

TURNING THE TIDE:

Strategies for Producing the
Mathematics and Science Teachers
Our Schools Need

ACKNOWLEDGMENTS

We are grateful to the Bill and Melinda Gates Foundation for funding this project.

This report was prepared for the National Association of System Heads (NASH) by Charles R. Coble, Catherine Walker, Katy Anthes, Ned Erickson and Arika Long of The Third Mile Group, a Denver-based consulting group.

Design and layout was done by Kym Bloom.

This report can be found on the web at www.edtrust.org under National Association of System Heads

The National Association of system heads (NASH) was formed in 1979 for the purpose of seeking improvement in the organization and governance of public higher education systems. It serves as the forum for the exchange of views and information among its members and with other higher education organizations, with special attention to the perspectives, problems, and opportunities of systems as a unique category of higher education executives. Currently there are 53 public multi-campus higher education systems in the United States and Puerto Rico.

NASH

NATIONAL ASSOCIATION OF SYSTEM HEADS

1250 H. St. NW, Suite 700

Washington, D.C. 20005

Phone: 202-887-0614

Fax: 202-293-2605

INTRODUCTION

Today, there is growing recognition that America's competitive edge in the global economy, the strength and versatility of its labor force, and its capacity to nourish research and innovation all depend on an education system capable of producing a steady supply of young people well prepared in science and mathematics.

Five years ago, the National Commission on Mathematics and Science Teaching – a blue-ribbon panel of educators, policymakers and state leaders led by Senator John Glenn – identified the pivot point for change and improvement in K-12 math and science education: the nation's teachers and the institutions that train them.

The dimensions, complexity and increasing urgency of the problem, the commission's final report warned, demand concerted, sustained action on the part of decision makers at the state, system and institutional levels. "Tinkering around the edges of reform will not suffice," the report said.

Among the commission's key recommendations was that greater visibility be given to the kind of programs, policies and practices profiled in this report – outstanding examples of innovation, initiative and leadership.

The same urgency for action was echoed more recently in the 2006 Report of the National Academy of Sciences, *Rising Above the Gathering Storm*. The NAS report made its first recommendation for action to: "Increase America's talent pool by vastly improving science and mathematics teaching. The report called for annually recruiting 10,000 science and mathematics teachers."¹

While the initiatives and programs profiled vary widely in scope, structure and emphasis, collectively they point to the power of three interrelated strategies:

- ✦ *Engaging arts and sciences faculty as leaders of reform*
- ✦ *Developing new pathways and incentives to enter the teaching profession*
- ✦ *Establishing ambitious, widely shared and measurable goals with support and accountability for action*

The initiatives featured here are, to some extent, works-in-progress, still growing and evolving; But there are already encouraging signs. For example, through the Regents' Initiative, the nine higher education institutions of the Texas A&M University System have collectively increased their annual production of teachers by 50%, and are turning out nearly four times as many black teachers, three times as many math teachers and twice as many science teachers as in 1999 – while raising standards for their programs. Another notable example is the NYC Teaching Fellows program, which since its inception in 2000 has recruited and trained more than 7,000 college graduates and mid-career professionals to teach in New York City public schools – roughly half of whom are currently working in high-need subject areas and high-need schools.

We welcome feedback and information from readers about other improvement efforts under way at the state, system and institutional levels. Our goal is to expand the knowledge base on preparing more and better math and science teachers – and, at the same time, to help policymakers, educators and others make better use of what we already have learned. We hope to hear from you.

Charles Coble
Study Director

Janis Somerville
Senior Associate, NASH

THE CHALLENGES AT HAND

Too many elementary and middle school students do not have access to the math and science instruction they need. In the Philadelphia-based Bayer Corporation's 10th annual status report on science education in the United States, only one-third of elementary teachers reported teaching science every day, and one in three said they teach science only twice a week or less.² As for math, one in three of the nation's 8th graders attends a school that does not even offer an algebra class – widely considered a “gatekeeper” course for more advanced science and math courses.³

Troublingly large numbers of the nation's middle school and high school students receive science and math instruction from under-qualified teachers. The National Science Board reported in 2004 that nearly 20% of high school students – and 57% of middle school students – studied math with a teacher who did not major or minor in math. Sixteen percent of high school students – and 48% of middle school students – received instruction in physical sciences from a teacher without a major or minor in a physical science, engineering or a related field.⁴

According to a 2003 analysis by the University of Pennsylvania's Richard Ingersoll, math and science have higher rates of annual teacher turnover than any other area of the school curriculum.⁵ Shortages of qualified math and science teachers are particularly severe in large urban districts; and in schools with high minority enrollments, students have less than a 50% chance of getting a science or math teacher who holds both a license and a degree in the field being taught.⁶

Despite some overall gains in achievement, most American students still perform below par on national science and math assessments, and there are large and persistent gaps in achievement between various ethnic/racial subgroups. On the most recent National Assessment of Educational Progress (NAEP) tests, just one-third of 4th and 8th graders scored at or above the proficient level in math.⁷ In science, roughly one-third of 4th and 8th graders – and nearly half of high school seniors – did not reach even the basic level of competence.⁸

In international comparisons, U.S. student performance in science and math is at best only slightly above average, and becomes weaker and weaker as students progress through school. On the Third International Mathematics and Science Study (TIMSS), which tested nearly a half-million students from 41 countries, U.S. 9-year-olds scored somewhat above the international average; 13-year-olds, near the average; and 17-year-olds, well below it.⁹

At a time when the number of jobs to be filled in engineering and science is predicted to continue growing at more than three times the rate of other professions, fewer and fewer high school students are interested in – and prepared for – obtaining a college degree in those fields. In 1975, the United States ranked third in the world in the percentage of students pursuing natural science and engineering degrees. Now it is 17th. Over the past 10 years, the number of high school seniors planning on careers in engineering has dropped more than 35%.¹⁰

These statistics and trends underscore the need for strategically rethinking current approaches to augmenting the size and capacity of the K-12 math and science teaching workforce.

And expectations for what both students and their teachers should know and be able to do are steadily rising. In 1992, only 13 states required at least three credits of math to graduate from high school; today, 24 states and the District of Columbia require three years of math – and five states currently, or soon will, require students to complete four years of math. Under the No Child Left Behind Act (NCLB), science will be added to the required mathematics and English assessments. States are required to have developed and put in place science standards and assessments by the 2007-08 school year, and to administer the assessments of student learning at least once during grade spans: 3-5, 6-9 and 10-12.



Engaging arts and sciences faculty as leaders of innovation and reform

Education schools alone cannot meet the challenge before us. A defining feature of the programs highlighted under this heading is the extent to which leaders in colleges of arts and sciences have stepped forward and taken the lead in redesigning curriculum, developing new preparation programs and recruiting their majors into K-12 teaching careers.

The ambitious efforts under way at the University of Texas at Austin (UT) and the University of Colorado (CU) to restructure and reform undergraduate math and science education – UTeach and STEM-TP – had as their driving force the dean of the College of Natural Sciences and a physics professor, respectively. Arts and sciences faculty were also deeply engaged in the design and development of CUNY’s Teacher Academy, University of California’s California Teach and the Texas A&M Regents’ Initiative profiled in later sections of this report.

Such collaborative efforts represent a significant shift in values and practices, sending strong signals to students that our best and brightest should consider teaching.

University of Texas at Austin

UTeach

A collaborative partnership of the University of Texas at Austin’s College of Natural Sciences and College of Education and the Austin Independent School District, UTeach has as its goal increasing the number and diversity of math, science and computer science students entering the teaching profession and assuming positions of educational leadership in their fields.

In 1997, the University of Texas at Austin set out to effect fundamental, lasting change in the way students were prepared for careers in math or science education. Mary Ann Rankin, dean of the College of Natural Sciences, brought together a group of veteran high school teachers and administrators and charged them with designing an innovative teacher preparation program based on national standards, educational research and their years of experience in the K-12 setting. At the same time, the dean of the College of Education made a commitment to rebuild and strengthen the college’s program in math and science education.

UTeach offers options for undergraduates who want to teach, college graduates who want to return for certification, and experienced teachers who want an advanced degree. Among the key features of the undergraduate program are:

- ✦ New classes focused on how to teach math and science, intermingled in the curriculum with discipline courses in the College of Natural Sciences; inclusion of field experiences in at every level; and a technology-rich curriculum that emphasizes the use of new educational tools in instruction in the major.
- ✦ Employment of outstanding, experienced high school and middle school teachers as instructors, advisors and field supervisors in the College of Natural Sciences along with regular College of Natural Sciences and College of Education faculty.
- ✦ Aggressive recruitment of math and science majors in the highly selective College of Natural Sciences, including providing two introductory UTeach courses that incorporate field teaching experiences. Students are carefully prepared to teach math/science lessons in elementary and middle school classrooms – in pairs, four times a semester and under the guidance of outstanding teachers.
- ✦ Monetary incentives, including (1) scholarships for good performance in the program, especially for upper-division students and (2) paid internships that offer opportunities for community outreach and informal science teaching.
- ✦ Degree plans that allow most students to graduate in four years, having completed both their content courses and the requirements for teacher certification; and an accelerated program for post-baccalaureate students that gets them into the classroom quickly but prepares them well.
- ✦ Substantial support for new teachers, including assistance with lesson plans, curriculum and classroom management.

Since the inception of UTeach nine years ago, UT/Austin has doubled the number of math majors, and increased by over five times the number of science majors, being certified. Roughly 450 students are currently enrolled in UTeach, and this year's 74 graduates will bring the total number of graduates to 350. According to program officials, 75% of those who graduated in 2001 or before are still teaching.

Expanding on the foundations built in the undergraduate program, UTeach has created the Summer Master of Arts in Science and Mathematics Education degree program. It is designed to produce the next generation of master-teacher leaders – individuals who will return to the classroom and their school districts as highly qualified content and instructional specialists. Based upon the success of the UTeach model in raising both the number and quality of math science teachers, The University of Texas System has incorporated replicating the UTeach approach across the system campuses as a key recommendation for increasing student success. Two campuses, UT/Dallas and UT/San Antonio, are underway.

For additional information, contact UTeach co-directors: Laurence Abraham, l.abraham@mail.utexas.edu or Michael Marder, marder@chaos.ph.utexas.edu. Phone: 512-232-2770 or visit the UTeach Web site at <http://www.uteach.utexas.edu/>.



University of Colorado at Boulder

Science, Technology, Engineering, Mathematics Teacher Preparation Project (STEM-TP)

The Science, Technology, Engineering, Mathematics Teacher Preparation Project (STEM-TP) was initiated in spring 2003 as a collaborative effort of faculty members in the University of Colorado's College of Arts & Sciences and School of Education. It focuses simultaneously on:

- ✦ Increasing the number of students who graduate with both a bachelor's degree in a STEM discipline and a teaching certificate
- ✦ Improving STEM education for all undergraduates.

A key premise of the program is that the best way to develop a qualified pool of undergraduate science and math majors interested in pursuing a teaching career is to place them in situations where they are directly involved in the teaching and learning process. To this end, top-performing undergraduates are given the opportunity to work as paid "learning assistants" in large-enrollment math, physics, biology, chemistry and astronomy classes, with responsibilities as recitation or tutor-group leaders, peer instructors and student-professor liaisons.

In the Learning Assistant (LA) program, students have the chance to learn about teaching while they are learning science/math content and, at the same time, to play an integral role in efforts to reform and restructure undergraduate education in math and the sciences. The program provides these students with continuous training and support – including instruction in pedagogy, teaching techniques, peer instruction and technology – and an environment in which knowledge and ideas are freely exchanged among veteran LAs, new LAs and STEM faculty.

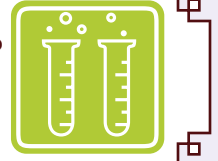
The STEM-TP initiative grew out of an undergraduate course taught by Richard McCray, the George Gamow Distinguished Professor of Astrophysical and Planetary Science at CU and former chair of the National Research Council Committee on Undergraduate Science Education.

By dividing large classes (over 200 students) into learning teams of 12 students each, McCray transformed his section of introductory astronomy to emphasize inquiry-based and collaborative learning with the aid of Web-based information technology. The employment of undergraduate learning assistants to supervise the learning teams led McCray to realize the potential of the program to recruit math and science teachers. With funding from the National Science Foundation, McCray developed a partnership with professors in other departments – including Nobel Prize winner Carl Weiman and mathematics professor Jim Curry – to apply the new teaching model to other subjects.

Since its inception, STEM-TP has attracted 108 LAs, 18 of whom have gone on to enroll in the School of Education's teacher licensure program, and the number of faculty who have used or are using LAs in their classes or laboratories has increased from seven to 28.

- For additional information, contact Valerie Otero at 303.492.7558 or Valerie.otero@colorado.edu, or visit
- the STEM-TP Web site at <http://stem.colorado.edu>.

Developing new pathways and incentives to enter the teaching profession



Diversification of rigorous, high quality pathways into teaching along with the emergence of innovative new approaches to recruitment and preparation has been a particularly encouraging trend. Today there are options and incentives for individuals of various ages, backgrounds and circumstances: undergraduate math and science majors, recent college graduates, professionals in math- and science-based fields, mid-life career changers and even retirees.

Incentives typically come in the form of scholarships, loan-forgiveness programs and paid internships for students who commit to teaching science or math and/or in high-need schools for a specified period after graduation – key components particularly of efforts to make it possible for talented low-income and minority students to pursue teacher training.

While important, money is not the only incentive for attracting students to teacher education. Profiled here are examples of programs that are rich in design. The ‘residency’ training model is designed along the lines of the medical residency, combining extensive on-the-job training with rigorous coursework integrated with the student’s major. In these programs, students have high challenge and intensive support through the opportunity to observe, collaborate with and be mentored by an experienced, master teacher over time.

New pathways for students who enter through a community college hold special promise for improving the diversity of the teaching force. Community colleges enroll a larger proportion of minority students than four-year institutions, and they are also an entry point for many mid-career adults. Establishing strong system level policies to remove barriers and clearer pathways to degree completion are proving to be two good ways of expanding the number of students pursuing careers as teachers.

In addition to the new pathways and options profiled here, several other initiatives throughout this report including the University of Texas at Austin, the University of Colorado and the University of California – UTEACH, STEM-TP and California Teach, respectively – also offer new pathways within the baccalaureate including courses of study that couple a challenging curriculum with field experience in K-12 classrooms, and allow math, science and engineering students to graduate in four years with both a bachelor’s degree and a teaching credential.



Boston Public Schools

Boston Teacher Residency

Boston Teacher Residency (BTR) is a 13-month teacher preparation and certification program aimed at attracting a diverse cohort of top-notch candidates in three categories: recent college graduates, mid-life career changers and community leaders who have experience in and passion for working on behalf of Boston's children.

Designed along the lines of the medical residency, BTR provides a set of integrated experiences, opportunities and incentives throughout the training program:

Extensive on-the-job training coupled with rigorous coursework. Program participants enter as cohorts and are placed in select Boston public schools. The structure of the residency is particularly attractive for career changers because during the residency period they are not solely responsible for a set of classes but have the opportunity to spend four days a week observing, collaborating with and being mentored by an experienced teacher of record as they assume increasing responsibility. Program participants also attend – during the summer and one day a week throughout the year – seminars and classes taught by a faculty of experts from schools, universities and local community agencies.

An affordable route into teaching. Program participants are paid a stipend of \$10,000 for their service in schools during the internship, and given a \$10,000 loan, upon admission, to cover program tuition. For each year a student teaches in Boston's public schools following his or her internship, one-third of the loan is forgiven.

The foundation for a successful career. Students who complete the BTR program earn a Massachusetts Initial Teacher License and a master's degree from the University of Massachusetts/Boston. They enter the profession as part of a strong cohort of new teachers and receive extensive support following their preparation year.

BTR was created collaboratively in 2003 by the Boston Public Schools, the Boston Partnership for Excellence in Public Schools and Strategic Grant Partners, a coalition of 12 Boston-area family foundations that helped design the program and provided \$2.2 million to cover start-up and operating costs for the first two years.

To date, BTR has placed 90% (43 out of 48) of its graduates in teaching jobs in the city's schools, with a 100% retention rate. In the first three cohorts of BTR residents, 50% have been people of color – and just over half of the middle and high school residents have been math and science candidates.

The program is slated to continue to grow, preparing approximately 75 new teachers in 2006-07, 100 new teachers in 2007-08 and reaching scale in 2008-09 at 120 residents per year (30% of the projected number of teachers Boston will hire that year). By June 2009, BTR will have graduated and placed almost 400 new teachers in the city's schools.

- For additional information, visit www.bpe.org or call Boston Plan for Excellence director
- Jesse Solomon at 617.227.8055.



City University of New York

Teacher Academy

In September 2006, the City University of New York (CUNY), the nation's largest urban public university, launched a selective baccalaureate program designed to recruit and prepare outstanding students to major in mathematics and science and teach in New York City's public schools.

Modeled on CUNY's Honors College – an innovative course of study for academically gifted undergraduates established in 2001 – and incorporating methods traditionally used for educating and training doctors, the Teacher Academy is designed to provide students with a continuum of experiences, opportunities and support extending from the time they are accepted into the program through their induction as new teachers.

Among the key features of the new program, offered at seven of CUNY's eleven senior college campuses in conjunction with two dozen "host schools" selected by the New York City Department of Education are:

- ✦ Four years of free tuition and fees, in addition to paid summer and after-school internships, in return for a two-year commitment to teach in the New York City schools
- ✦ A challenging curriculum developed collaboratively by CUNY faculty and lead teachers in participating schools that provides students with both a strong grounding in the liberal arts and a deep foundation in their major field – mathematics, biology, chemistry or earth science
- ✦ The benefits of a "college within a college" learning environment, including small classes, dedicated advisors and a Teacher Academy home base for study and socializing
- ✦ Placement in a selected middle or high school where, starting the summer prior to their freshman year and continuing for four years, students will observe, study and eventually practice the profession of teaching. The high school or middle school becomes an extension of the classroom with the intention that when a graduate of the Academy enter his or her own classroom for the first time, it won't be as a stranger.

The cornerstone of The Teacher Academy, which was begun with funding from the Carroll and Milton Petrie Foundation as part of the New York City Partnership for Teacher Excellence, is the partnership between CUNY and the New York City Department of Education. The partnership brings together leaders from across CUNY, educators from the Department of Education and specially selected public schools to collaborate closely on all aspects of The Teacher Academy.

The Teacher Academy demonstrates how a system can be responsive to a city's needs, how learning *what to teach* and *how to teach* can better come together, and how beginning teachers can be ready from the start to do what they need to do in real classrooms.

Launched in September 2006, the initial Teacher Academy classes total 109 students. Subsequent entering classes will increase with a goal of graduating 300 math and science Teacher Academy students each year.

- For additional information, contact the Teacher Academy at 212.794.5323 or visit
- www.cuny.edu/teacheracademy.

North Carolina Department of Public Instruction/University of North Carolina

NC TEACH

North Carolina Teachers of Excellence for All Children (NC TEACH) is a rigorous alternative-teacher preparation program designed to recruit, train, support, and retain mid-career professionals as they become licensed teachers in North Carolina. The program is administered by the University of North Carolina (UNC) Office of the President, in collaboration with the North Carolina Department of Public Instruction. More than 1,500 individuals have become licensed teachers through the NC TEACH program since its inception in 2000.

NC TEACH is the product of a collaborative effort among the 15 teacher-preparing institutions of the University of North Carolina system and is designed to provide a single point of information and entry for individuals who have a bachelor's degree and are seeking to prepare as teachers.

- ✦ NC TEACH has developed a comprehensive statewide recruitment effort that includes advertisements on commercial and public radio.
- ✦ Through NC TEACH, participants receive support and advising that begins with the recruitment of the prospective teacher, and extends through all program courses and activities through the licensure process.
- ✦ Nine public universities and three independent colleges have adopted NC TEACH as their key strategy for working with mid-career adults and lateral-entry teachers, and for the development of new master's degree programs. Participating institutions have agreed upon a common 18-credit hour core training program.

The NC TEACH program begins with a one-week orientation and an intensive five-week Summer Institute. Higher education faculty and master teachers lead the Summer Institute, which focuses on understanding children and young adults as learners, lesson planning, classroom management, instructional technology, student learning/assessment, strategies for student success, understanding state and local contexts for public education, parental involvement and the North Carolina Standard Course of Study.

Various methods of instruction are used during the Summer Institute, including interactive multimedia, case studies, peer coaching and teaching, and other small-group activities. Instructors assess the academic performance of each participant, and university credit is awarded for successfully completed courses.

After successfully completing the Summer Institute, participants begin teaching full-time in a North Carolina public school (including charter schools). During the first year of teaching, participants continue to attend NC TEACH classes and seminars. These for-credit seminars cover topics such as educational philosophy and pedagogy, and also serve as a forum for teachers to share ideas and discuss the challenges they have encountered in their classrooms.

Each program participant is provided a mentor assigned by the school district. NC TEACH instructors are available to provide additional guidance if requested by the participant, the school or the district. Participants may also request to be assigned an online mentor, who is available throughout the year to provide assistance, suggestions, coaching and other forms of support.

NC TEACH has yielded impressive results:

- ✦ More than 1,500 program completers are working in 150 schools and 85 counties in North Carolina. NC TEACH is preparing more math and science teachers than any other single teacher-preparation program in the state.

- ✦ The retention rate, for all cohorts, is 80% after one year and 72% after three years.
- ✦ Between 2000 and 2004, the percentage of black and Hispanic program participants increased from 14% to over 30%.

NC TEACH is attracting interest from other states interested in providing a clear, statewide center and education leaders in 27 states have requested information about NC TEACH and/or come to North Carolina for a first-hand look at the program.

For additional information, contact Dorothy J. Mebane, NC TEACH Director, Center for School Leadership Development, at 919. 962.4562 or 866. 998.3233 or visit www.ncteach.ga.unc.edu.



The New Teacher Project/ New York City Department of Education NYC Teaching Fellows Program

The New Teacher Project (TNTP) is a national nonprofit organization formed in 1997 that focuses on getting high-achieving individuals to commit to improving public education through teaching. TNTP works with school districts, state departments of education and universities to recruit, select, train and support outstanding new teachers from many different professional backgrounds. It specializes in recruiting candidates for shortage-area subjects and staffing high-need schools.

Over the course of its history, TNTP has attracted and prepared nearly 20,000 new, high-quality teachers and launched more than 40 programs in 20 states.

Among the best-known TNTP-operated recruitment partnerships is the NYC Teaching Fellows program, begun with the NYC Department of Education in spring 2000 amid New York City's most severe teacher shortage in decades. Today, the program – which targets recent college graduates, mid-career professionals and retirees – is the largest alternative-certification program in the country and among the most selective. In 2006 the program received 17,500 applications for 2,000 positions. The average undergraduate GPA of NYC Teaching Fellows is 3.3. Three in four have attended selective undergraduate institutions, and one in four holds an advanced degree.

Teacher Fellows engage in a short, intensive pre-service training program and complete further academic requirements while they teach. Each Fellow matriculates in a subsidized master's degree program at one of the City University of New York campuses or other collaborating institution of higher education that qualifies him or her for certification in their subject area. The master's program takes two to three years to complete. Fellows are responsible for \$4,000 of the cost of their master's degrees to be paid over the course of two years in the form of automatic paycheck deductions.

The NYC Teaching Fellows program has developed a specialized Math Immersion Program to increase the supply of mathematics teachers in the City. Designed for individuals who have strong background in mathematics, but do not necessarily have a major in the field, candidates are carefully screened and enter an intensive training program. All must pass the New York state content licensing examination prior to entering a classroom. In 2005 the NYC Teaching Gellows Program placed 390 new math teachers in the NYC public high schools.

There are more than 7,000 Teaching Fellows currently working in New York City schools – primarily in high-need schools in the Bronx and central Brooklyn. Almost 80% of them are teaching high-need subject areas (roughly 40% in math and science), and 40% are people of color. Ninety percent of all Fellows complete a full year of teaching and return for a second year. Ninety-two percent of administrators surveyed say they would hire a Teacher Fellow again.

For more information about the NYC Teaching Fellows program, visit www.nyctf.org/about/.
For additional information about TNTP, contact Michelle Rhee, Chief Executive Officer, at 303-918-3311 or at mrhee@toast.net, or visit www.tntp.org.

University System of Georgia Board of Regents

Double the Numbers and Double the Diversity

Another notable effort is the University System of Georgia's initiative to improve the quality and productivity of its teacher preparation programs. Its goal is to produce 7,000 new teachers in 2010, up from 3,157 in 2004 (including 1,555 minority teachers, up from 601 in 2004), and emphasize preparing more teachers in math, science and other high-need subject areas.

The Double, Double Initiative, as it's called, was launched in January 2005, building on prior and ongoing work by the University System of Georgia (USG) to improve its 15 educator-preparation programs and increase the number and diversity of teachers prepared.

The Initiative includes several strategies:

- ✦ Increase the number of teacher preparation institutions, from 15 to 20. Status: Done.
- ✦ Expand the role of two-year public colleges by helping more students pass the qualifying exam for entering a teacher preparation program, and giving students more convenient access to teacher preparation by four-year institutions offering programs on two-year college campuses. Status: Four-year programs offered by four-year institutions on two-year campuses are in place; two-year colleges have advisement programs in place to help aspiring teacher candidates meet the entrance criteria for program admission.
- ✦ Placing special emphasis on the recruitment of math and science teachers through its Partnership for Reform in Science and Mathematics (PRISM) initiative, funded by a grant from the National Science Foundation. Status: Underway at 14 institutions.
- ✦ Expanding pathways into the teaching profession for paraprofessionals and career-changers. Status: Underway at 15 institutions.
- ✦ Offering online programs and increasing the flexibility of course scheduling to make teacher-preparation programs as convenient and efficient as possible for students. Status: Under development.
- ✦ Providing one-stop shopping for teacher candidates through the USG Teacher Career Center. Status: In Place.

Are the strategies paying dividends? FY 2004 was the baseline, with 3,157 teachers prepared by the USG. In FY 2006, USG teacher production increased by 52%, with 4,806 teachers prepared. Through its data mart that "bridges" at the individual level, teachers prepared by the USG with the teachers hired by the public schools, we know that the yield rate was 79%. In other words, 79% of the teachers prepared by the USG in FY 2006 were teaching in the public schools this fall. By November 2006, the USG will have the breakdown of teachers prepared by ethnicity and by academic field.

The USG, as a member of the Georgia Committee on Quality Teaching, is also working to reduce teacher attrition by one-third.

- ⋯ For additional information on the Double, Double Initiative, contact Jan Kettlewell,
- ⋯ Associate Vice Chancellor for P-16 Initiatives, at jan.kettlewell@usg.edu or visit
- ⋯ www.usg.edu/p16/initiatives/doubledouble.phtml.

Establishing ambitious, widely shared and measurable goals with support and accountability for action



In its 2000 report, the National Commission on Mathematics and Science Teaching called for more systematic, strategic and collaborative approaches to expanding the supply and capacity of K-12 math and science teachers.

Multi-campus system and state leaders in several states are rising to the challenge, marshalling the collective strengths of their campuses to accelerate improvement. Although the specific initiatives vary with the state circumstance, all the system initiatives profiled contain two key strategies pioneered by the Texas A&M University System: (1) setting specific growth targets for systemwide and institution production of teachers, based on current and emerging state needs and (2) establishing a support structure and an accountability plan for achieving the goals.

In addition to the Texas A&M University System, examples include the joint efforts in California of the California State University System the University of California System, and the University of North Carolina System initiatives.

In California, Governor Arnold Schwarzenegger has marshaled significant support – including several million dollars in corporate contributions – for the joint efforts of the state’s two university systems – California State University and the University of California – to significantly increase their production of math and science teachers over the next five years.

In 2002-03, nearly 1,500 mathematics classes – and more than 800 science classes – in California high schools were taught by teachers with no teaching credential. Even more classes were taught by a teacher with a credential in an unrelated subject area. The National Science Foundation recently reported that just 4% of 9th graders in California schools go on to complete degrees in science, math or engineering.

Under the agreement brokered by Gov. Schwarzenegger in 2004, the California State University system, which currently trains 60% of the state’s elementary and secondary teachers, has made a commitment to double the number of credentialed math and science teachers it produces each year from 750 to 1,500 by 2010. The University of California has set its sights on quadrupling its production of credentialed science and math teachers, from 250 a year to 1,000 a year by 2010. The governor pledged additional resources in the state budget and through partnerships with business.

California State University System

Mathematics and Science Teacher Initiative

The California State University (CSU) system, with its 23 institutions, is the largest provider of teachers for California. In their Mathematics and Science Teacher Initiative, each campus has its specific campus goals for increasing production tied to the System's commitment to double the production of mathematics and science teachers in five years.

The CSU approach includes five primary strategies focused on increasing recruitment and expanding pathways to the teaching credential. It also calls for building strong partnerships with business and industry and for evaluating promising campus initiatives that have scale-up potential. Each campus has developed its own approach to implementation based on the needs and opportunities within its region. System and partnership supports are being developed for each of the five primary strategies described below:

Comprehensive recruitment aimed at expanding and diversifying the pool of candidates. Marketing, information and outreach will be targeted to high school students, families, teachers and counselors; current two- and four-year college students and recent graduates; mid-career and pre-retirement professionals; military retirees; and experienced teachers with the potential to change fields.

Multiple points of entry into math and science teaching. New pathways include (1) additional programs blending innovative undergraduate courses of study and partnerships between the community college system and CSU system and (2) programs enabling professionals in math- and science-based fields to transition to teaching careers under the state's recently established Specialized Science credentials in biology, chemistry, geosciences and physics and the Foundational Level credential in mathematics – the last of which is designed primarily for middle school teaching.

Internet-supported delivery of instruction. Internet-supported instruction is being developed and will be available to individuals who are interested in becoming teachers but are working fulltime in another fields.

Collaboration with community colleges. A central component of the CSU plan is collaboration with community colleges in integrated two- to four-year programs that provide an articulated and continuous sequence of preparation for math and science teaching. CSU campuses are working with their regional feeder community colleges to ensure aligned programs, and the CSU and California Community Colleges chancellor's offices have recently formalized an agreement for coordinated system-level strategies to support these partnerships.

Financial support and incentives. To make teacher preparation financially viable for students of all backgrounds, CSU is providing scholarship and loan assumption programs, paid tutoring and internship opportunities. This is important because students from underrepresented groups, who are particularly in need of financial assistance, represent an important population for expanding and diversifying the future math and science teacher workforce.

- For additional information, please visit www.calstate.edu/teachered/msti or contact Beverly Young, Assistant Vice Chancellor, Academic Affairs, at byoung@calstate.edu, or Joan Bissell, Associate Director, Teacher Education and Public School Programs, at jbissell@calstate.edu.

The California Teach program, as it is known, is a sequence of courses and experiences designed to prepare and support math, science and engineering majors who are interested in becoming K-12 teachers. The program incorporates research-tested best practices identified by the National Science Foundation, as well as certain features of the Carnegie Foundation's Teachers for a New Era initiative and of the University of Texas' UTeach program.

The program, which is in various stages of planning and implementation at nine University of California (UC) campuses, offers:

- ✦ A science, engineering or mathematics bachelor's degree, plus preparation for a single-subject teaching credential, in four years of study
- ✦ Field experience in K-12 classrooms, supervised by "mentor teachers," plus summer institutes focusing on discipline-specific teaching methods to meet state teacher-credentialing requirements
- ✦ A paid one-year teaching internship upon graduation to facilitate students' entry into the teaching work force
- ✦ Financial incentives, including loan-forgiveness programs, for participants who commit to teaching science or mathematics for a specified period after graduation, and additional incentives to encourage students to teach in low-performing schools
- ✦ Post-graduation summer internships in industry settings and other similar activities to help keep teachers in the profession and keep them updated on the linkages between their classroom curriculum and its applications in the world of business and industry.

In the course of designing and developing California Teach, the University System of California and its campus leaders have reached out to more than 700 faculty members; a variety of state and national organizations involved in science, mathematics, engineering, technology and teaching; and business, foundation and K-12/postsecondary education leaders.

To launch California Teach, corporate leaders from across the state pledged to contribute an initial \$4 million over a five-year period. Contributors include Intel Corp., AT&T Inc. (formerly SBC California), Sun Microsystems, Qualcomm, Boeing, Apple, Hewlett-Packard and US Bank. In addition, Governor Schwarzenegger pledged to support first-phase planning and implementation of California Teach, and to cover the costs of the loan-forgiveness component of the program.

For additional information about California Teach, visit www.universityofcalifornia.edu/academics/1000teachers or call 510.987.9200.



Texas A&M University System

The Regents' Initiative for Excellence in Education

Over the past several years, the Texas A&M University System has significantly improved the quality and productivity of its teacher-preparation programs. These gains are the result of an ambitious initiative undertaken by the system's Board of Regents in 1999 under the leadership of then-Chancellor Howard D. Graves which set specific, ambitious growth five-year targets for systemwide production of teachers, based on current and emerging state needs and campus assessment of their capacity for growth.

Through the Regent's Initiative, university leaders were able to galvanize resources to provide support for campuses. Like so many of the programs highlighted in this report, the Regents' Initiative focused on actively engaging arts and sciences faculty *and* public school partners in the effort to produce more – and more well-prepared – teachers. Fueled by \$14 million in grants from the Texas Department of Education, the Pew Charitable Trusts and other funders, the initiative supported:

- ✦ An increase in scholarships to attract students in high-need areas, and efforts to encourage students outside the College of Education to consider teacher certification
- ✦ Community college recruitment and a transition-to-teaching program for mid-career professionals
- ✦ School-university partnerships, including the development of induction programs to mentor beginning teachers and collaborative research projects
- ✦ A university-wide Academy for Educator Development that provides a forum for faculty members from all colleges and departments to learn more about K-12 issues, and supports their active participation in field-based preparation programs.

The A&M System's nine universities today produce a considerably larger, more diverse annual pool of prospective teachers than just six years ago – including nearly four times as many black teachers; three times as many math, special education and bilingual/ESL teachers; and twice as many science teachers. In the 2003-04 academic year, the A&M System's colleges of education produced a total of 3,437 teacher candidates – a 50% increase since 1999-2000, when the Regents' Initiative was launched. During the same period, the number of teachers produced in every targeted subject and skill area increased significantly: math (228%), science (113%), special education (217%), bilingual/ESL (174%) and foreign languages (71%).

While the Regents' Initiative formally ended in 2005, the work continues on the A&M campuses under the leadership of the deans of education.

For additional information, contact Texas A&M Vice Chancellor for Academic and Student Affairs Leo Sayavedra at 979.458.6072 or sayavedra@tamu.edu.

University of North Carolina

Strategic Plan to Address the Teacher Shortage in North Carolina

More recently, the 16-campus University of North Carolina (UNC) also has embarked on an ambitious system plan and has set specific, measurable targets for increasing the productivity of its teacher-preparation programs.

The strategic plan being developed by the University of North Carolina (UNC) Board of Governors with the 15 UNC system campuses that have teacher preparation programs aims to double, over the next decade, the number of credentialed teachers produced by both traditional and alternative-entry programs in four high-need areas: math science, middle grades and exceptional children.

President Bowles, who took over leadership of UNC in January 2006, early in his presidency called system campus leaders together and told them he would make UNC's preparation of teachers to meet the needs of the state's schools his top priority under one condition – that they take stock of their teacher-training programs and eliminate things that don't work.

A system whose annual production of teachers has not kept pace with growing demand – and which, over the past four years, has turned out only three physics teachers – can and must do better, he said.

Following a period of analysis of current state teacher needs and future projections, the leaders of each of the campuses and the Board of Governors have agreed upon the following goals:

- ✦ Increase the output of UNC's traditional preparation programs from roughly 2,450 teachers a year today, to 3,700 by 2010 and 5,000 by 2015.
- ✦ Increase the number of college graduates completing alternative-entry programs from roughly 1,300 a year today, to 2,200 by 2010.
- ✦ Increase the number of credentialed teachers produced by both traditional and alternative-entry programs in four high-need areas: math, science, middle grades and exceptional children. In math, for example, the strategic plan calls for both types of programs to be producing 366 teachers a year by 2010 (compared with 109 in the base year of 2002-03).

Campus leaders in each of the 15 institutions preparing teachers in the UNC system are developing detailed plans for achieving the numerical goals established for each teacher-education program on their campus. The system office is creating a reporting system to track year-to-year progress toward the goals. Determining how to help promote the retention of new teachers is a key component of each campus plan.

- For additional information, contact Alisa Chapman, Assistant Vice President for University-School Programs, at 919.843.8929 or chapman@northcarolina.edu.

ENDNOTES

¹ National Academy of Sciences, Committee on Science, Engineering and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Better Future*. National Academy of Sciences. Washington, DC 2006.

² <http://www.bayerus.com/msms/news/facts.cfm?mode=detail&id=survey04>

³ <http://www.nsf.gov/statistics/seind04/pdf/c01.pdf>

⁴ <http://www.nsf.gov/statistics/seind04/pdf/c01.pdf>

⁵ <http://depts.washington.edu/ctpmail/PDFs/Shortage-RI-09-2003.pdf>

⁶ <http://www.ed.gov/americaaccounts/glenn/>

⁷ http://nces.ed.gov/nationsreportcard/nrc/reading_math_2005/s0017.asp?printver=

⁸ http://nationsreportcard.gov/science_2005/

⁹ <http://nces.ed.gov/timss/results03.asp>

¹⁰ <http://www.nsf.gov/statistics/seind04/pdf/c01.pdf>

1250 H. St. NW, Suite 700 • Washington, D.C. 20005
Phone: 202-887-0614 • Fax: 202-293-2605