

Key Issue:

Recruiting Science, Technology, Engineering, and Mathematics (STEM) Teachers

June 2009

Updated by Kristin L. McGraner, Ed.D.
Vanderbilt University



1100 17th Street NW, Suite 500
Washington, DC 20036-4632
877-322-8700 • 202-223-6690
www.tqsource.org

Copyright © 2009 National Comprehensive Center for Teacher Quality, sponsored under government cooperative agreement number S283B050051. All rights reserved.

This work was originally produced in whole or in part by the National Comprehensive Center for Teacher Quality with funds from the U.S. Department of Education under cooperative agreement number S283B050051. The content does not necessarily reflect the position or policy of the Department of Education, nor does mention or visual representation of trade names, commercial products, or organizations imply endorsement by the federal government.

The National Comprehensive Center for Teacher Quality is a collaborative effort of ETS, Learning Point Associates, and Vanderbilt University.

3655_05/09



Contents

	Page
Scenario.....	1
Benefits	2
Tips and Cautions	3
Strategies.....	4
Resources	4
Strategy 1: Gather and Analyze Data to Inform the Design and Implementation of Recruitment Initiatives	5
Strategy 2: Build Strong and Sustainable Relationships With Institutions of Higher Education.....	7
Strategy 3: Develop Differentiated Pay Systems, and Create Financial Incentives to Attract Prospective Mathematics and Science Teachers.....	10
Strategy 4: Provide Prospective Teachers Adequate Information About Teaching Opportunities Across Districts, Schools, and Communities	15
Strategy 5: Develop Multiple Entry Points Into Teaching for Nontraditional Mathematics and Science Teacher Candidates.....	17
Strategy 6: Provide High-Quality Induction and Professional Development Experiences to Attract and Retain Teachers	19
Real-Life Example	21
References.....	22

Scenario

Jean McKinney is the director of educator quality for her state and serves as chief of the teacher recruitment task force. The state has experienced demographic shifts not unlike other states in the region, losing approximately 14 percent of urban teachers and 25 percent of rural teachers to retirement each year.

Retirement alone, however, is not the dominant reason for the state's mathematics and science teacher shortages. Mathematics and science continue to be high-needs, critical-shortage areas; at the start of each school year, the state's urban districts report they have unfilled vacancies in both mathematics and science. McKinney analyzed available state data and found the state loses up to half of its mathematics and science teachers within their first five years of teaching. Teacher exit survey and interview data indicated that these teachers leave for reasons related to low salary, inadequate administrator support, and unsatisfactory working conditions.

McKinney recognizes the need for the state to develop a comprehensive human capital strategy that addresses each dimension of the educator's career continuum (i.e., from aspiring to retiring). However, while her office works diligently on a comprehensive strategy, students are sitting in some mathematics and science classrooms waiting for the opportunity to learn from qualified teachers.

Moreover, the state already engages in several teacher recruitment efforts. For example, it offers an alternative route program for former military personnel, business executives, and other nontraditional teacher candidates. Individuals who commit to teach mathematics, science, or special education for five years receive tuition waivers and reimbursements. In addition, the state's largest urban school district utilizes state and local funding to award signing bonuses to high school mathematics and science teachers who sign six-year contracts to remain in their schools.

Although these incentives show some promise, they have not solved the twin dilemmas of (1) recruiting qualified mathematics and science teachers, and (2) achieving equitable distribution of qualified mathematics and science teachers for all students. (Classes in high-poverty, high-minority schools are almost twice as likely to have an underqualified mathematics teacher as classes in more affluent schools with few minorities.) Therefore, the state struggles not only to find mathematics and science teachers but also to place these teachers in the classrooms where students need them most.

How should McKinney approach the state's recruitment dilemma to ensure that qualified mathematics and science teachers are equitably distributed across districts? What data-based and viable strategies can the state design and implement, and what guidance can be given to districts? Further, how can current recruitment initiatives be revised to better address the needs of a state with mathematics and science shortages in both rural and urban districts? How can the effectiveness of recruitment initiatives be measured to ensure program improvement and sustainable outcomes? Finally, how should McKinney think about recruitment within the context of the state's larger human capital strategy?

Benefits

Who Is a STEM Teacher?

A STEM teacher is one who teaches in the fields of science, technology, engineering, and mathematics. In K–12 schooling, most STEM teachers instruct mathematics and science classes, which continue to be critical shortage areas.

As part of a comprehensive human capital strategy, designing recruitment initiatives to attract qualified STEM teachers will help school districts do the following:

- **Ensure the equitable distribution of qualified mathematics and science teachers.** The shortage of mathematics and science teachers in underserved schools is critical. Students in high-needs classrooms without successful teachers will ultimately be left behind. A strong recruitment strategy can help states and school districts more effectively compete for teachers in shortage areas. Strategies such as district-university partnerships, financial incentives, and alternative licensure can assist a district or school to be competitive in the job market.
- **Design a systematic and seamless recruitment and hiring effort that meets the needs of the district or school and thereby strengthens the quality of candidates for mathematics and science positions.** Schools and districts spend an inordinate amount of time randomly searching for teachers, especially in shortage areas such as mathematics and science. The New Teacher Project (Levin & Quinn, 2003) released its study of hiring practices in urban school districts desperately in need of teachers in shortage areas; the study revealed that many districts and schools are caught up in red tape and bureaucracy to the extent that even when good candidates for shortage areas apply, they are not hired. A systematic recruitment effort designed to meet the needs of a particular school or district not only attracts the right candidates but also streamlines the process, so the candidates applying for the positions are most likely a good fit for the job.
- **Retain effective teachers in the hard-to-staff positions through better job-candidate matches.** States and districts need not only to stimulate the supply of and effectively recruit mathematics and science teachers but also to keep them in their positions. Research shows that almost half of new teachers leave within the first five years of their careers, and this number increases in underserved districts and schools (Lankford, Loeb, & Wyckoff, 2002; Smith & Ingersoll, 2004). Schools and teachers must be committed to students in order to raise their achievement, and continuity is needed in key positions such as mathematics and science to bolster the quality of learning environments. First, a strong recruitment program places the right teachers into the right classrooms, and then it supports them through strong induction, mentoring, and professional development programs. A strong commitment to this process gives urban states and districts a better opportunity to retain the high-quality teachers they desperately need.

Tips and Cautions

When developing targeted mathematics and science teacher recruitment strategies to address local needs, remember to do the following:

- Gather and analyze available data to inform the design and implementation of recruitment initiatives.
- Begin recruiting *before* prospective teachers graduate or do their clinical internships. Do not expect early access to prospective teachers if you are not willing to build strong partnerships with college- or university-based teacher preparation programs.
- Look for state-level interventions on multiple fronts, including increases in teacher pay, to help the highest need districts recruit and retain high-quality mathematics and science teachers. Don't expect change in schools if you are not willing to work for state-level change in policy.
- Provide prospective teachers with adequate information about districts, schools, and communities to ensure they recognize the teaching opportunities and gather adequate information to make well-informed and appropriate job decisions.
- Work with district and school leaders to raise awareness and understanding of effective recruitment and hiring practices, as well as the importance in creating learning environments that attract, support, and retain qualified mathematics and science teachers.
- Develop multiple entry points into teaching for nontraditional mathematics and science teacher candidates.
- Provide high-quality induction and professional development experiences to ensure successful recruitment and retention outcomes. Schools and districts must create and foster productive learning communities to which prospective teachers will be attracted and in which they will be successful.

Strategies

1. Gather and analyze data to inform the design and implementation of recruitment initiatives.
2. Build strong and sustainable relationships with institutions of higher education.
3. Develop differentiated pay systems, and create financial incentives to attract prospective mathematics and science teachers.
4. Provide prospective teachers adequate information about teaching opportunities across districts, schools, and communities.
5. Develop multiple entry points into teaching for nontraditional mathematics and science teacher candidates.
6. Provide high-quality induction and professional development experiences to attract and retain teachers.

Resources

The following resources provide helpful information about implementing the strategies listed on this page. Some resources highlight the rationale for a strategy or the research base that supports it; others provide examples of how the strategy has been implemented elsewhere or practical toolkits that can assist school leaders in adopting these strategies.

Strategy 1: Gather and Analyze Data to Inform the Design and Implementation of Recruitment Initiatives

All facets of state and district human capital strategies should be supported and informed by valid and reliable data. The state and district must first have an accurate understanding of applicable recruitment and retention challenges, and they must work to build solid data warehousing structures to facilitate data gathering, analyses, and the development of targeted policy and program initiatives. States, districts, and schools often fail to maintain data on teacher recruitment and retention, which may prevent the development of policies and programs that effectively address local needs.

Moreover, states and districts should disaggregate their data by school, teacher, and student characteristics to ensure the equitable distribution of mathematics and science teachers to high-needs schools. Agencies should consider collecting and analyzing the following data:

- Number of mathematics and science teacher candidates at local colleges and universities
- Number of applicants for each vacant mathematics and science position disaggregated by student and school characteristics
- Professional backgrounds of mathematics and science teacher applicants, including their routes into the profession
- Number of applicants to alternative route programs
- Number of new mathematics and science teachers for each district and school, disaggregated by student and school characteristics
- Rates of attrition for mathematics and science teachers by teaching assignment
- Rates of migration for mathematics and science teachers
- Dates mathematics and science positions are vacated and dates of hire for those positions
- Surveys of working conditions
- Surveys of mathematics and science teachers' professional development needs
- Qualitative analyses of district and school leaders' methods of recruitment and selection, school leaders' understandings of the needs of novice mathematics and science teachers, and new teachers' identification of challenges as beginning mathematics and science teachers in their local contexts

Resource 1: Equitable Distribution Workbook

National Comprehensive Center for Teacher Quality. (2009). *Thinking systemically: Steps for states to improve equity in the distribution of teachers*. Washington, DC: Author. Retrieved June 10, 2009, from <http://www.tqsource.org/publications/thinkingSystemically.php>

This workbook helps users identify state and local needs as well as develop context-specific strategies to solve problems of policy and practice in teacher recruitment.

Resource 2: Council of Chief State School Officers

Website: <http://www.ccsso.org/>

A key initiative of the Council of Chief State School Officers (CCSSO) is comprehensive data systems. The council helps states develop the accountability frameworks and data systems required to enhance teacher quality and raise student achievement. The organization's resources do not directly address recruitment data quality or systems; however, the guiding frameworks, principles, and implementation guides available on the CCSSO website can assist states and districts that are actively building better data systems to study recruitment and retention.

Resource 3: Data Quality Campaign

Website: <http://www.dataqualitycampaign.org/>

The Data Quality Campaign (DQC) is a national effort to encourage state policymakers to improve the collection and analysis of state education data and to promote the implementation of longitudinal data systems. The DQC provides states with tools and resources needed for improving data systems as part of the effort to raise student achievement. Although the DQC does not directly address issues around teacher recruitment data, its resources and tools can support states and districts as they develop more robust data systems that address all facets of the education system in general and of educator quality in particular.

Resource 4: Grant Program From the Bill & Melinda Gates Foundation

Bill & Melinda Gates Foundation. (2009). *Foundation invests \$22 million in research and data systems to improve student achievement* [Press release]. Retrieved June 10, 2009, from <http://www.gatesfoundation.org/press-releases/Pages/collect-and-use-data-for-maximum-impact-on-teaching-and-learning-090122.aspx>

The Bill & Melinda Gates Foundation announced a grant program focused on developing education research and data systems. The grants are designed to assist states, districts, and schools in using data and relying on evidence-based practices to bolster student learning. Although the primary focus is on longitudinal data systems to track and raise student achievement, states may explore opportunities to use these grants to build a system to assess and monitor educator quality, including the recruitment and retention of mathematics and science teachers. Contact the foundation (info@gatesfoundation.org) for more information.

Resource 5: Regional Educational Laboratory Program

Website: <http://ies.ed.gov/ncee/edlabs/about/>

The 10 regional educational laboratories (RELs) serve their respective regions through applied research and technical assistance efforts geared toward systemic school improvement. The RELs assist regions and states with the collection and analyses of local data and may serve as resources to states and districts that are using data to design and implement recruitment strategies.

Strategy 2: Build Strong and Sustainable Relationships With Institutions of Higher Education

To fill vacancies in hard-to-staff schools and for hard-to-staff subjects, a strong collaboration is needed among teacher preparation organizations and programs as well as districts and schools. Districts can work with the universities not only to increase the pipeline of teachers in shortage areas such as mathematics and science but also to ensure that those teachers are prepared to meet the challenges of high-needs schools.

Simply focusing on recruiting highly qualified mathematics and science teachers assumes there is a pool from which to recruit. Factors that are diminishing the supply pool include low interest among college students in the teaching profession; low enrollment and graduation rates of students majoring in mathematics, science, and engineering; and the exodus of new and experienced teachers from the classroom (e.g., Fideler, Foster, & Schwartz, 2000; Smith & Ingersoll, 2004). Early-college and dual-enrollment programs can help maintain and expand the interest of students who might not have access to higher level courses in their high schools. Summer bridge programs are useful strategies for helping students who might be interested in mathematics and science disciplines but need additional help to get on track to complete majors in those areas without remediation during their first two years of college. Aligning high school mathematics and science courses with the skills and competencies needed to succeed in college-level coursework also will help get students on the path to success at the college level.

Resource 6: Urban Teacher Education Partnership in St. Paul, Minnesota

Website: <http://www.teachercenter.mnscu.edu/featuredactivity.html>

Six Minnesota state colleges and universities have joined with six St. Paul public schools to form the Urban Teacher Education Partnership (UTEP). The program prepares students to teach in hard-to-staff schools and provides experience in the diverse city schools that increasingly will resemble Minnesota's classrooms of tomorrow.

Resource 7: Urban Teacher Training Collaborative

Website: <http://ase.tufts.edu/education/projects/projectUTTC.asp>

The Urban Teacher Training Collaborative (UTTC) is a school-university, school-based, master of arts in teaching program developed by Tufts University in conjunction with Boston Public Schools. The collaborative—an example of the Professional Development School model—focuses on the needs of urban students and teachers. The mission of UTTC is to help meet the need for good urban teachers through an innovative model for teacher training similar to the residency model used to train medical professionals.

Resource 8: Mathematics, Computer, and Science Instructional Improvement Programs (McSiip)

Website: <http://www.rowan.edu/open/mcsiip/>

Rowan University was awarded \$2.5 million to work with four southern New Jersey school districts in reforming mathematics and science instruction. The project is intended to unite the activities of higher education institutions, prekindergarten through high school systems, and other partners to better support teacher development in mathematics and science as well as raise student achievement.

Resource 9: Education Plus Program

Marian College. (2006, May 11). *News: Marian College joins “Education Plus” program* [News release]. Retrieved June 10, 2009, from <http://www.marian.edu/Pages/news.aspx?newsid=184>

In May 2006, Marian College and the Greater Indianapolis Chamber of Commerce announced a partnership that would provide annual scholarships for children of employees of companies or nonprofit organizations that are members of the chamber. The Education Plus scholarships are available to students majoring in science, science education, mathematics, or mathematics education.

Resource 10: NYC Partnership for Teacher Excellence

Website:

<http://schools.nyc.gov/FundForPublicSchools/AboutUs/KeyInitiatives/TeacherExcellence/default.htm>

In 2006, the New York City Department of Education formed the Partnership for Teacher Excellence with New York University and City University of New York. The partnership is dedicated to developing and implementing a new model for teacher education that addresses the city’s need for highly qualified, well-trained teachers in high-needs areas such as mathematics, science, and special education.

Resource 11: Teacher Quality Enhancement Grants

Website: <http://www.ed.gov/programs/heatqp/index.html>

This section of the Education Department’s website provides information about resources and funding available to state and local education agencies and teacher preparation institutions to better prepare and recruit new teachers. It covers the three teacher quality programs authorized by Title II: state grants, partnership grants, and recruitment grants.

Resource 12: *Ahead of the Class*

Clewell, B. C., & Villegas, A. M. (2001). *Ahead of the class: A handbook for preparing new teachers from new sources*. Washington, DC: The Urban Institute. Retrieved June 10, 2009, from http://www.urban.org/UploadedPDF/ahead_of_the_class.pdf

This handbook describes the steps necessary to create a successful institutional partnership.

Resource 13: University-School Teacher Education Partnerships

Website: <http://www.northcarolina.edu/academics/usp/partnerships.htm>

At the urging of the University of North Carolina Deans' Council on Teacher Education, the North Carolina General Assembly provided funding to establish university-school teacher education partnerships at the 16 constituent institutions of the state university system. Partnerships were intended to improve teacher education and professional development and increase enrollment in teacher education programs in high-needs content areas such as mathematics and science. The move by the General Assembly was the impetus for many of the professional development school partnerships started around the state as well as for the professional development networks that reached out to rural districts.

Resource 14: Education Renewal Zones

Website: <http://files.ruraledu.org/misc/erz.htm>

According to the Rural School and Community Trust, an education renewal zone (ERZ) is a collaborative effort by schools and institutions of higher education to connect schools in high-needs communities with resources that can help improve and sustain them. Higher education plays the following role as part of the ERZ initiative:

Each ERZ centers on a teacher education institution that assumes the lead in identifying 10 to 15 rural school or district partners; selecting and forming an ERZ Advisory Committee with school, community, and higher education representation; developing and implementing an ERZ needs analysis pertaining to teacher quality, recruitment, and retention; and designing a specific focus and plan of work to meet the needs of partnership schools and communities.

Resource 15: Capital Educators Collaborative

Website: <http://gsehd.gwu.edu/Special+Projects#anchor23>

The George Washington University has developed a number of partnership programs with local school systems. This Special Projects page of the graduate school's website presents the reasoning behind these partnerships, many of which provide alternative routes to certification. Also included are an overview and contact information for each district-university partnership.

Strategy 3: Develop Differentiated Pay Systems, and Create Financial Incentives to Attract Prospective Mathematics and Science Teachers

Decades of research have indicated that teachers are not equally distributed across high- and low-needs schools and districts (e.g., Hanushek, Kain, & Rivkin, 2004; Lankford et al., 2002). Given equal pay across assignments, most teachers will choose to work in better resourced systems in high-amenity communities with higher performing students (Hanushek et al., 2004). Moreover, one of the reasons teachers leave their schools and the profession at large relates to salary and compensation (Smith & Ingersoll, 2004). Teacher pay should be structured to encourage the natural distribution of highly qualified teachers across districts, schools, and content areas. Local, state, and federal policymakers must provide incentives and policy supports that will encourage and support the voluntary redistribution of the teacher workforce.

General Compensation

Resource 16: Center for Educator Compensation Reform (CECR)

Website: <http://cecr.ed.gov/>

Contact: cecr@westat.com

The mission of the Center for Educator Compensation Reform is to raise awareness of alternative strategies for the reform of educator compensation structures. The center provides resources for policymakers, states, and districts in the design and development of compensation policies and programs. The CECR website provides a collection of research syntheses on teacher pay and educator compensation, as well as guides, frameworks, and case studies to inform the implementation of reform initiatives.

Resource 17: National Center on Performance Incentives (NCPI)

Website: <http://www.performanceincentives.org/>

Contact: ncpi@vanderbilt.edu

NCPI at the Peabody College of Vanderbilt University conducts rigorous research focused on the effect of performance incentives on the quality of teaching and learning. The center acts as a resource for researchers, policymakers, and state and district educational leaders.

Compensation and the Redistribution of Teachers to High-Needs Areas

Resource 18: *America's Pressing Challenge—Building a Stronger Foundation*

National Science Board. (2006). *America's pressing challenge—Building a stronger foundation* (NSB-06-02). Arlington, VA: National Science Foundation. Retrieved June 10, 2009, from <http://www.nsf.gov/statistics/nsb0602/nsb0602.pdf>

This report is a companion to *Science and Engineering Indicators—2006*, also published by the National Science Foundation. The report sounds an alarm regarding the low level of mathematics and science education in the country and calls on policymakers to implement policies for improving the quality of mathematics and science teachers through competitive compensation.

Resource 19: Study of Personnel Needs in Special Education

Westat. (2002). *SPeNSE summary sheet: Recruiting and retaining high-quality teachers*. Rockville: MD: Author. Retrieved June 10, 2009, from <http://ferdig.coe.ufl.edu/spense/policymaker5.pdf>

This summary sheet is one in a series funded by the U.S. Department of Education to analyze personnel issues in special education. Salary is a factor reported by special education teachers as making a difference in their employment decisions.

Resource 20: Diversifying Teacher Compensation

Azordegan, J., Byrnett, P., Campbell, K., Greenman, J., & Coulter, T. (2005). *Diversifying teacher compensation* (Issue Paper). Denver, CO: Education Commission of the States. Retrieved June 10, 2009, from <http://www.ecs.org/clearinghouse/65/83/6583.pdf>

This paper provides a general overview of the issue of diversifying teacher compensation, reviews policy options, and provides a glance at what actions states and districts have taken to reform compensation.

Resource 21: Better Pay for Better Teaching

Hassel, B. C. (2002, May). *Better pay for better teaching: Making teacher compensation pay off in the age of accountability*. Washington, DC: Progressive Policy Institute. Retrieved June 10, 2009, from http://www.ppionline.org/documents/Hassel_May02.pdf

The 21st Century Schools Project at the Progressive Policy Institute argues the need for differential pay for teachers in hard-to-hire areas and offers policy options and considerations for reforming teacher compensation.

Resource 22: Pay Levels Needed to Attract Skilled Mathematics and Science Teachers

Milanowski, A. (2003). An exploration of the pay levels needed to attract students with mathematics, science and technology skills to a career in K–12 teaching. *Education Policy Analysis Archives*, 11(50). Retrieved June 10, 2009, from <http://epaa.asu.edu/epaa/v11n50>

This study explores the role of salary levels and other factors in motivating potential mathematics, science, and technology teachers. Results suggest that low pay was a factor in undergraduates' not considering teaching as a career; however, job demands, individual abilities, and interests also contributed to undergraduates' career decisions.

Resource 23: Arkansas State Teacher Assistance Resource (STAR)

Website: http://www.adhe.edu/divisions/financialaid/Pages/fa_star.aspx

This program is for students pursuing secondary education teacher licensure in an accredited Arkansas public or private college or university in the following shortage areas: mathematics, chemistry, physics, biology, physical science, general science, special education, and foreign language. Merit-based scholarships are available for \$6,000 per academic year. Recipients must maintain a 2.5 cumulative grade point average (GPA); juniors and seniors must maintain a 3.0 GPA in their major area of study.

Resource 24: California Assumption Program of Loans for Education (APLE)

Website: <http://www.csac.ca.gov/doc.asp?id=111>

In this teacher incentive program, recipients must agree to teach in a low-income school with a shortage for up to four years in exchange for up to \$19,000 in student loan forgiveness. If participants teach in mathematics, science, or special education, they are eligible for an additional \$1,000 in loan assumption benefits—and an additional \$1,000 if they teach in a school ranking in the lowest 20th percentile on the Academic Performance Index.

Resource 25: Louisiana Critical Teacher Shortage Incentive Program

Critical Teacher Shortage Incentive Program, RS 17:427.2 (2004). Retrieved June 10, 2009, from <http://www.legis.state.la.us/lss/lss.asp?doc=81075>

Newly certified Louisiana teachers in elementary and secondary schools in the areas of mathematics, biology, chemistry, physics, or special education receive \$3,000 per year for their first four consecutive years in the classroom.

Resource 26: Pennsylvania Urban and Rural Teacher Loan Forgiveness Program

Urban and Rural Teacher Loan Forgiveness Program, Pennsylvania Code, Subchapter L. (1996). Retrieved June 10, 2009, from <http://www.pacode.com/secure/data/022/chapter121/subchapLtoc.html>

Applicants must spend the major portion of the school day during the school year teaching in a classroom at an eligible urban or rural school district in Pennsylvania. The program offers up to \$2,500 in forgiveness for each year that the teaching commitment is fulfilled, and up to \$10,000 will be forgiven for any participant.

Resource 27: Rhode Island Teacher Reward Program

Website: <http://www.risla.com/programs/reward.aspx>

With this program, there is zero interest on Stafford loans (subsidized or unsubsidized) for the first four years of teaching. The program provides 250 awards to full-time teachers in the

predicted shortage areas of mathematics and science. In order to qualify, a teacher must be employed full time and certified in Rhode Island. Minority applicants have high priority, along with those teaching in an urban or high-needs school district.

Resource 28: Regulation Versus Markets

Podgursky, M. (2001). Regulation versus markets: The case for greater flexibility in the market for public school teachers. In M. C. Wang & H. J. Walberg (Eds.), *Tomorrow's teachers* (pp. 117–148). Richmond, CA: McCutchan.

Economist Michael Podgursky argues that the single-salary pay scale, even with higher pay, does not allow for adjustments to compensate for differing working conditions. Given equal pay, teachers will use their seniority to transfer to preferred schools, and new teachers will look for better conditions in which to begin. Consequently, troubled schools—including hard-to-staff rural schools—end up with the least experienced teachers. Podgursky concludes that “if schools differ in terms of nonpecuniary conditions (e.g., safety, student rowdiness [and rural-ness]), then equalizing teacher pay will disequalize teacher quality. On the other hand, if districts wish to equalize quality, they will need to disequalize pay” (pp.137–138).

Resource 29: Rural Districts Meeting Teacher Quality Requirements

Schwartzbeck, T. D., & Prince, C. D. (with Redfield, D., Morris, H., & Hammer, P. C.). (2003). *How are rural districts meeting the teacher quality requirements of No Child Left Behind?* Charleston, WV: Appalachia Educational Laboratory. Retrieved June 10, 2009, from <http://www.edvantia.org/publications/index1.cfm?§ion=publications&area=publications&id=480>

Researchers surveyed rural teachers and superintendents to determine the challenges related to meeting No Child Left Behind (NCLB) teacher requirements, the obstacles they face in recruiting and retaining teachers, and the strategies they were using to get highly qualified teachers in their classrooms. The smaller the school, the more difficulty superintendents reported in attracting and retaining teachers. The most frequently cited challenge to recruitment was social isolation, and the most frequently cited challenge to retention was low salaries.

Resource 30: The Costs of Getting and Keeping Rural Teachers

Prince, C. D. (2002). *Higher pay in hard-to-staff schools: The case for financial incentives*. Arlington, VA: American Association of School Administrators. Retrieved June 10, 2009, from http://www.aasa.org/files/PDFs/Publications/higher_pay.pdf

The author notes that rural areas are generally viewed as having a lower cost of living than other areas and thus requiring lower teacher pay. Policymakers need to consider the hidden costs of living in rural places, where the lack of public transportation, suitable housing, and necessary services require expenditures for home ownership and automobile operation. For these reasons, more money will be needed to attract teachers to rural areas.

Resource 31: Virginia Middle School Teacher Corps

Website: <http://www.pen.k12.va.us/VDOE/Instruction/OCP/teachercorps.html>

In Virginia, 69 low-performing middle schools can hire qualified mathematics teachers from the Virginia Middle School Teacher Corps. Teachers apply to enter the state-approved pool and receive extra pay for teaching in those schools. If hired from outside the division (or district), teachers receive an extra \$10,000 per year for each of three years. Teachers from inside the division who enter the pool and take assignments in designated schools earn an extra \$5,000 per year for each of three years. Corps members must be highly qualified and submit a letter of recommendation. The teachers are trained in a coaching model that also is used in the state's Mathematics Specialist program. It is expected that the effects of these highly qualified teachers will be felt throughout the school through professional development activities and other leadership roles that they might assume.

Resource 32: Shaw (Mississippi) School District's Local Incentive Pay Plan

Contact: Shaw School District, P. O. Box 510, Shaw, MS 38773

Incentive pay may take the form of a signing bonus, often a single payment made at the time of contract signing. In contrast, the impoverished Shaw School District, which is located in the rural Mississippi Delta, provides locally funded teacher pay bonuses spread over a three-year period and paid at critical points in the year—at contract signing, just before Christmas, and at the end of the school year as teachers enter the summer months of unemployment. This mutually beneficial plan gives the teachers cash when they need it most and gives the school the opportunity to pay in increments without depleting its funds. It is important to note that this local incentive fills a gap in the state's teacher recruitment plan, which provides housing assistance, moving expenses, scholarships and loan forgiveness, the opportunity for master's level study, and sabbaticals for teachers in critical teacher shortage areas.

For a summary of these efforts in Shaw School District, please see Chapter 5 of the National Comprehensive Center for Teacher Quality report *America's Challenge: Effective Teachers for At-Risk Schools and Students*

(http://www.tqsource.org/publications/NCCTQBiennialChapters/NCCTQ%20Biennial%20Report_Ch5.pdf).

Resource 33: *Partnerships for Success*

American Association of Colleges for Teacher Education. (2005). *Partnerships for success: No Child Left Behind meets the Higher Education Act*. Washington, DC: Author. (ERIC Document Reproduction Service No. ED346082). Retrieved June 10, 2009, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/ec/6d.pdf

This brochure showcases partnerships with universities that facilitate school improvement, teacher preparation, and professional development.

Strategy 4: Provide Prospective Teachers With Adequate Information About Teaching Opportunities Across Districts, Schools, and Communities

Research indicates that teachers lack information during the job search process; furthermore, prospective teachers often experience information-poor hiring interactions (Liu & Johnson, 2006). The lack of adequate information available during teachers' job search processes may lead to teaching assignments that are not the best fit for the teachers, their districts, or their schools. These ill-fitting placements may lead to migration and attrition. Moreover, research suggests that teachers make job search decisions based on feelings of familiarity or comfort, and they rely on student and demographic data to inform their searches (Cannata, in press). States and districts should examine their public outreach, marketing, and recruitment efforts and craft new strategies that ensure the distribution of information to prospective mathematics and science teachers. Research has shown that teachers often make decisions based on salary and benefits (e.g., Stinebrickner, 2001), geographic location (e.g., Boyd, Lankford, Loeb, & Wyckoff, 2005), and working conditions (e.g., Johnson, Kardos, Kauffman, Liu, & Donaldson, 2004).

Resource 34: The New Teacher Project

Website: <http://www.tntp.org/>

Contact: info@tntp.org

The New Teacher Project (TNTP) is a nonprofit organization whose mission is to eliminate achievement gaps by ensuring that all students are taught by qualified teachers. A key component of the organization's work is hiring and staffing reform whereby it works with states and districts to eliminate barriers to effective human capital management. TNTP has published a series of groundbreaking papers on recruitment and hiring practices and their effects on teacher supply and the equitable distribution of teachers.

Resource 35: *New Teachers' Experiences of Hiring*

Liu, E., & Johnson, S. M. (2006). New teachers' experiences of hiring: Late, rushed, and information-poor. *Educational Administration Quarterly*, 42(3), 324–360. Abstract retrieved June 10, 2009, from <http://eaq.sagepub.com/cgi/content/abstract/42/3/324>

The authors examine the processes by which new teachers are hired and the extent to which these processes result in good matches between new teachers and their schools. Guiding this examination is their conception of new-teacher hiring, which they identify as a two-way process with both the school and individual teacher as active participants. They contend that a good match between the teacher and school is important for two reasons: (1) a good match can facilitate teacher effectiveness because the knowledge, skills, and dispositions required for a particular position at a particular school are different from those required for a different teaching assignment; and (2) good matches can affect both the teacher's job satisfaction and retention.

The authors also report that new teachers often are hired through a school-based, decentralized hiring process. Even though they hypothesized that decentralized hiring structures would act as a strong prerequisite for information-rich hiring, they found that schools and teacher candidates had limited interactions during the hiring process, which led to the process being information poor. Further complicating this picture of hiring is the fact that many teachers (more than one third in California and Florida) are not hired until the school year has begun. In sum, teacher hiring was found to be information poor and rushed, despite the prevalence of decentralized hiring structures.

Strategy 5: Develop Multiple Entry Points Into Teaching for Nontraditional Mathematics and Science Teacher Candidates

After candidates become interested in teaching and schools have identified their staffing needs, alternative routes to certification provide a path for moving certified teachers into the classroom. Alternative routes often are attractive to midcareer changers and other nontraditional prospective teachers who want to become certified teachers. A program's flexibility can allow teacher candidates to complete coursework and training toward certification while continuing to earn a living as a teacher of record, paraprofessional, or businessperson. Through collaborative efforts, states, districts, universities, and colleges can develop alternative routes that attract and prepare teachers to fill shortages in high-needs areas. No two alternative routes look alike, but researchers have begun to highlight several components of high-quality programs.

Resource 36: Traders to Teachers Task-Track Program at Montclair State University

Website: <http://cehs.montclair.edu/cehs/academic/cop/t2t.shtml>

The Traders to Teachers program, available at Montclair State University in New Jersey, is an accelerated, “fast track” program designed to prepare displaced individuals from the financial sector to become mathematics teachers. Teacher candidates engage in an intensive, three-month preparation curriculum focused on mathematics content and effective instructional strategies for teaching students mathematics. Upon completion of the program, candidates will be placed in paid teaching positions and will take their Praxis examinations to earn full state certification. There is no evidence for success of this program as of yet.

Resource 37: Boston Teacher Residency (BTR)

Website: <http://www.bpe.org/btr/>

The Boston Teacher Residency program is an urban teacher preparation and certification program. During the 13-month program, teacher residents coteach with a mentor teacher in one of Boston's schools, take coursework, and receive \$10,000 during their year of service to a school. Teacher residents earn a Massachusetts Initial Teacher License and a master's degree in education and work toward dual licensure in special education. The website lays out the structure of the program and answers frequently asked questions. An evaluation of this program is forthcoming.

Resource 38: Project 5,000: Recruiting New Mathematics and Science Teachers for U.S. Schools

American Board for Certification of Teacher Excellence. (2006, May 11). *ABCTE to host 17 events to jumpstart math & science teacher recruitment initiative—Project 5,000* [Press release]. Retrieved June 10, 2009, from <http://www.abcte.org/node/989>

The American Board for Certification of Teacher Excellence (ABCTE) launched an initiative in May 2006 to recruit and certify 5,000 new mathematics and science teachers by 2009. The

national nonprofit organization is offering its alternative certification program, Passport to Teaching, to states that agree to accept its credentials. ABCTE has hosted events in Florida, Idaho, New Hampshire, and Utah to spread the word about the certification program for mathematics and science career changers. With new certifications in chemistry and physics in addition to current certifications in mathematics, general science, and biology, the organization is recruiting teachers for some of the highest need subject areas.

Resource 39: North Carolina Teachers of Excellence for All Children

Website: <http://ncteach.ga.unc.edu>

North Carolina Teachers of Excellence for All Children (NC TEACH) is an alternative teacher preparation program designed to recruit, train, support, and retain midcareer professionals as they become licensed teachers in North Carolina. NC TEACH has a new effort to attract mathematics and science professionals who are interested in becoming teachers. The website provides detailed descriptions of the organization, program offerings, and helpful resources.

Resource 40: *Alternative Routes to Teacher Certification*

Office of Innovation and Improvement. (2004). *Innovations in education: Alternative routes to teacher certification*. Washington, DC: U.S. Department of Education. Retrieved June 10, 2009, from <http://www.ed.gov/admins/tchrqual/recruit/altroutes/report.pdf>

This report presents elements of effective alternative routes to certification and then profiles six promising programs.

Strategy 6: Provide High-Quality Induction and Professional Development Experiences to Attract and Retain Teachers

Formalized new-teacher induction programs are a dominant policy response to the challenges around recruitment, retention, and educator quality. Induction programs are designed to enhance novices' instructional effectiveness while socializing them to their schools. Induction programs vary in both content and structure; however, most programs involve mentorship, new-teacher orientations and workshops, and some form of collaboration with colleagues (Smith & Ingersoll, 2004). Much of the current research in teacher induction focuses on the content of these programs, specifically on the opportunities for teachers to strengthen their content and pedagogical content knowledge (e.g., Luft, Roehrig, & Patterson, 2003). This research suggests that content-focused induction positively affects teachers' knowledge of content and pedagogy, which researchers suggest will lead to greater gains in student achievement. Likewise, professional development has been shown to strengthen teachers' knowledge and instructional practices when particular core and structural features are present (Garet, Porter, Desimone, Birman, & Yoon, 2001).

This research indicates that professional development focused on content, how students learn content, and the instructional strategies most effective in teaching the content leads to positive outcomes for both teachers and students. This induction and professional development research is of critical importance to states and districts as they design recruitment and induction initiatives for mathematics and science teachers. High-quality induction and professional development not only are attractive organizational features but also may serve to bolster the effectiveness of novices, thereby facilitating their retention decisions.

Resource 41: *Increasing Teacher Retention to Facilitate the Equitable Distribution of Effective Teachers*

Lasagna, M. (2009). *Increasing teacher retention to facilitate the equitable distribution of effective teachers* (Key Issue). Washington, DC: National Comprehensive Center for Teacher Quality. Retrieved June 10, 2009, from http://www.tqsource.org/publications/KeyIssue_TeacherRetention.pdf

This publication presents strategies, programs, and resources for improving the retention of teachers and promoting the equitable distribution of teachers. Strategies discussed include enhancing teacher induction and mentoring, improving working conditions, reforming teacher compensation systems, and providing advancement and leadership opportunities to teachers. It also includes four real-life examples of promising initiatives designed to stem teacher turnover.

Resource 42: Content-Focused Teacher Induction

Luft, J. A., Roehrig, G. H., & Patterson, N. C. (2003). Contrasting landscapes: A comparison of the impact of different induction programs on beginning secondary science teachers' practices, beliefs, and experiences. *Journal of Research in Science Teaching*, 40(1), 77–97. Abstract retrieved June 10, 2009, from <http://www3.interscience.wiley.com/journal/102019992/abstract>

The researchers examined the impact of three induction programs on novice secondary science teachers. Teachers were assigned to one of three approaches: science-focused induction, general induction, or no formal induction program. The analysis revealed that teachers in the science-focused induction program were more likely to employ student-centered and science inquiry instructional practices and less likely to experience constraints to their teaching. The authors recommend that states and districts work with universities in providing more content-focused induction programs.

Resource 43: Features of High-Quality Professional Development

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38(4), 913–945. Retrieved June 10, 2009, from <http://aztla.asu.edu/ProfDev1.pdf>

The authors used a national probability sample of mathematics and science teachers to compare features of professional development on teacher learning. The core features shown to have positive effects on teacher learning and practice include a focus on content, opportunities for active learning, and coherence among other learning and professional development experiences. Furthermore, the authors identified the following structural features as contributing to positive outcomes for teachers: collective participation of teachers from the same subject, grade, team, or school; the form of the activity (e.g., workshop); and the duration of the activity. States and districts may use these findings to design high-quality professional development experiences for new teachers as well as promote high-quality professional development opportunities as a recruitment tool.

Resource 44: *Identifying Effective Professional Contexts to Support Highly Effective Teachers*

Hirsch, E. (2008). *Identifying professional contexts to support highly effective teachers* (Key Issue). Washington, DC: National Comprehensive Center for Teacher Quality. Retrieved June 10, 2009, from <http://www2.tqsource.org/strategies/het/ProfessionalContexts.pdf>

This comprehensive set of resources and strategies helps school and district officials begin to assess the quality of working conditions at their schools and to conceptualize the link between working conditions and teacher job satisfaction. It also offers tips on implementation of reforms.

Real-Life Example

North Cascades and Olympic Science Partnership

Funded by the National Science Foundation, the North Cascades and Olympic Science Partnership (NCOSP) is a collaborative science education reform effort among 28 school districts; two education service districts; four community colleges; Washington Leadership and Assistance for Science Education Reform (LASER); Naval Undersea Museum; Washington Mathematics, Engineering, Science Achievement (MESA) program; and Western Washington University. The project aims to improve science education in Grades 3–10 through improved teacher recruitment, professional development, and curricula reform initiatives. More specifically, the NCOSP project works to increase the diversity of beginning science teachers and to strengthen the quality of their preparation in local colleges and universities. Key to the success of NCOSP is the thoughtful and well-structured interactions among institutions of higher education and local school districts.

Prior to the implementation of the project, NCOSP districts lost 50 percent of their teachers every six years, and the teacher workforce was 93 percent Caucasian. Rural districts experienced significant challenges because of out-of-field teaching assignments and difficulties recruiting and retaining high-quality teachers with adequate content and pedagogical content knowledge to advance student learning in science.

While the work of NCOSP continues, initial outcomes have suggested the program is making an impact on student learning. In 2007, student achievement in NCOSP districts was consistently above the state averages. Furthermore, 73 percent of eighth-grade students at Nooksack Valley Middle School in Everson were proficient on the science Washington Assessment of Student Learning in 2007, which is a significant increase from only 36 percent proficient in 2005.

States, districts, and university partnerships are encouraged to examine the ongoing NCOSP initiatives, particularly in the areas of teacher recruitment and educator quality in science.

For more information, visit <http://www.ncosp.wwu.edu/> or contact George Nelson, Ph.D., at george.nelson@wwu.edu.

References

- Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2005). The draw of home: How teachers' preferences for proximity disadvantage urban schools. *Journal of Policy Analysis and Management*, 24(1), 113–132. Retrieved June 10, 2009, from [http://www.teacherpolicyresearch.org/portals/1/pdfs/The Draw of Home \(JPAM\).pdf](http://www.teacherpolicyresearch.org/portals/1/pdfs/The_Draw_of_Home_(JPAM).pdf)
- Cannata, M. (in press). Understanding the teacher job search process: Espoused preferences and preferences in use. *Teachers College Record*.
- Fideler, E. F., Foster, E. D., & Schwartz, S. (2000). *The urban teacher challenge: Teacher demand and supply in the great city schools*. Belmont, MA: Urban Teacher Collaborative (Recruiting New Teachers, Council of the Great City Schools, & Council of the Great City Colleges of Education). Retrieved June 10, 2009, from <http://www.cgcs.org/pdfs/utc.pdf>
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38(4), 915–945. Retrieved June 10, 2009, from <http://aztla.asu.edu/ProfDev1.pdf>
- Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. *Journal of Human Resources*, 39(2), 326–354.
- Johnson, S. M., Kardos, S. M., Kauffman, D., Liu, E., & Donaldson, M. (2004). The support gap: New teachers' early experiences in high-income and low-income schools. *Education Policy Analysis Archives*, 12(61).
- Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis*, 24(1), 37–62.
- Levin, J., & Quinn, M. (2003). *Missed opportunities: How we keep high-quality teachers out of urban classrooms*. Brooklyn, NY: The New Teacher Project. Retrieved June 10, 2009, from <http://www.tntp.org/files/MissedOpportunities.pdf>
- Liu, E., & Johnson, S. M. (2006). New teachers' experiences of hiring: Late, rushed, and information-poor. *Educational Administration Quarterly*, 42, 324–360.
- Luft, J. A., Roehrig, G. H., & Patterson, N. C. (2003). Contrasting landscapes: A comparison of the impact of different induction programs on beginning secondary science teachers' practices, beliefs, and experiences. *Journal of Research in Science Teaching*, 40(1), 77–97.
- Smith, T. M., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, 41(3), 681–714.
- Stinebrickner, T. R. (2001). A dynamic model of teacher labor supply. *Journal of Labor Economics*, 19(1), 196–330.