantage of these incentives are effective and that our investment makes sense? Are teachers who receive these bonuses teaching where they are most needed?
10. Have we looked closely at school district salary schedules? What do these schedules reward? If the answer is that there is no real incentive either for teachers to teach in the most challenging situations or to produce unusually strong results, what could we do to bring those schedules more in line with our state's goals? What about other incentive structures for teachers? Have we considered other ways—double retirement credits (making twice the contribution to teachers' retirement funds) or regular sabbaticals, for example—to encourage strong teachers to teach in the most challenging settings?

Questions for School District Leaders to Consider

1. How well do our teachers' qualifications match their teaching assignments? Are some children being taught by teachers who do not have adequate grounding in the subjects they are teaching? If so, in which subjects and at what levels? How have these numbers changed over time?
2. Does access to high-quality teachers vary across schools serving different kinds of children? Do students from low-income families and students of color have fewer appropriately credentialed teachers?
3. When is the last time we talked honestly with our community about these numbers? Can community voices help us address any inequities in who teaches whom?
4. Have we taken the necessary steps to connect teacher and student-learning data, so we can move beyond proxy measures for quality (experience, for example) and better understand which of our teachers are especially good at improving student learning, which are not so good, and who is taught by our most effective teachers?
5. Who is responsible for eliminating any inequities in teacher quality either between schools or within schools? Do our principals understand the importance of this issue and what we expect them to do? Do they have the help they need to get the job done?
6. Have we asked our strongest teachers what would be an appropriate incentive to attract them to teach in the most impoverished schools? How do they respond? Have we acted on their ideas?
7. Does our district do anything to recognize and reward exemplary teachers? Is there evidence that common incentives, such as master's degrees, are linked to increasing student achievement? Does our district reward teachers for earning certification from the National Board for Professional Teaching Standards? Do we have evidence that teachers who earn these incentives are more effective and that our investment makes sense? What types of students do they teach? If they mostly teach more advantaged children, do we have a plan to ensure equity in access?
8. Has our district developed an in-service program for teachers to address unmet needs in terms of teacher quality?
9. How does the district support new teachers, especially in schools that experience high attrition? What is the district doing to ensure teachers can be successful in high turnover schools? Is the district looking at leadership issues these schools may have?
10. Is the district ensuring that high-quality administrators are matched to the schools that most need them? What is the district's plan to ensure that such administrators are fostering high-quality teaching in the highest poverty schools?

NOTES

(Some links may have expired. Some links that appear on multiple lines may not be reachable directly from this document. It may be necessary to copy and paste the entire link into your browser.)

[1] Dan Goldhaber and Dominic Brewer, "Does Teacher Certification Matter? High School Teacher Certification Status and Student Achievement," *Educational Evaluation and Policy Analysis* 22, no. 2 (2000): 129-145. See also David H. Monk, "Subject Area Preparation of Secondary Mathematics and Science Teachers and Student Achievement," *Economics of Education Review* 13 (1994): 125-145; and David H. Monk and Jennifer Rice King, "Multilevel Teacher Resource Effects on Pupil Performance in Secondary Mathematics and Science," in Ronald G. Ehrenberg, ed., *Choices and Consequences: Contemporary Policy Issues in Education* (Ithaca N.Y.: ILR Press, 1994), pp. 29-58.

[2] To be considered "highly qualified," a teacher must possess a bachelor's degree and full state certification or licensure and demonstrate knowledge of the content in the subject he or she teaches. For more information, see Title IX Sec. 9101. Definitions. (23)(A)-(C) of the No Child Left Behind Act of 2001, *www.ed.gov/policy/elsec/leg/esea02/pg107.html.*

[3] For example, in Pennsylvania, researchers have concluded that high enrollment in schools of education is resulting in a significant excess supply of teachers in the state. For more information, see R.P. Strauss, T. Tucci, and Ji Yang, "The Market Demand for Teachers and the Financial Position of State-Supported Teacher Preparation Institutions in Pennsylvania" (paper presented at the 2008 Annual Meeting of the American Education Research Association, New York, 2008).

[4] For further discussion of teacher staffing and shortages in mathematics and science, see Richard M. Ingersoll, "Understanding Supply and Demand Among Mathematics and Science Teachers," in Jack Rhoton and Pat Shane, eds., *Teaching Science in the 21st Century* (Arlington, Va.: NSTA Press, 2006).

[5] For more information about the Consolidated State Performance Reports, see *www.ed.gov/admins/lead/account/consolidated/index.html.*

[6] Dan Goldhaber and Dominic Brewer, "Evaluating the Effect of Teacher Degree Level on Educational Performance," in William J. Fowler Jr., ed., *Developments in School Finance, 1996* (Washington, D.C.: U.S. Department of Education, National Center for Education Statistics, 1997), (ED 409 634), p. 197-210. *http://nces.ed.gov/pubs97/97535l.pdf.*

[7] Dan Goldhaber and Dominic Brewer, "Evaluating the Effect of Teacher Degree Level on Educational Performance," in William J. Fowler Jr., ed., *Developments in School Finance, 1996* (Washington, D.C.: U.S. Department of Education, National Center for Education Statistics, 1997), (ED 409 634), p. 7. *http://nces.ed.gov/pubs97/97535l.pdf.*

[8] Charles T. Clotfelter, Helen F. Ladd, and Jacob L. Vigdor, "Teacher Credentials and Student Achievement in High School: A Cross-Subject Analysis With Student Fixed Effects" (Washington, D.C.: The Urban Institute, 2007), *www.urban.org/url.cfm?ID=1001104.*

[9] Cliff Adelman, "The Toolbox Revisited: Paths to Degree Completion from High School Through College," (Washington, D.C.: U.S. Department of Education, 2006), *www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html.*

[10] Anthony Carnevale, "Discounting Education's Value," *Chronicle of Higher Education*, 2006. Available at *www.educationsector.org/analysis/analysis_show.htm?doc_id=405521.*

[11] National Center for Education Statistics, NAEP Data Explorer, *www.nces.ed.gov/nationsreportcard/nde.*

[12] This ranking refers specifically to the ranking of the United States within the group of 26 countries participating in the Programme for International Student Assessment (PISA) in 2000, 2003, and 2006. Organization for Economic Cooperation and Development (OECD), PISA 2006 Results, *www.oecd.org.*

[13] Organization for Economic Cooperation and Development (OECD), PISA 2006 Results, *www.oecd.org.*

[14] Achieve, Inc., "Closing the Expectations Gap: An Annual 50-State Progress Report on the Alignment of High School Policies with the Demands of College and Careers," American Diploma Project Network, (Washington, D.C., 2008), *www.achieve.org/node/990.*

[15] Cliff Adelman, "The Toolbox Revisited: Paths to Degree Completion from High School Through College" (Washington, D.C.: U.S. Department of Education, 2006), *www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html.* See also Achieve, Inc., "Closing the Expectations Gap: An Annual 50-State Progress Report on the Alignment of High School Policies with the Demands of College and Work," (Washington, D.C., 2008), *www.achieve.org/node/990.*

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Appendix A - Data Disparities in Out-of-Field Teaching

	Percentage of Core Academic Classes Taught in Secondary Schools* by Highly Qualified Teachers	Percentage of Core Academic Classes Taught in Secondary Schools by a Teacher With In-Field Certification
	State Reported (Consolidated State Performance Reports, 2003-04)	**Teacher Reported** (Schools and Staffing Survey, 2003-04)
Alabama	77.2%	74.1
Alaska	Unavailable	54.1
Arizona	94.4%	58.4
Arkansas	Unavailable	81.4
California	53.0%	72.4
Colorado	86.0%	71.1
Connecticut	98.6%	73.0
Delaware	71.6%	63.3
District of Columbia	Unavailable	56.0
Florida	85.4%	66.1
Georgia	95.3%	65.1
Hawaii	68.0%	68.9
Idaho	97.1%	73.4
Illinois	Unavailable	73.6
Indiana	96.5%	89.5
Iowa	93.8%	80.5
Kansas	92.6%	78.3
Kentucky	92.0%	71.6
Louisiana	86.0%	51.5
Maine	89.1%	67.3
Maryland	64.3%	60.9
Massachusetts	92.0%	69.7
Michigan	88.7%	70.3
Minnesota	98.4%	88.9
Mississippi	96.3%	75.8
Missouri	Unavailable	75.7
Montana	98.4%	72.1
Nebraska	89.6%	81.1
Nevada	51.4%	67.3
New Hampshire	70.0%	71.1
New Jersey	94.5%	67.7
New Mexico	64.5%	66.2
New York	94.0%	68.0
North Carolina	82.0%	63.1
North Dakota	55.8%	83.9
Ohio	93.0%	62.5
Oklahoma	98.0%	78.9
Oregon	85.0%	72.7
Pennsylvania	Unavailable	75.0
Rhode Island	75.0%	80.6
South Carolina	74.8%	69.1
South Dakota	91.0%	76.2
Tennessee	Unavailable	70.2
Texas	92.8%	73.1
Utah	69.8%	84.9
Vermont	Unavailable	77.2
Virginia	93.8%	66.1
Washington	98.8%	58.2
West Virginia	94.7%	74.8
Wisconsin	98.1%	77.2
Wyoming	98.4%	75.0
Average		**70.8**

Note: The Consolidated State Performance Reports and the Schools and Staffing Survey use different definitions to determine whether teachers are qualified to teach a specific subject. Teachers deemed "highly qualified" in the state reports may not necessarily possess certification in the subject they are assigned to teach. By contrast, SASS asks teachers to indicate whether they have state certification in the subject they are assigned to teach. Nevertheless, substantial discrepancies between state-reported and teacher-reported rates of out-of-field teaching raise legitimate questions.

* Secondary schools comprise grades 7-12.

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