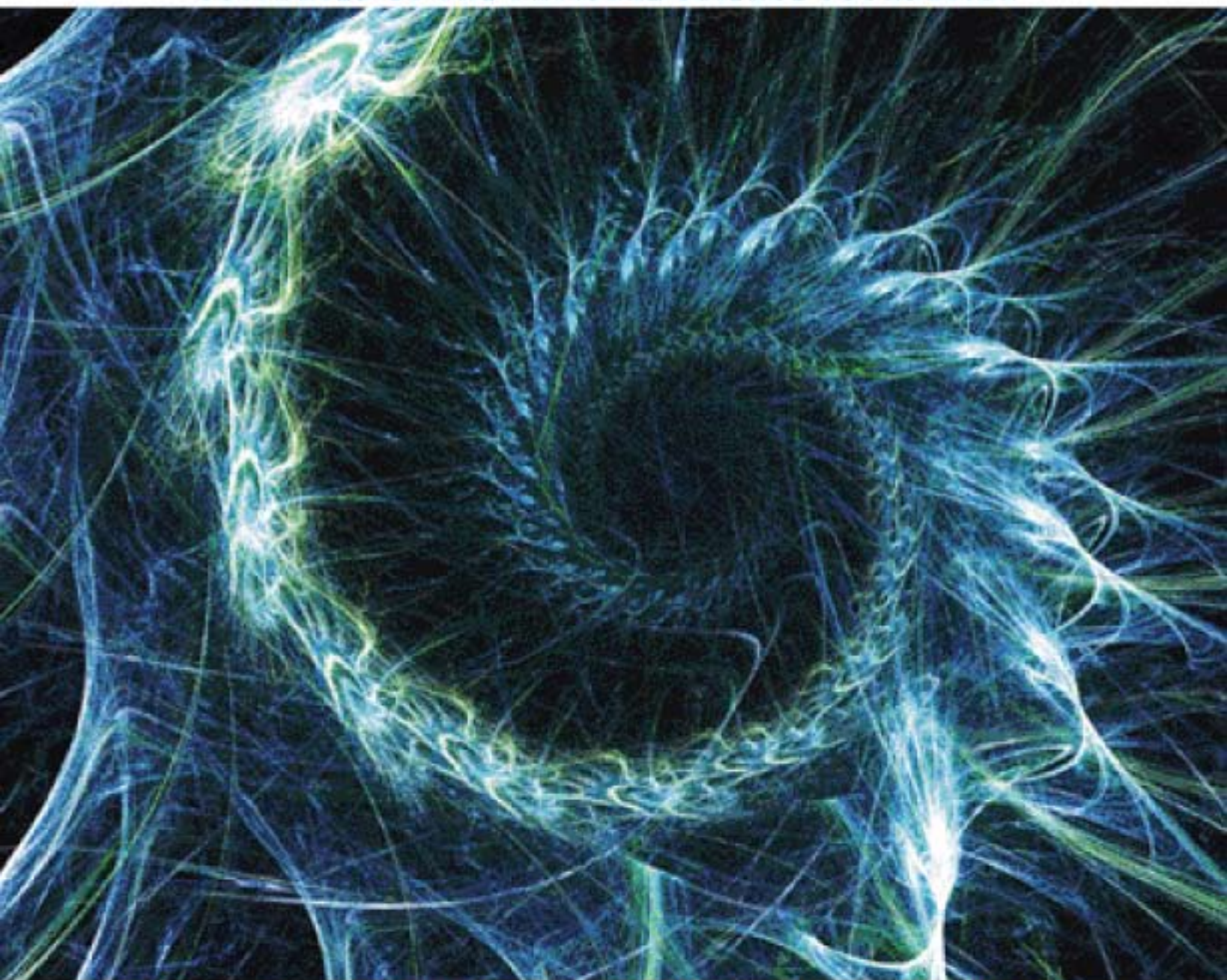


TEACHING BY CHOICE:

Community Colleges Expand K-12 STEM Pathways and Practices

SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION



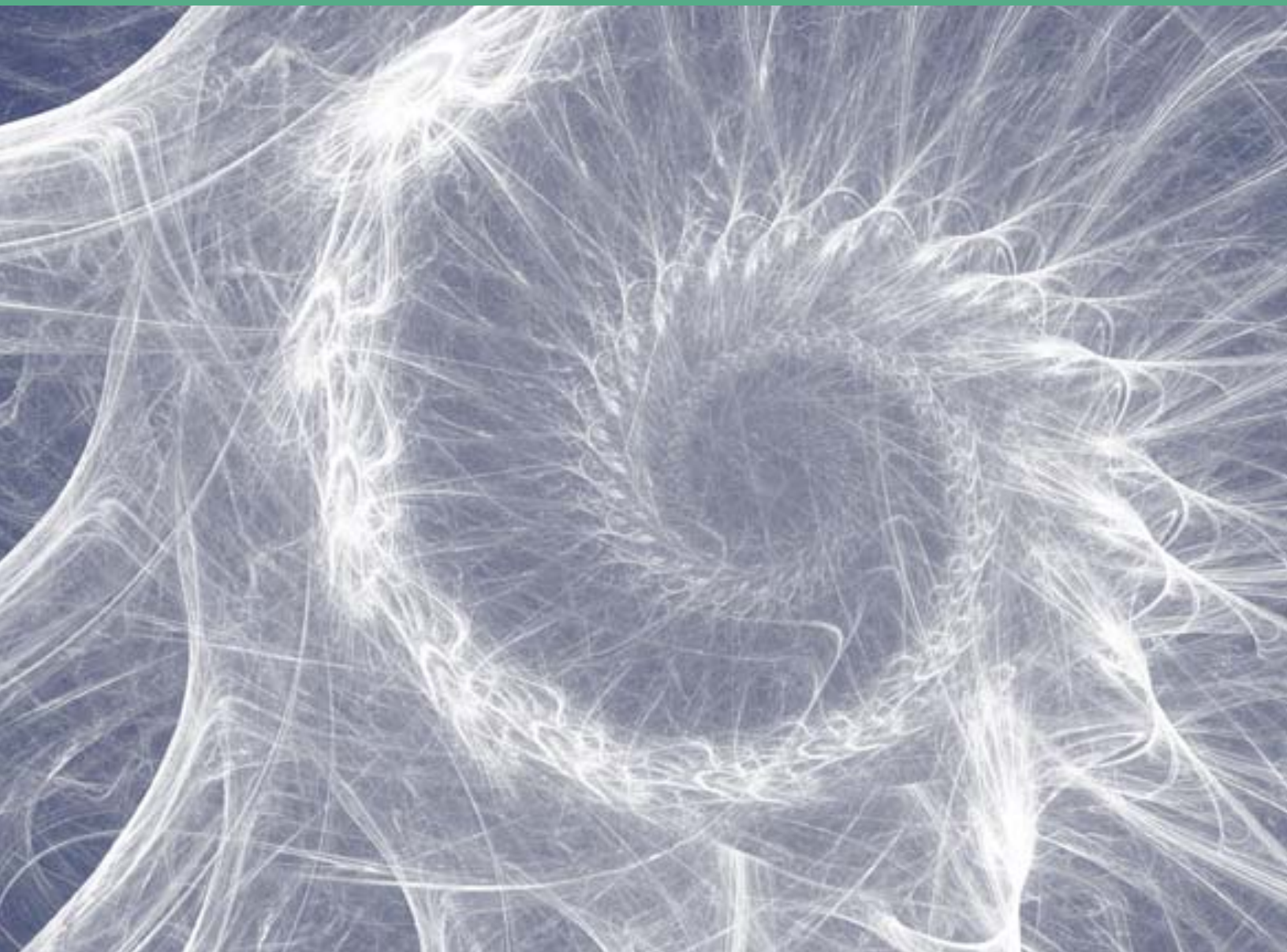
SCIENCE • TECHNOLOGY • ENGINEERING • MATHEMATICS

Edited by Lynn Barnett and Faith San Felice
Text by Madeline Patton

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S U P P O R T E D B Y T H E N A T I O N A L S C I E N C E F O U N D A T I O N



Edited by Lynn Barnett and Faith San Felice
Text by Madeline Patton



American Association of Community Colleges
Washington, DC

The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges. The association represents 1,200 two-year, associate degree-granting institutions and more than 11 million students. AACC promotes community colleges through five strategic action areas: recognition and advocacy for community colleges; student access, learning, and success; community college leadership development; economic and workforce development; and global and intercultural education.

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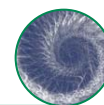
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"Teaching by Choice: Beyond 2 + 2" conference facilitated by Steve Brigham, *AmericaSpeaks*

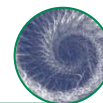
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■ Foreword	2
■ Introduction	3
■ Insights from K–12 Classroom Teachers	4
■ Community College Post-Baccalaureate Teacher Education Programs	6
● Recommendations	
■ Community College Professional Development Programs in K–12 STEM Education	9
● Recommendations	
■ Conclusion	12
■ References	13
■ Conference Participants	14



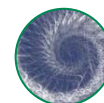
Policymakers, business leaders, and educators are rightly concerned about the capacity of the United States to remain competitive in a global economy, particularly in the areas of science, technology, engineering, and mathematics (STEM). We are confronting a STEM skills gap at the same time that we face two significant demographic shifts—large numbers of workers are retiring just as the number of school-age children is escalating. Like other sectors of the economy, education is facing a supply and demand problem; we simply do not have enough highly qualified teachers to fill the K–12 classrooms that need them.

Community colleges are playing a pivotal role in meeting this need. Teacher education programs at community colleges have traditionally prepared students for transfer to four-year colleges and universities to earn bachelor's degrees in education. Now an increasing number of community colleges also offer post-baccalaureate teacher education programs for “career switchers” as well as professional development programs in science, mathematics, and technology for teachers already in the K–12 workforce.

This report grew out of a February 2008 national conference, “Teaching by Choice: Beyond 2 + 2,” which was convened by the American Association of Community Colleges in partnership with the National Association of Community College Teacher Education Programs to enhance, expand, and sustain the science, math, and technological knowledge and practices of current and future K–12 teachers. Based on deliberations and recommendations from the conference participants, the report offers practical suggestions for developing and strengthening these “post-bacc” and professional development programs.

We are grateful to the National Science Foundation for helping us launch the Teaching by Choice program, and for the Foundation's continued interest in and support of the community college role in preparing STEM teachers for our nation's K–12 classrooms.

George R. Boggs
President and CEO
American Association of Community Colleges



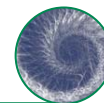
The American Association of Community Colleges (AACC) convened “Teaching by Choice: Beyond 2 + 2” (TBC), a conference to focus on community colleges’ growing role as providers of teacher education and as sources of professional development for elementary, middle, and secondary teachers of science, technology, and mathematics. The conference, held in February 2008 in Denver, was supported by the National Science Foundation (NSF), and was held in partnership with the National Association of Community College Teacher Education Programs (NACCTEP).

This report, based on the discussions of the forty conference participants, includes recommendations for community colleges to expand post-baccalaureate teacher education programs and to enhance professional development in science, mathematics, and technology for teachers in kindergarten through twelfth grade (K–12). Some community colleges already offer these services to their communities. For most community colleges, providing post-baccalaureate and professional development programs is an extension of their traditional role as transfer institutions. Most public community colleges provide the first two years of baccalaureate studies in a wide array of fields, including education, for students who transfer to other colleges and universities to complete four-year degrees. Researchers estimate that 20–40 percent of the nation’s teachers began their post-secondary educations at community colleges (Recruiting New Teachers, Inc. 2002; Shkodriani 2004; Tsapogas 2004). NSF was among the first organizations to recognize that a significant number of elementary teachers in the United States take most of their science and mathematics courses at community colleges.

Consequently, since the 1990s, NSF has supported efforts to improve science, technology, engineering, and mathematics (STEM) programs at community colleges as a way of improving elementary, middle, and secondary school instruction.

The trend in community colleges to move beyond more traditional transfer, or 2 + 2, teacher education programs responds to the nation’s critical need for K–12 teachers in STEM subjects. It also responds to the professional needs of teachers who must keep current in their fields as they vie for the attention of students who have grown up immersed in fast-paced digital media. Technological advances not only add to the competition for students’ attention, they also raise the stakes for students and educators by adding to the list of complex skills that students need in order to succeed. In an era of heightened calls for accountability, teachers also face the increasing demand for schools to adopt curricula that integrate assessment with the latest research-based teaching and learning strategies.

This report addresses key issues for recruiting and retaining K–12 mathematics and science teachers, for designing and delivering programs that will place well-prepared instructors in the nation’s K–12 classrooms, and for developing appropriate assessment and evaluation strategies for community college post-baccalaureate teacher education and professional development programs. Its recommendations encourage community college educators to build on their colleges’ strengths as teaching-focused institutions that are committed to lifelong learning and continuing education for professionals and as access points to new skills for career changers.



Insights from K–12 Classroom Teachers

The presence and participation of eight elementary, middle, and secondary public school teachers grounded the Teaching by Choice conference discussions in real-world classroom experiences. The K–12 attendees were either graduates of community college post-baccalaureate teacher education programs or participants in community college professional development programs. Their candor and willingness to discuss their teaching experiences during an opening facilitated dialog set a positive, productive tone for the conference. The K–12 teachers shared their thoughts and opinions on

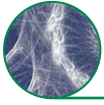
- opportunities and challenges that national trends generate for K–12 teachers of science, technology, and mathematics;
- opportunities and challenges that state and local issues create for K–12 teachers of science, technology, and mathematics; and
- the impact of community college teacher education programs and professional development experiences on classroom practices.

The teachers expressed appreciation for new technologies that make a wide array of materials available for use in their classrooms, including virtual labs in science courses and the multimedia resources that come with many new textbooks. However, not all K–12 teachers have access to, or knowledge of, these new educational technologies. The teachers noted the importance of community college faculty knowing what technology is (or is not) available in local

schools when designing programs for current and future teachers. By opening their labs and classrooms to local school districts, community colleges can offer K–12 teachers and their students access to more advanced technologies. In fact, some of the teachers indicated that they attended community college-sponsored professional development programs to refresh their technology skills and to learn how to assess when and where it is most effective to use technology as a teaching tool.

Although the teachers came from different parts of the United States, they experienced common demands to meet detailed curricula requirements and simultaneously prepare students for high-stakes standardized tests. Despite the depth of curricula, classroom lessons do not always match the material covered in state and federal tests. The K–12 teachers identified a particularly compelling challenge: the hands-on and inquiry-based instruction that researchers find most efficacious for learning math and science simply takes more time due to its emphasis on student-driven exploration and investigation.

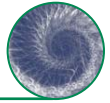
Praising their community college experiences, the teachers reported that their best preparation for teaching came from courses where the learning outcomes were clearly identified. They also appreciated post-baccalaureate and professional development program instructors who modeled the same effective pedagogies they advised teachers to use in K–12 classrooms. After the opening dialog, conference participants reflected on the ways in which the remarks of the K–12 teachers might inform their own post-baccalaureate teacher education or professional development programs.



The conference participants reached consensus on several issues and recommended that community colleges

- begin teacher education and professional development programs with student outcomes clearly stated in order to build the skills of current and future teachers in creating lesson plans and activities that focus on outcomes for their students;
- model hands-on, inquiry-based teaching methods in professional development and post-baccalaureate programs;
- offer professional development workshops in multiple venues, at various times, and in a sequence that grants continuing education units, academic credits, or stipends based on attendance or completion of specific activities such as the development of lesson plans;
- offer content-specific professional development in ways that blend classroom management, pedagogy, and strategies for motivating students;
- develop online professional development programs that incorporate some face-to-face instruction and teamwork; and,
- know which technologies local school districts have available and prepare teachers to use them.

Using the K–12 teachers’ remarks as a starting point, the TBC participants worked in small groups to brainstorm recommendations for community college post-baccalaureate teacher education and professional development programs, specifically addressing recruitment and participation, program design and delivery, and assessment and improvement. A series of questions, developed by the conference coordinating committee, guided the discussions and helped the conferees reach consensus across all topic areas. The recommendations, as well as the questions that provided the framework for the discussions, are examined in the following sections of this book.



Community College Post-Baccalaureate Teacher Education Programs

Framework for Discussion

How can community college post-baccalaureate programs increase recruitment of a diverse cadre of future K–12 teachers with degrees and work experience in STEM fields? What are the critical program design components of an effective post-baccalaureate STEM teacher education program? What are the critical program delivery components of an effective post-baccalaureate STEM teacher education program? What are the outcomes of a successful post-baccalaureate program for future K–12 STEM teachers? How do post-baccalaureate programs systematically assess these outcomes? How are assessment results used to improve post-baccalaureate programs?

Community college post-baccalaureate programs are an effective approach for boosting the nation’s teaching ranks with mid-career professionals and retirees whose first careers in STEM fields enrich their teaching of elementary, middle, and high school students. The cost-effectiveness of community college tuition and the colleges’ geography provide particular incentives for career switchers. These features can be strong assets in a post-baccalaureate teacher education program recruitment plan. Community colleges can capitalize on their proximity to diverse neighborhoods and rural communities, which are often most in need of teachers, to recruit retirees or career switchers from downsizing industries, as well as from community organizations with which faculty and staff already interact. The TBC conference participants suggested that community colleges partner with local school districts to recruit future

Recommendations for Increasing Diverse Applicant Pools

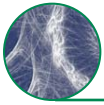
- Utilize community organizations and activities that serve diverse cultures in outreach efforts.
- Create opportunities for peer-to-peer recruiting where career switchers can meet mid-career professionals who are considering a new career in teaching.
- Develop partnerships with professional organizations and STEM discipline societies.
- Recruit prospective teachers from business, community organizations, and parents of local K–12 school students.

Recommendations for Program Design and Delivery

- Model collaborative, hands-on, and inquiry-based teaching practices in all teacher education courses.
- Offer early, structured, and extensive field experiences in local K–12 schools.
- Build content-specific resources such as “toolkits” for teachers to use in classrooms.
- Focus on pedagogy, particularly strategies that help STEM professionals translate their deep content knowledge into lessons for K–12 students.
- Inform mid-career professionals about the nuances of school cultures and provide them with strategies for dealing with multiple management layers and school procedures.
- Add in-person instruction to online courses to foster communities of practice and peer support networks.

Recommendations for Assessment and Improvement of Post-Baccalaureate Programs

- Survey post-baccalaureate program completers, their mentors, and employers periodically.
- Track the licensure exam passage rate of post-baccalaureate program completers.
- Monitor retention rates of post-baccalaureate teacher education program completers.
- Modify the post-baccalaureate program curriculum and completion requirements based on assessment results.



NEW PATHWAYS TO TEACHING IN NEW JERSEY (NPTNJ)

Mid-career professionals enrolled in the NPTNJ post-baccalaureate teacher education program have the benefit of an experienced community college educator observing their teaching and providing constructive advice. The in-class observation is an important extension of the courses that the novice teachers attend as a cohort once or twice each week during their first year of teaching.

Fifteen New Jersey community colleges participate in the NPTNJ partnership with New Jersey City University, the New Jersey Department of Education, and the local school districts. New Pathways students have the option of taking the program for graduate credit that several New Jersey universities accept toward master's degrees.

An attentive approach to the practical aspects of teaching begins even before the NPTNJ students—who all have bachelor's degrees and passing scores on the Praxis II exam for content knowledge—begin teaching. The first stage of the program requires that students complete a 60-hour pre-service component to help them gain insights about teaching as they learn classroom management and pedagogical skills.

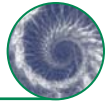
As many as 400 NPTNJ students will embark on their first year of teaching in 2008. Since the program began in 2003, more than 3,000 individuals have completed the pre-service component, and more than 2,000 people have completed the one-year teaching experience.

For more information, see
<http://web.njcu.edu/sites/nptnj/Content/default.asp>.

teachers from among the parents of school children. As one participant pointed out, parents who have stayed at home to rear young children often are looking for new and different career challenges when their youngsters begin attending school full time.

Structuring post-baccalaureate programs to meet the scheduling needs of various groups of mid-career professionals can make a huge difference in whether an individual decides to pursue a career in teaching. Stay-at-home parents looking for a new career may need courses that coincide with their children's school schedule. Business people may want compressed programs offered in the evenings or on weekends, while those transitioning from military and government work may prefer full-day, full-week courses.

As institutions that have long served both older adult students and traditional college-age students, community colleges have the flexibility to adjust their teacher education programs to meet the needs of mid-career professionals. Adults with years of career experience are accustomed to multitasking, digesting complex information quickly, and getting things done in competitive markets. Typically, once mid-career professionals or retirees have made the decision to teach, they are eager to get the credentials and experience they need to work in classrooms. Post-baccalaureate programs that include early, extensive field experiences capitalize on this enthusiasm and give the novice teachers the opportunity to test their teaching skills with the support of mentors from the community college and K–12 arenas. The proximity of community colleges to where novice teachers live and work makes ongoing mentoring feasible.



Helping career switchers move successfully from retirement, business, military, or government careers requires extra attention from community college faculty who lead post-baccalaureate programs. Explicit information about school cultures and how they differ from business environments should be woven into programs. While teachers have some autonomy in their classrooms, some career switchers will need to be prepared to deal with the challenges of navigating multiple layers of authority—the school board, principal, department chair, and taxpayers—and multiple constituencies—the students and their parents and guardians.

Post-baccalaureate programs must also provide their future teachers with practical tactics for motivating students and managing a classroom. From their work in teaching-centered institutions, community college faculty members possess classroom management skills and know how to break complex concepts into segments that students can absorb and understand. Content-specific toolkits filled with best practices that meet national standards are essential resources that community colleges can provide to help their newly certified teachers start well.

Obtaining accurate data about the teaching experiences of post-baccalaureate teacher education program graduates and their K–12 students' performance is essential for continuous improvement of these programs. Students can be key players in this improvement process. Conference participants urged community colleges to track the career switcher students to determine the effectiveness of their programs and analyze the results. Post-baccalaureate programs establish strong relationships with their students and can capitalize on these relationships to track their students' success. Ongoing contact with program graduates and their employers can help assess the program and respond to school and community needs.

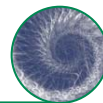
VIRGINIA COMMUNITY COLLEGE SYSTEM CAREER SWITCHERS PROGRAM

The Virginia Community College System's Career Switchers post-baccalaureate teacher education program delivers instruction statewide using compressed video for real-time teleconferences at six campuses, online assignments, interactive student dialogs, a 30-hour field placement, and one daylong meeting during which the students work in large and small groups.

This blending of distance and face-to-face instruction with in-school experience makes for an intense 16 weeks of teacher education. The prospective middle school and high school teachers, whose average age is 43, also must pass a Praxis II exam for the content areas in which they hope to teach. All the Career Switcher program participants already have bachelor's degrees and at least five years of full-time experience in another career; many previously worked as engineers or served in the military.

Experienced K–12 teachers are mentors as well as colleagues for the Career Switchers during their first year of teaching with a provisional license. They also stay in contact with their Career Switcher cohort and instructors by attending five seminars and sharing assignments monthly. More than 80 percent of the 202 Career Switchers who completed their first year of teaching obtained a five-year teaching license by 2007. During the 2007–2008 academic year, 135 students completed the 16-week semester.

For more information see <http://www.educateva.com>.



Community College Professional Development Programs in K-12 STEM Education

Framework for Discussion

How can community colleges recruit current K–12 teachers to participate in professional development opportunities in STEM disciplines? What are the critical program design components of an effective professional development program in K–12 STEM education? What are the critical program delivery components of an effective professional development program in K–12 STEM education? What are the outcomes of a successful professional development program in K–12 STEM education? How do community colleges systematically assess STEM teacher professional development outcomes? How are assessment results used to improve professional development programs?

Professional development programs offer opportunities for K–12 teachers to reflect on their current teaching methods and acquire new knowledge and strategies that they can apply in their classrooms.

Conference participants encouraged community colleges to create professional development programs that integrate STEM content with pedagogy. It is one thing to understand a concept theoretically and quite another to be able to teach it to a young child or teenager. Teachers want practical applications; they need them to engage students and to teach them to understand and apply new concepts. As one community college faculty participant explained, when he was a high school teacher he considered professional development workshops and conferences successful “if I [had] one new thing to take and put in my classroom on Monday.”

Recommendations to Encourage Participation in K–12 STEM Professional Development Programs at Community Colleges

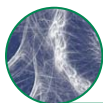
- Create programs rich in mathematics and science content and classroom applications.
- Partner with local school districts to use local and federal funds to support programs.
- Establish professional development networks with school districts, community colleges, and four-year colleges and universities to design, implement, and advertise opportunities.
- Provide stipends, academic credits, continuing education units, and other incentives to teachers.

Recommendations for Program Design and Delivery

- Align programs with state and national curriculum standards for math and science.
- Supply classroom materials and demonstrate strategies for teachers to use immediately with students.
- Include cross-curricular activities that integrate mathematics skills and concepts into science courses, and science topics into mathematics instruction.
- Deliver programs in formats and at times and locations that are convenient for teachers.

Recommendations for Assessment and Improvement of Professional Development Programs

- Assess pedagogy and content needs of K–12 teachers regularly.
- Follow up with participants to determine the usefulness and applicability of their new knowledge and teaching strategies.
- Design collaborative assessments with local school districts to collect and analyze student performance data before and after their teachers participated in the professional development program.
- Establish advisory committees to evaluate assessment results and make recommendations for future programming.



COMMUNICATION IN SCIENCE INQUIRY PROJECT (CISIP)

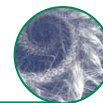
CISIP cultivates the development of “science discourse communities” in middle and high school English and science courses. This professional development program offered by the Maricopa Community Colleges in Arizona introduces its cross-discipline methods to teams of K–12 teachers during a three-week summer institute. CISIP reinforces ways to use inquiry-based lessons effectively to boost student science knowledge and writing skills with Saturday programs during the school year.

With support from the National Science Foundation, CISIP designs and delivers its research-based curriculum using a team of master teachers from secondary schools, community colleges, and universities. The project aims to partner with math and science organizations in other states to broaden dissemination efforts to begin in 2009.

For more information see
<http://www.maricopa.edu/academic/teachered/CISIP.html>.

Conference participants urged community colleges to create their professional development programs with state standards in mind. They also recommended that community colleges systematically follow up with their program attendees to assess the impact of the teachers’ learning on student performance. When structuring professional development programs, the conference participants urged community colleges to design standards-based programs that incorporate promising practices identified by national organizations such as the American Mathematical Association of Two-Year Colleges, National Council of Teachers of Mathematics, the National Science Teachers Association, and the Association for Supervision and Curriculum Development. National Science Foundation-supported programs, like those the agency funds through the Advanced Technological Education program, are also valuable resources for innovative curricula and teaching materials that are available to U.S. educators free of charge. (See <http://www.nsf.gov/ate> and <http://www.aacc.nche.edu/ateprogram>.)

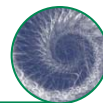
Close collaboration between community colleges and local school systems generates substantial benefits for students, parents, teachers, and the community. Broadening these partnerships to include state education departments, four-year colleges and universities, and area businesses can provide additional resources as school districts identify gaps in student learning that teachers can address with the aid of targeted professional development provided by community colleges. By offering content-specific professional development programs, community colleges can truly help districts that need to enhance student performance in particular



subjects. The proximity of community colleges to local schools in most communities makes it easy for them to deliver programming when and where school districts need it to fit teachers' busy schedules. This geographic accessibility of community colleges also favors online, hybrid delivery of professional development programs. This blending of asynchronous and in-person instruction helps teachers who prefer the flexibility of online courses to gain the added benefit of periodic meetings with faculty instructors and teacher colleagues who are pursuing similar professional goals. Such face-to-face meetings help build a community of practice among teachers who can stay connected online even after their courses end.

Whether community colleges offer professional development on their campuses or take their programs to teachers in their schools, these programs are opportunities for community college faculty to share their expertise in STEM disciplines and to make the campus facilities and academic resources, such as lab equipment and other educational materials, available to the K-12 teachers. With standardized tests built into the accountability measures of the No Child Left Behind Act of 2001 and state benchmarks, community colleges can provide a service to local school districts simply by offering professional development programs that educate teachers about strategies that can assist their students in taking standardized tests.

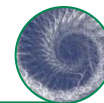
The TBC conference participants saw these K-12 professional development programs as a venue for community colleges to share from their strengths to meet the national need for exemplary STEM instruction.



Conclusion

Community colleges across the United States are reinventing and redefining pathways for K-12 teacher education and professional development. The recommendations that emerged from the “Teaching by Choice: Beyond 2+2” conference encouraged community colleges to maintain this trend toward innovation. Participants renewed the call for community colleges to take the lead in providing STEM experiences for current and future K-12 teachers and to demonstrate research-based teaching methodologies. To strengthen such experiences, the conference participants encouraged community colleges to partner with K-12 schools, four-year colleges and universities, and local STEM businesses and industries to share resources as well as ideas.

Conferees also emphasized the need for greater acceptance of systematic formative assessment to improve and expand community college post-baccalaureate teacher education and professional development programs. By integrating assessment measures into program design, community colleges can demonstrate their commitment to offering high-quality programs that address the needs of their students, the local K-12 schools, and the larger community.



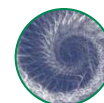
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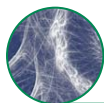
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