TEACHING BY CHOICE:
Cultivating Exemplary Community College STEM Faculty
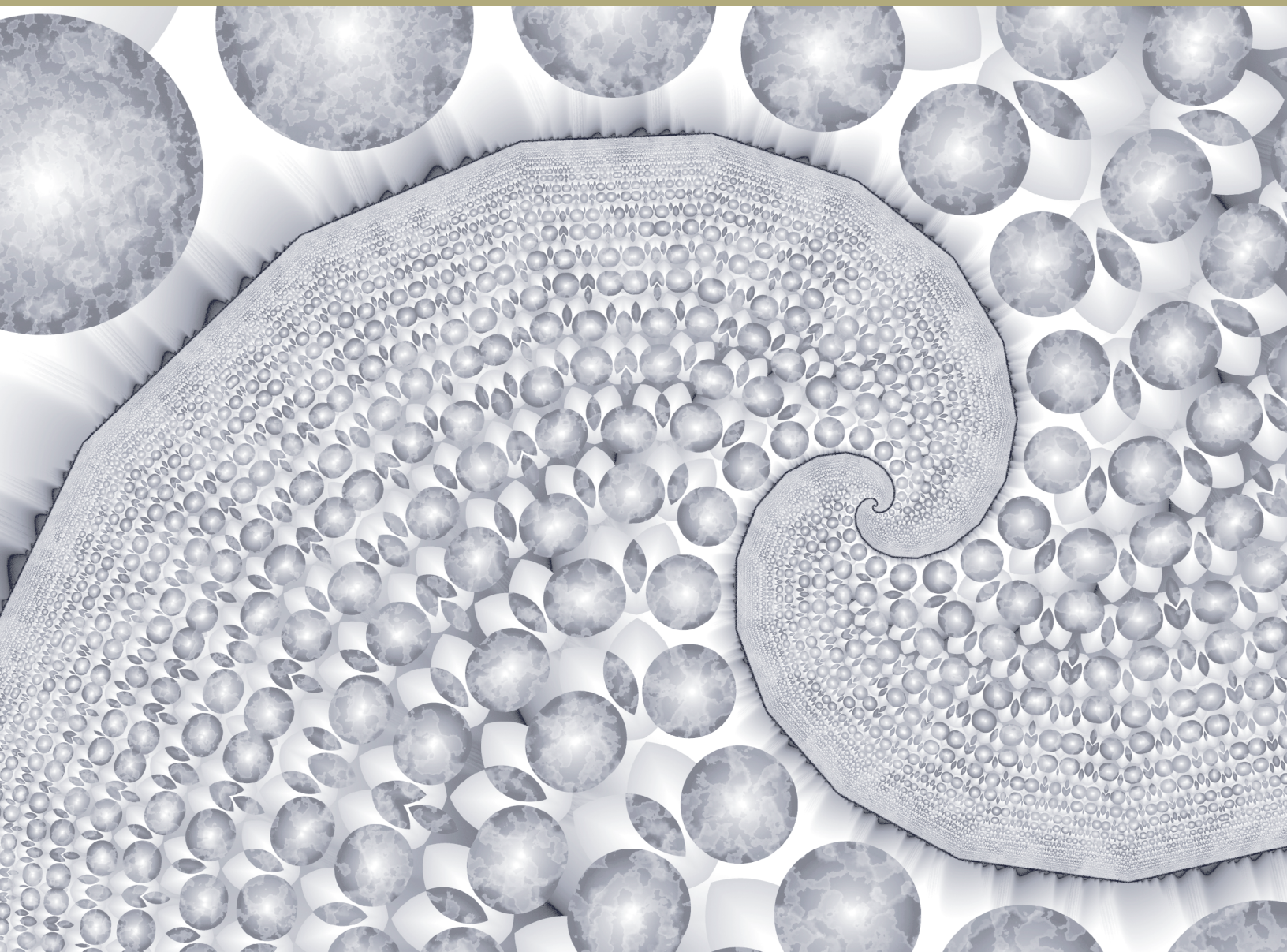
SCIENCE • TECHNOLOGY • ENGINEERING • MATHEMATICS

Edited by Lynn Barnett and Faith San Felice

Text by Madeline Patton

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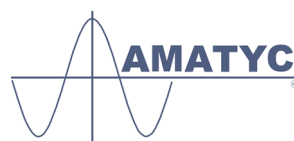## Cultivating Exemplary Community College STEM Faculty

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The flattening global economy and its potential threat to America's standard of living have recently stimulated public discourse and policy initiatives concerning the nation's science, technology, engineering, and mathematics (STEM) competitiveness. At the same time, American student interest and competence in STEM fields is declining compared to other industrialized nations. We live in a world where STEM expertise is becoming increasingly important not just at the highest levels but across a wide swath of industries and job titles. Community colleges, "can do" institutions committed to problem solving, are leading innovative efforts that involve industry, business, and other education sectors to resolve the complex challenges of educating and training STEM students in the United States.

One of the critical factors affecting the community college role in STEM education is the recruitment and development of community college STEM faculty. Community colleges face enormous challenges as they strive to find and retain qualified educators in the high-demand STEM fields. Helping faculty members keep up with the rapid pace of changing technologies is also needed to maintain our nation's competitiveness.

This report is the result of a national conference convened in December 2005 by the American Association of Community Colleges in partnership with the American Mathematical Association of Two-Year Colleges (AMATYC) and supported by the National Science Foundation (NSF). This event, the Teaching by Choice Leadership Summit on Community College Faculty, examined the challenges and opportunities related to recruiting, retaining, and developing exceptional STEM faculty in community colleges. The recommendations presented here should be useful for college faculty and administrators, business leaders, and policymakers in all sectors concerned about the nation's competitiveness.

We are grateful for our partner, AMATYC, and for the continuing support of the National Science Foundation.

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

C O N T E N T S

1

Community colleges value faculty and the scholarship they bring to their teaching. Assembling exemplary, diverse faculty in all disciplines is an ongoing process at community colleges. In the near future, however, retirements, growing enrollments, and other factors will add to the challenge of hiring and retaining faculty.

Demographic changes are at the core of several of the challenges. Many community college faculty members are reaching retirement age as enrollments increase with children of baby boomers becoming young adults. Nontraditional students also continue to advance their learning at community colleges. Fiscal constraints may also limit community colleges' abilities to compete with other employers for individuals with the specialized knowledge and competencies necessary to teach. The competition for faculty is expected to be especially acute in the science, technology, engineering, and math (STEM) fields where many employers seek knowledgeable workers with the expertise that community college faculty use in their teaching.

Nationally, 56 percent of 112,000 full-time faculty members and 47 percent of 221,000 part-time or adjunct instructors plan to retire in the next 10 to 15 years (Cataldi, Fahimi, & Bradburn, 2005). Forty-three percent of full-time STEM faculty and 49 percent of part-time STEM faculty are 55 years of age or older (Cataldi et al., 2005). The aging trend carries over, though to a slightly lesser degree,

to the general science and engineering (S&E) labor force. "In 2003, 13 percent of S&E bachelor's degree holders, 20 percent of master's degree holders, and 28 percent of doctorate holders were 55 years old or older" (National Science Board, 2006b). S&E enrollments have increased in recent years, but the anticipated wave of community college faculty retirements comes at a time when individuals with the potential to teach science, technology, engineering, and mathematics are in demand by businesses, industries, and other education sectors that offer higher salaries.

> **"THE BIG RESPONSIBILITY IS TO TEACH THE NATURE OF SCIENCE TO FUTURE SCIENTISTS AND ALSO TO STUDENTS WHO WILL NOT BE SCIENTISTS, BUT WHO WILL NEED TO FUNCTION IN THE WORLD WITH SCIENCE."**
>
> Liz Dorland, Co-Principal Investigator, *National Community College Conversation: What Does It Mean To Be Educated in the 21st Century?* (personal communication, December 13, 2005)

The recruitment and retention of STEM faculty at community colleges is a concern because of the important role these educators play across the curriculum, including those in disciplines that may not at first seem related to science or math. Community colleges educate 11.6 million students each year, which represents 45 percent of all the undergraduates in the United States (American Association of Community Colleges, 2006). The infusion of technology in nearly every aspect of Americans' work and personal lives makes the understanding of basic math and science concepts as essential as language fluency.

Community colleges are the major source of technician education in the United States. The faculty who teach in community college certificate and associate degree programs for technicians make an impact that stretches from local manufacturers to the nation's cyber infrastructure. Nearly 40 percent of
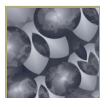
elementary and secondary teachers begin their postsecondary studies in community colleges (Shkodriani, 2004), which means community college faculty provide the math and science that tens of thousands of teachers pass on to students in their classrooms. Community colleges help directly educate the nation's scientists and engineers too. On average, 44 percent of recent S&E graduates attended community colleges at some point in their academic career (Tsapogas, 2004).

With historically strong enrollments of women and underrepresented minorities, community colleges could play a pivotal role in attracting larger proportions of these populations to STEM fields. As a resource for people seeking everything from remedial education to core courses in baccalaureate degree transfer programs, community colleges already influence many of the fields directly tied to the increased competition of the global marketplace.

In *America's Pressing Challenge – Building a Stronger Foundation*, the National Science Foundation makes the case that America's "competitive edge … its strength and versatility, all depend on an educational system capable of producing young people and productive citizens who are well prepared in science and mathematics" (National Science Board, 2006a, p. 6). This report points out the need for all citizens to be able "to think critically or make informed decisions based on technical and scientific informa-tion" (National Science Board, p. 6), and calls for drastic improvements in science and mathematics education from kindergarten through college. It also argues that, "a grasp of academic language [is] necessary to advance into STEM careers and produce the innovation and discovery necessary to maintain our nation's prosperity in the future" (National Science Board, p. 6).

Recognizing the community college role in math and science education and the potential problems that faculty shortages could create, the American Association of Community Colleges (AACC), in partnership with the American Mathematical Association of Two-Year Colleges (AMATYC), convened the *Teaching by Choice Leadership Summit on Community College Faculty*, with support from the National Science Foundation, in Washington, DC, December 12–14, 2005. The goal of the summit was to identify successful strategies for recruiting, retaining, and developing exemplary, diverse community college faculty in science, technology, engineering, and mathematics.

"We can look at this as both a challenge and an opportunity," AACC President and CEO George R. Boggs (2005) said, during his keynote address at the summit. He continued:

> It is a challenge in many ways because we have to make sure that we adequately prepare faculty who care about what we do in a community college: teaching and learning, and focusing on student success. And then, of course, we need to attract them to the community college. So, that is the challenge ahead of us. But it also is a great opportunity for us: an opportunity to bring greater diversity into community colleges, new energy, and enthusiasm.

A steering committee guided the summit planning and developed a seven-question survey to identify key issues surrounding the recruitment, retention, and development of community college STEM faculty. Survey responses were distributed to all participants. Six discussion areas emerged from the responses, specifically recruitment, retention,
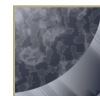
professional development, adjunct faculty, partnerships, and national pathways. These topics were the focus of small and large group discussions during the summit.

The summit began with plenary discussions on the external trends that affect the recruitment, development, and retention of exemplary, diverse community college STEM faculty. The interdisciplinary nature of emerging science and mathematics fields, the growth of high-quality mathematics and science programs in other countries, the more advanced technical skills of students, and a shift toward data-driven decision making were among the leading trends identified. The summit participants also considered the characteristics of exemplary, diverse community college faculty and agreed that STEM faculty must teach problem solving and scientific processes in ways that accommodate the flow of information updates. In other words, STEM faculty should teach students how to think rather than merely how to regurgitate information. Being able to connect science and math to other disciplines was also identified as a key characteristic of STEM faculty.

Participants spent most of the summit working in small groups preparing responses to questions developed by the steering committee. The small groups shared their priority responses with all the summit participants. Small group responses were

> "**THE CORPORATE SECTOR VIEWS THE POTENTIAL SHORTAGE OF KNOWLEDGE WORKERS AS A NATIONAL EMERGENCY, AND MANY BELIEVE WE ARE LOSING OUR 'COMPETITIVE EDGE.' YET THE RESPONSE FROM HIGHER EDUCATION IS SLOW AND POSSIBLY IMPERCEPTIBLE TO THOSE OUTSIDE THE SYSTEM. ISOLATED, EPISODIC, OR INCREMENTAL CHANGES ARE INSUFFICIENT."**
>
> *From the conclusions and recommendations of The National Community College Conversation: What Does It Mean to Be Educated in the 21st Century?*

reached by consensus, creating the basis for the fuller recommendations contained in this report.

Many of the suggestions made by the different groups were remarkably similar, such as a desire for national marketing to promote community colleges as attractive workplaces for full- and part-time faculty. Several groups advocated for advertising and recruiting that would target underrepresented minorities and other special populations. The summit participants expressed the need for national collaborations with professional societies that would encourage STEM graduate students and professionals to teach at community colleges. Widespread agreement surfaced about the usefulness of more and better data that could facilitate community college faculty recruitment and retention. Summit participants also endorsed efforts to link the pedagogical practices of community college faculty to educational research and current challenges facing the colleges.

With the vast expansion of science and technology in the 21st century, community colleges could play an even larger role in math and science education. In order for them to be of the greatest use to the nation and its citizens, it is critical for community colleges to make the most of this opportunity by addressing the needs of faculty members, particularly those of STEM faculty.

2

What are the characteristics of exemplary community college faculty, particularly in STEM fields?

Community college faculty, much like their students, do not fit easily into categories. Faculty have the requisite academic credentials necessary to teach in their respective disciplines: master's degrees or doctoral degrees. But community college faculty do not necessarily follow rigid career steps on their way to the fronts of classrooms. As community colleges cast an even wider net to fill vacancies left by retiring faculty, it is appropriate to consider the qualities that distinguish exemplary community college faculty. What are the characteristics that search committees should look for as they consider applications from increasingly more diverse pools of candidates?

Perhaps the most outstanding common feature is their desire and passion to teach students whose ages range from teens to older adults in open enrollment institutions. Exemplary community college faculty members embrace the challenge of helping people of various ages and cultural backgrounds and with widely disparate educational goals to learn. It is a difficult task that also requires flexibility and creativity. Exemplary faculty members exhibit care, patience, respect, and sensitivity in their interactions with students. They are student centered.

Good communication skills, both written and oral, and proficiency in technologies that assist with student learning are among the basic workplace skills of community college faculty. A willingness to try new methodologies, such as those that use learning communities, service learning, team teaching, or instructional technologies, is essential when dealing with students who are immersed in technology and who have various learning styles.

Community college faculty are expected to have solid backgrounds in their fields, and to model for their students what it means to be lifelong learners. A willingness to keep up with developments in their fields is apparent through their active participation in professional organizations, attendance at relevant conferences, and published writings. They are expected to be content experts who possess the pedagogical skills to guide students in the practical application of theoretical knowledge.

In addition to these expectations, STEM faculty have other responsibilities due to the evolving nature of their fields and the way those fields connect with business and industry. Exemplary STEM faculty have networks of business and industry contacts that keep them informed about innovations and industry trends. They also infuse their classrooms and laboratories with current information and opportunities to solve real-world problems. Exemplary STEM faculty also collaborate with faculty in other disciplines and at other institutions. The interdisciplinary nature of STEM fields puts STEM faculty on the front lines of cross-curriculum initiatives and outreach efforts to other education sectors. Exemplary faculty are those who take on these leadership roles and help colleagues and communities achieve the best possible outcomes.
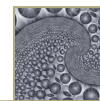
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What kind of teaching and learning environment in STEM disciplines is required to prepare 21st century community college learners for life beyond college?

Creating an appropriate teaching and learning environment for 21st century learners means more than cleverly rearranging desks or using a gadget to project lecture notes. Appropriate teaching tools and supplies are essential. It can be expensive to purchase, maintain, and periodically update high-tech equipment and laboratory supplies for STEM disciplines. Eliminating the artificial distinctions between academic questions and real-world dilemmas carries other costs. Faculty must invest considerable time to plan and monitor hands-on or project-based learning experiences in classrooms, and service learning programs and internships in the community.

But educational materials and an appropriate setting are only part of what makes an environment conducive to teaching and learning. Participants in the *Teaching by Choice Leadership Summit* identified an open attitude by teachers and learners as critically important, too. In their view, optimal teaching and learning environments are places in which faculty and students are free to take risks with learning and where teachers and learners challenge themselves to tackle difficult

> **"Changing workforce requirements mean that new workers will need ever more sophisticated skills in science, mathematics, engineering and technology. Scientific and engineering occupations are expected to continue to grow more rapidly than occupations in general, with a projected 70 percent greater increase by 2012 (26 percent versus 15 percent overall), or 1.25 million additional science and engineering (S&E) jobs. Long-term growth in S&E occupations has far exceeded that of the general work-force—with four times the annual growth rate of all occupations since 1980."**
>
> *(National Science Board, 2006a)*

material. They are places where students can make mistakes without becoming discouraged or turned off to an academic discipline.

The summit participants also agreed that effective teaching and learning environments:

- **Use activities and inquiry-based lessons.** Community colleges should focus on authentic problems, collaborative strategies, and hands-on learning. Students must learn how to use the technologies employed in their fields of interest, as well as learn how to tackle complex real-world projects through collaborative research assignments, internships, or service learning.

- **Incorporate employability skills.** Students should learn the soft skills of communication and teamwork. Every worker is part of a team. Essential skills in the global marketplace include knowing how to work on a team, how to communicate with people from different disciplines and backgrounds, and how to troubleshoot workplace problems.

- **Provide opportunities for further education in STEM fields.** STEM disciplines should be taught with the expectation that all students will move through career lattices requiring additional formal

education to progress. Therefore, learners need theoretical grounding, critical-thinking processes, and hands-on skills.

- **Connect with business and industry.** Students should gain familiarity with the workings of their fields while in college. Today that means having a global perspective and an understanding of entrepreneurial principles and techniques.

- **Mesh across disciplines.** STEM disciplines blend in many ways, and the curriculum taught at community colleges should reflect this interdisciplinary mingling. Students will need to learn how to make connections across disciplines and synthesize new concepts.

- **Employ technology effectively.** Appropriate technology must be used in the classroom and laboratory and, as much as possible, those two learning environments should not be separated.

> "THE RAPID ADVANCES IN TECHNOLOGY IN ALL FIELDS MEAN THAT EVEN THOSE STUDENTS WHO DO NOT PURSUE PROFESSIONAL OCCUPATIONS IN TECHNOLOGICAL FIELDS WILL ALSO REQUIRE SOLID FOUNDATIONS IN SCIENCE AND MATH IN ORDER TO BE PRODUCTIVE AND CAPABLE MEMBERS OF OUR NATION'S SOCIETY."
>
> *(National Science Board, 2006a)*

- **Respond flexibly to students.** Learners come from different academic and cultural backgrounds. This diversity requires community college faculty to understand the various ways students learn and interact and to respond with appropriate teaching methodologies.

Regardless of how problem-solving strategies and multi-disciplinary approaches are used in the classrooms and laboratories, 21st century STEM faculty must actively help students learn scientific processes in ways that accommodate the flow of constantly updated information. Students must understand how to think critically and need to know and apply concepts to different situations. It is a great challenge and awesome responsibility, one that is accomplished most efficiently when the environment facilitates the process.
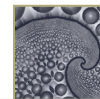
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Framework for Discussion

Where will future community college full-time STEM faculty come from? What creative strategies can community colleges adopt to recruit an exemplary, diverse cadre of full-time STEM faculty? What will community colleges have to do better or differently to attract a wider, more diverse, and exemplary pool of full-time STEM faculty? How can community colleges evaluate the effectiveness of their efforts to recruit exemplary and diverse full-time STEM faculty?

Hiring and retaining faculty starts with recruitment. Efforts to improve recruitment should begin with colleges examining how they market themselves to potential STEM faculty. College leaders should consider what they are doing to reach underrepresented minorities, mid-career workers with relevant experience in industry, military personnel, and members of STEM professional organizations. In addition, college leaders should attend to what can be done to make community colleges attractive workplaces for STEM faculty.

Discussions about recruiting sources for STEM faculty frequently turn to the untapped potential among graduate students, mid-career professionals, and retired people with STEM academic credentials or work experience. Colleges can target recruitment efforts to recent PhD graduates, doctoral students, and individuals with master's degrees in teaching and STEM fields. The community college emphasis on student learning rather than research could provide a refreshing alternative for individuals whose love of learning is apparent in their graduate school enrollment. Community college teaching could similarly appeal to middle-aged alumni and others who are ready for new challenges after many years in a STEM field. Some of these people may be

Recruitment Strategy

About half of the students in a typical cohort of Oregon State University's (OSU) mathematics master's degree program join the faculties of west coast community colleges upon graduation, according to Tom Dick, math professor and director of the Math Learning Center at OSU.

The graduate-level mathematics students gain teaching experience through assistantships teaching freshman and sophomore math courses at OSU, tutoring undergraduates at the Math Learning Center, and as adjunct faculty at a local community college.

Though not a formal community college faculty preparation program, OSU's emphasis on part-nering mathematics with education courses and teaching experiences has been structured for more than 20 years to meet community colleges' needs. "I think it's why we've had really good luck," Dick said of the high rate of student placements (personal communication, April 11, 2006).

young retirees from industry or the military; others may be unemployed white-collar workers. Veterans should not be overlooked as potential community college educators.

Casting a wider net requires that community colleges develop strategies to nurture the instructional skills of individuals who lack teaching experience but who have master's degrees or work experience in STEM fields. Fast-track programs developed on community college campuses or in collaboration with university partners can quickly enhance pedagogy and cross-discipline knowledge. Both will be needed for
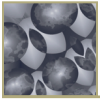
Recruitment Strategy

A multiyear discussion with faculty at The Metropolitan Community Colleges (MCC) in Kansas City, Missouri, about the qualifications necessary to teach at the five-campus urban college resulted in MCC changing some of its hiring procedures and creating a teaching internship program.

MCC screening committees now look for candidates who are best able to teach a particular subject. Applicants are categorized as veteran college-level teachers, bright and talented individuals with initial teaching or other experiences, people with unusual or interesting backgrounds or experiences, or successful MCC adjunct faculty. Applicants from each of the categories are invited to interviews.

MCCs teaching internship program has created an opening in its hiring process to help promising candidates gain the teaching experience they need to compete for full-time openings. Interns are given one-year contracts with full salaries, benefits, and mentoring.

Don Doucette, vice chancellor for education and technology, said the procedural changes immediately made interviews more interesting and eventually added more diversity to the college's faculty (personal communication, April 10, 2006).

newcomers to meet the expectations of accrediting organizations, students, and faculty colleagues. On-campus teaching centers or formal mentoring programs that provide ongoing support to novice instructors may also encourage people to consider community college teaching. Overtures to graduate students are more likely to succeed if community college teaching opportunities are advertised along-side university teaching assistantships. Forgiveness of federal educational loans for multiple years of community college teaching could be a powerful incentive for graduate students and mid-career professionals.

Casting a wider net requires additional financial resources. Setting aside "target-of-opportunity" funds for bonuses or differential pay would help community colleges negotiate with individuals in high-demand or highly specialized fields. Funds may be needed for travel expenses to bring candidates in shortage areas to campus for interviews, and to send college personnel to professional conferences to recruit and interview potential instructors.

Colleges also can take inexpensive approaches to enhance their recruiting efforts. Personal letters informing worthy candidates of faculty openings may require some collective thinking among faculty and administrators but very little money. Job postings can list minimum rather than preferred credentials and experience. Placing positive and upbeat people on the interview team and making sure the team includes appropriate minority representatives can add to a college's appeal. Limiting the involvement of search committees in the evaluation of candidates could help avoid the tendency of committee members to recommend people who are like
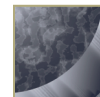
themselves. Allowing time for candidates to tour the campus and to meet students and staff gives potential faculty a clearer understanding of the community that will welcome them. Including information about faculty openings in alumni publications, the college Web site, course schedules, and other college publications are low-cost ways of informing populations who are already emotionally attached to the community college and whose demographics likely mirror the community's.

All community college marketing should convey the institution's commitment to diversity and excellence. College Web sites should be in multiple languages. Employment advertisements should be placed in publications with diverse audiences. College-issued success stories should include a representative sample of the student population.

Community colleges can offer perks and services that make the work environment as attractive as possible to prospective faculty members. These may include workload adjustments, job sharing, childcare benefits, competitive salaries, and flexible benefits. These quality-of-life issues are covered in greater detail in the Retention section of this report.

Community college recruitment and hiring processes would benefit from continuous evaluations to ensure that job descriptions do not mute diversity, and that the hiring procedures are unbiased and expeditious. Closer collaboration between human resources staff and faculty can help the college to navigate legal and accrediting considerations, and to understand cultural differences that could create barriers to building an exemplary, diverse faculty.

RECRUITMENT RECOMMENDATIONS

- Seek STEM faculty from among underrepresented minority groups, graduate students, military veterans and immigrants who already have postsecondary degrees, and professionals working in STEM fields.

- Publicize faculty openings in a variety of media, including those targeted to diverse populations.

- Structure marketing to reflect the embedded value of diversity and excellence at the college.

- Make community colleges attractive to STEM faculty.

- Cultivate STEM faculty among local business and industry partners.

- Explore alternative credentialing for STEM professionals interested in teaching.

5

Framework for Discussion

How can community colleges create highly effective professional development programs to prepare faculty to educate students in the 21st century? How can community colleges facilitate and support professional development for novice and veteran STEM faculty alike? How should community colleges evaluate the quality of professional development programs? How do community colleges evaluate the outcomes of professional development for their faculty?

Professional development should be led by faculty, supported by administrators, and focused on student outcomes. A broad approach, with the active involvement of STEM faculty, works well when planning, determining the content of, and assessing professional development activities. Because STEM fields influence activities in many disciplines, the involvement of STEM faculty in all professional development would help colleges weave STEM information and advancement across the curriculum. This integration should improve students' understanding of STEM skills and knowledge in their chosen fields; the collaborative approach promotes a college culture that values professional development and encourages faculty participation. Professional development is even more effective when aligned with the college's mission and strategic plan.

Some colleges have found that on-campus teaching and learning centers bring attention to the importance of professional development activities, and help

> "EDUCATORS NEED EFFECTIVE STRATEGIES AND INSTRUCTIONAL MATERIALS WHICH WILL REACH THIS NATION'S GROWING ENGLISH LANGUAGE LEARNERS POPULATION IN ORDER TO PROVIDE OPPORTUNITIES FOR ALL STUDENTS TO DEVELOP THEIR MATHEMATICAL AND SCIENTIFIC SKILLS TO THE LIMITS OF THEIR ABILITIES."
>
> *(National Science Board, 2006a)*

structure professional development endeavors whether they occur on or off campus. Placing the learning center under the auspices of the college's chief academic officer or vice president of instruction can underscore the value and prominence of ongoing professional development activities. If possible, a full-time faculty member with a background in professional development should lead such centers. It is important that teaching and learning centers provide safe spaces for faculty to acknowledge weaknesses, acquire new pedagogical skills, and learn to teach beyond their comfort zones.

Whether or not colleges have actual teaching and learning centers, community college leaders can do much to facilitate a culture that values professional development. Recognizing faculty achievements, providing time and money for professional development activities, and streamlining the process of approving professional development requests are basic tactics for encouraging faculty to extend themselves professionally. Offering training in grant writing can encourage faculty to write grant proposals that can bring money and prestige to colleges and individuals. Disseminating information about what faculty members learned during their professional development experiences–using newsletters, trip reports, Web pages, and presentations–helps spread new knowledge among various constituencies and may spur others to engage in professional development activities.
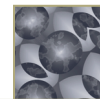
Professional Development Strategy

Hands-on work with rockets and composite materials, as well as tours of aeronautical entrepreneurs' facilities inspire and inform the adjunct and full-time faculty who participate in the workshops offered by SpaceTEC, the National Aerospace Technical Education Center. SpaceTEC was created with a National Science Foundation Advanced Technological Education grant to Brevard Community College (BCC) in Cocoa, Florida. Thirteen community colleges and one university are SpaceTEC partners. The grant funding supports professional development opportunities, which are open to faculty from across the nation. The rocket workshop was hosted by BCC at its Spaceport Center, located at the Kennedy Space Center in Florida (A. Koller and F. Margiotta, personal communication, May 17, 2006).

Informal "brown bag" lunch discussions and formal lectures can advance a collegial spirit of learning. A college can demonstrate its desire to be an inclusive learning community by opening faculty presentations to the entire community. This low-cost tactic may also encourage students and other stakeholders to consider academic careers.

Ideally, every faculty member–novice and experienced, adjunct and full-time–will have individual professional development plans that are updated annually with their supervisors. These plans should reflect the needs of students, the college, and the individual faculty members. They should also accommodate the different needs of novice and veteran faculty members. For instance, mentoring by experienced faculty can help new faculty develop the modes of inquiry and multitasking skills necessary to sustain their careers. Externships affirm and rejuvenate veterans.

Professional development should be regularly evaluated for relevancy and effectiveness. To accomplish this task, assessments of professional development activities should move beyond the typical quantification of workshops and participants to student outcomes. Verbal and written reports from faculty about their professional development experiences along with student retention rates and student course evaluations, serve as outcome measures for professional development.

Vision and support from the top down–from professional organizations at the national level and from the president, deans, and trustees at the college level–are essential for professional development to weather the increasingly frequent cycle of budget cuts. Reimbursements for travel to professional

conferences are typically among the first items cut when budgets get tight, but administrators should find ways to support this kind of travel if professional development is truly a priority. Professional meetings are critical for faculty, particularly those in fast-changing STEM fields. Funding for professional development from any source is greatly needed.

PROFESSIONAL DEVELOPMENT RECOMMENDATIONS

- Involve STEM faculty in the development and assessment of professional development programs.

- Create or enhance centers for teaching and learning with faculty input.

- Fund travel expenses for full- and part-time faculty to attend professional conferences.

- Employ substitute instructors to cover classes while faculty members attend professional conferences.

- Develop individualized professional development plans for all faculty, and update the plans annually.

- Acquire more public financial support for professional development.

Professional Development Strategy

Experienced faculty share their insights with novice educators at the College of Lake County's New Faculty Institute. Since 1998, the college in Grayslake, Illinois, has offered the institute as a week-long orientation program each August. Weekly three-hour seminars continue through the fall semester to facilitate the new instructors' learning from veteran faculty. The seminars are grounded in educational theory, rooted in practice, and enhanced by open dialogue. The resulting structured academic acculturation experience sets the standards for academic expectations while explaining the community college mission and fostering collegiality (Murphy & Pollard, 2006).
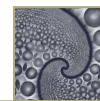
6

Framework for Discussion

How can community colleges create a culture that sustains high retention rates of exemplary, diverse, full-time STEM faculty? What expectations should community colleges have of full-time STEM faculty regarding teaching, service, and scholarship? How can community colleges help faculty to exceed those expectations? What specific policies (i.e., working environment issues) should community colleges institute to enhance the retention of exemplary, diverse, full-time STEM faculty? How should community colleges evaluate their effectiveness in retaining STEM faculty?

Discussions about how to retain exemplary, diverse STEM faculty may assume the prospects for success are enhanced when the general campus atmosphere as well as the working environment–shaped by policies and programs–supports the entire spectrum of teaching, service, and scholarship.

A team approach is needed to create a collegewide culture that retains exemplary, diverse faculty. Such a culture respects all faculty, recognizes their achievements, and involves them in curriculum decisions. Efforts should be made to bring the faculty together in discipline-neutral settings, and to encourage, plan, and support collaborative ideas across disciplines. Administrative support would make available up-to-date learning resources, offer professional development opportunities, and provide release time for externships and other professional development experiences. A team approach recognizes that a dynamic teaching environment is one in which students, faculty, and administrators continuously learn from one another.

Creating a collaborative culture begins with college stakeholders stepping back and examining the current environment, focusing on the implicit and explicit expectations and requirements of faculty. Evaluative information should be gathered and used to develop programs and policies. Open communication and thoughtful consideration of suggestions, as well as attentive responses to suggestions, are essential to a genuinely collegial environment.

An individual making a decision about whether to continue teaching at a community college often considers actions as well as words. Verbal support from administrators should be obvious in a faculty member's workday experiences. For example, ongoing acquisition and replacement of equipment shows, particularly in equipment-intense STEM fields, the college's commitment to providing the tools necessary to teach. Colleges committed to diversity should make efforts to solicit a diverse applicant pool when seeking to hire new employees, including faculty. Well-run orientation programs can help make new faculty feel welcome, as well as help them adjust to their new setting. Regular, efficient departmental meetings build collegiality and give faculty a sense of belonging to an organization that values their input. A reward system that provides merit pay or some other acknowledgement of faculty members' innovative ideas or improvements in student outcomes, such as job placement or transfer rates, could persuade faculty to continue teaching at a community college.

Clearly stating expectations minimizes misunderstandings among new and veteran faculty. Baseline expectations should include currency in one's discipline, fluency with relevant technologies, collaboration within one's department and across disciplines, creative teaching, openness to change that will
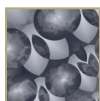
improve student success, and engagement in campus and community activities.

To exceed these expectations, community college faculty may need additional support. For STEM faculty, this could take the form of support for additional lab technicians to assist with the time-consuming process of managing laboratories and equipment. All faculty members could benefit from formal mentoring or leadership development programs. STEM faculty should seek leadership positions as a way to bring attention to the distinct needs of STEM educators and students, and to underscore and highlight the interconnectedness of STEM fields. For those seeking tenure, a peer support system can be helpful when it guides faculty in ways to shore up weaknesses and build on strengths. Formal and informal recognition of faculty generates goodwill (e.g. something as simple as a note thanking a faculty member for submitting a grant proposal or volunteering for a committee). Though potentially problematic, merit or differential pay may be necessary to retain STEM faculty and other faculty in high-demand fields.

Colleges should carefully analyze the effectiveness of their efforts to retain faculty. The number of full-time faculty who choose to continue teaching is a readily available measure. Valuable quantitative and qualitative data can also be gathered from evaluations completed by students at the end of courses, exit interviews with outgoing faculty, and feedback from four-year institutions and students' employers. Standardizing a process for gathering and using a variety of data would advance efforts to recruit and retain an exemplary, diverse faculty.

RETENTION RECOMMENDATIONS

- Use a team approach to create a collegial workplace.

- Nurture an environment that supports scholarly activities within and across disciplines.

- Examine the college's culture, expectations, and requirements for STEM faculty.

- Gather evaluative information from all stakeholders.

- Use evaluation findings to improve policies and practices to meet the unique needs of STEM faculty.

- Develop policies that ensure ongoing acquisition and replacement of equipment.

- Provide access to professional development.

- Encourage STEM professionals to become community college leaders.

7

Framework for Discussion

What creative strategies can community colleges adopt to recruit an exemplary, diverse cadre of adjunct STEM faculty? How can community colleges facilitate and support professional development for both novice and veteran adjunct STEM faculty? How can community colleges support and retain exemplary, diverse adjunct STEM faculty? How can community colleges assess the effectiveness of their efforts to recruit, develop, and retain adjunct STEM faculty?

Two-thirds of all community college faculty members are adjunct faculty or part-time instructors who teach approximately 45 percent of the courses (NCES, 2006). They typically teach a course or two per semester, and in metropolitan areas, some teach at more than one college. While it would be nice if more full-time faculty could be hired to handle the advising and curriculum responsibilities that typically accompany full-time status (and some adjuncts would welcome the opportunity to teach full-time), massive growth in the full-time ranks is not anticipated. The demographics of aging faculty and increased enrollments, and the unpredictability of public funding, are simply not expected to change soon.

Given these realities, the Teaching by Choice Leadership Summit participants suggested that colleges more fully engage their adjuncts. The hiring-by-course approach–and expectations that adjuncts will be on campus only while teaching–means that adjuncts usually have little contact with

> "**PART-TIME FACULTY NEED TO BE FULLY INTEGRATED INTO THE CULTURE AND LIFE OF THE COLLEGE AND GIVEN APPROPRIATE OPPORTUNITIES FOR PROFESSIONAL DEVELOPMENT. FAR FROM SECOND-CLASS CITIZENS, ADJUNCT FACULTY IN COMMUNITY COLLEGES SHOULD BE VALUED AND APPRECIATED AS PROFESSIONAL COLLEAGUES.**"
>
> *(Wallin, 2005)*

full-time faculty or others affiliated with the college except their students. This disconnect is not in the best interest of students or the college. The part-time status of adjunct faculty helps colleges with personnel costs and scheduling, but adjuncts offer more than a budgeting strategy. They teach millions of community college students each year, and their needs are too often overlooked. Adjuncts, particularly those in STEM fields, bring valuable subject expertise and work experiences to their classroom instruction. Recognition of adjuncts' strengths and initiatives to improve their pedagogy and connections with colleagues, both full- and part-time, would benefit the entire educational enterprise. Community colleges need to develop more explicit strategies to recruit, develop, and retain adjunct faculty.

Recruitment

Community colleges should use the full array of traditional methods to advertise openings, such as classified ads, Web site notices, and announcements to professional organizations and public employment service bureaus. To recruit a diverse cadre of adjunct STEM faculty, college administrators and faculty should stretch further and recruit through their professional and community networks, including business and industry advisory boards, local professional societies, other community colleges, and nearby public school districts.

Adjunct Faculty Recruitment and Retention Strategies

Indian River Community College in Fort Pierce, Florida, makes a concerted effort to include adjunct faculty as full members of the college's professional community. Part-time instructors are welcome to participate in all college activities, including professional development programs. New adjuncts begin their employment with face-to-face meetings with department chairs who provide group and individual mentoring. A required one-credit, online orientation course provides information about the college and offers appropriate teaching and learning methodologies for all new adjuncts.

Adjunct faculty members have college e-mail addresses and will soon have Web course tools that can be personalized for each course they teach. Office space with phone access is available for an adjunct's use in every classroom building on campus. "We appreciate them. We know that we cannot provide the course schedules we do without them," said Henri Sue Bynum, vice president for academic affairs at Indian River Community College (personal communication, May 18, 2006).

Other recruitment strategies to consider include partnering with graduate schools for their students to teach with mentor support; interviewing at historically black colleges and other minority-serving institutions; holding job fairs staffed by the college personnel who select adjunct faculty; cultivating alumni contacts; and using targeted advertising for specific populations, such as retirees, veterans, women, and minorities.

More ambitious and complex strategies are also needed. These could include offering differential pay

for high-demand and difficult-to-staff disciplines, setting up business-industry partnerships that make community college teaching assignments part of select employee duties, establishing dual enrollment programs that allow qualified high school instructors to teach college courses at their high schools, and creating greater awareness of community colleges as good places to work.

Professional Development

Professional development for adjunct faculty begins with an institutional commitment to support and facilitate the growth of part-time instructors. Training, defined as how-to skills for navigating the community college, must be balanced with professional development, which enhances pedagogy or knowledge within an academic field. Novices should receive training about their colleges through orientation and mentoring programs, and all adjuncts should be included in professional development opportunities.

Novice instructors, who may have been hired for their field expertise rather than teaching experience, benefit from well-run orientation programs that familiarize them with the community college students and the college's multiple missions, culture, and operations. Using veteran adjunct and full-time faculty to present orientation programs together could help to bond the faculty. Attention to logistics and policies could also be valuable. Offering formative teaching evaluations during the semester also would help to build connections among the faculty. Assigning a faculty member to coordinate courses with multiple sections would help novices and ensure consistent coverage of material with common outlines and syllabi.

Both novice and veteran adjunct faculty should be integrated into the professional development opportunities that community colleges offer on their
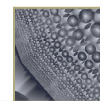
campuses. Scheduling professional development activities to accommodate adjuncts' schedules or offering professional development programming through the college's Web site would increase the likelihood of adjunct participation. Compensating adjuncts for participating would probably have a positive effect on participation. Colleges should also encourage adjuncts to become involved in professional organizations. By providing for adjuncts' time, registration fees, and travel costs to attend workshops and other professional development opportunities offered by professional organizations, community colleges demonstrate their commitment to adjuncts' professional growth.

Retention

Other incentives would help community colleges retain exemplary, diverse adjunct STEM faculty. Equitable compensation whether an adjunct teaches a laboratory section or lecture would be a good start. Some colleges have paid adjuncts less for lab classes than non-lab classes. This seems counterintuitive given the intense, careful attention that laboratory work entails. Research suggests that students learn more effectively through active learning; i.e., being engaged with the course content through laboratory experiments or other experiential approaches. Colleges could also show consideration to adjuncts by offering amenities, such as campus parking, office space with access to telephones and personal computers, and tuition waivers for adjunct faculty and their dependents. Longtime adjuncts could be given job titles that recognize the length of their service and commitment to community college teaching as a career choice. They should be invited to departmental meetings, included in other social and professional activities, and honored for their achievements.

In the face of policymakers' emphasis on data-driven decision making, community colleges need to

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Adjunct Faculty Recruitment and Retention Strategies

Metropolitan Community College in Omaha, Nebraska, uses a proactive approach in its effort to hire adjunct faculty and to engage them in the campus community. The college holds an adjunct hiring fair annually that connects prospective instructors with the leaders of its academic departments. It employs a part-time adjunct faculty support coordinator whose responsibilities include managing an online adjunct faculty resource center, coordinating the quarterly adjunct newsletter, and attending College Council meetings. The college holds quarterly roundtable discussions with adjunct faculty to discuss issues of importance. The adjunct faculty support coordinator and the vice president for learning and academic affairs participate in these discussions. The college also pays adjunct faculty for up to 21 hours per year of professional development participation (R. VanWagoner, personal communication, May 16, 2006).

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evaluate the effectiveness of their efforts to recruit, develop, and retain exemplary, diverse adjunct STEM faculty using quantitative and qualitative data. Defining measurable outcomes and having baseline data are the first steps. Surveys at the beginning and end of adjuncts' service will inform colleges about how adjuncts learned of openings, why they signed on, what they thought of their teaching experience, and why they are leaving. Data on the number of applicants in the pool for various faculty positions over several years will provide discipline-specific information about the candidate pool and the impact of recruitment strategies. Student evaluations can help determine whether professional development is making a difference in classroom performance.

ADJUNCT FACULTY RECOMMENDATIONS
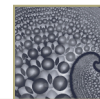
Recruitment

- Partner with businesses, school districts, and STEM graduate school programs to recruit instructional candidates.

- Target advertising for STEM faculty openings to specific populations, such as retirees, midcareer professionals, underrepresented minorities, active and retired military personnel, and graduate students.

- Publicize community colleges as attractive workplaces.

- Hold a job fair to publicize all open adjunct positions.

Retention

- Compensate equally for teaching labs and lectures.

- Provide parking and office space with phone and computer access.

- Focus more national attention on adjunct faculty issues.

- Provide incremental pay rate increases based on years of service or number of courses taught.

- Celebrate the successes of adjuncts and their students loudly and often.

Professional Development

- Provide detailed orientation for novice STEM instructors on lab safety and equipment, and the college's organization, mission, facilities, and goals.

- Supplement group orientation programs with a manual for adjunct faculty that includes frequently asked questions about the college and community.

- Mentor novice instructors to connect them more fully with the faculty.

- Provide opportunities for adjunct faculty to enhance their teaching skills and growth within their disciplines.

- Use electronic technologies to offer professional development programs accessible to adjuncts unable to attend campus programs.

- Set up Web-based discussion boards.

8

Framework for Discussion

*What are the elements of an effective partnership?
To support the recruitment, development, and retention
of diverse, exemplary STEM faculty, how can community
colleges build and sustain effective partnerships with local
business and industry; local community organizations;
professional societies and organizations; K-12 schools;
and other community colleges, four-year colleges, and
research universities?*

Partnerships with a wide range of organizations are
important to the success of efforts to recruit, retain,
and develop STEM faculty. Partnerships involve
open, honest dialogue, clear goals, and a willingness
to work together and be held accountable for the
success of the partnership. Building mutually benefi-
cial partnerships takes time and effort regardless
of whether they are with K-12 school systems,
research universities, particular industries, or local
business groups. The investment of time and effort,
however, has the potential to bring many more
people into community college teaching.

K-12 partnerships can be organized according to
discipline or in systematic adopt-a-school or service
learning programs. Sharing professional development
opportunities or meeting to discuss STEM issues
could serve as icebreakers for new partnerships.
As K-12 and community college educators become
accustomed to working together, they could share
dual credit courses, apply jointly for grants, and
develop programming to promote career paths for
students in STEM disciplines.

Partnership Strategy

A new master's degree program at Washington
State University (WSU) is intended to help
community colleges find well-qualified faculty and
prepare graduate students who prefer teaching
math to conducting theoretical mathematics
research.

WSU sent surveys to the math department chairs
of Washington's community colleges inquiring
about the mix of math and education courses
they prefer for faculty. The response from the
community colleges was overwhelming; they
want people with master's degrees in math and
some pedagogical knowledge.

Students in the program are required to complete
27 credits of master's level mathematics courses
and three new education courses taught by
math faculty. The graduate students also work as
part-time teaching assistants and must complete
a formal practicum teaching math to elementary
education majors. This lab-based class gives
graduate students experience using math
manipulatives and dealing with adult students'
math fears (K.M. Vincent, personal
communication, 2006).
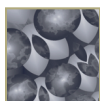
While K-12 partnerships involve students moving into postsecondary education, community college partnerships with business and industry typically focus on student employability and whether students have the necessary competencies required by employers. If business and industry people feel they can influence the development of students who can help them compete globally, they are highly motivated to become involved in community college partnerships. Highly effective partnerships typically include some combination of faculty externships, student internships, professional development support, or even the temporary assignment of company personnel to community colleges to teach or assist with curriculum projects. The involvement of STEM specialists in such partnerships increases the likelihood that retiring business and industry personnel will consider making community college teaching a second career.

Collaborating with four-year colleges and research universities helps community college students transfer and opens possibilities for sharing facilities and leveraging resources, including faculty. Universities are obvious professional development resources for community colleges. In turn, the community college emphasis on learning provides university faculty and researchers the opportunity to teach small classes and gives graduate students the chance to explore college teaching as they complete their advanced coursework.

Partnering with professional societies to encourage graduate students to consider community college teaching careers is another way to attract emerging scholars. Professional society members include mid-career professionals who might consider teaching full- or part-time at community colleges. Inviting professional societies to use community college

campuses for meetings and workshops is another marketing tactic that could help attract new STEM faculty.

The involvement of community college administrators and faculty members in local organizations–such as the Chamber of Commerce, Rotary, or Habitat for Humanity–can help cast a wider net when trying to fill faculty positions. Positive formal and informal connections with stakeholder groups raise the college's profile and add to its appeal as a workplace.

Establishing benchmarks, goals, and timelines for the recruitment, retention, and development of STEM faculty is essential for evaluating the impact of partnerships. Assessments should reflect the goals and objectives of the partnership. For some partnerships, increasing STEM faculty may be only one of several intended goals. Nevertheless, evaluations should gauge whether partnerships have had a positive impact on diversity among faculty, and whether the collaborative activities have influenced students' performance or attitudes, particularly in STEM fields.

PARTNERSHIPS RECOMMENDATIONS

- Build alliances and coalitions that will develop into solid partnerships to facilitate the recruitment, retention, and professional development of exemplary STEM faculty.

- Set goals with quantitative and qualitative benchmarks for recruitment, retention, and professional development of STEM faculty.

- Publicize community colleges nationally as attractive workplaces for full- and part-time faculty.

9

Framework for Discussion

What different strategies are required to significantly increase the pool of future STEM faculty from a variety of sources, professional tracks, and occupations? What roles will organizations other than community colleges (e.g., professional societies, graduate schools, K-12 schools, business and industry, military) have in implementing these strategies? How would national organizations collectively evaluate their progress in addressing these long-term pathway needs?

Between 2004 and 2014, community colleges could lose nearly 38 percent of full-time STEM faculty to retirement. The percentage decreases slightly to 35 percent for faculty in non-STEM fields (NCES, 2006). Given these challenges, community colleges need to take a longer, more strategic view of the many professional pathways from which future faculty will be drawn.

What leads to a community college teaching career? Answering that question will require identifying the educational and employment backgrounds of highly effective community college STEM faculty and their career pathways prior to teaching. An analysis of data on faculty background could lead to strategies for attracting more STEM professionals to community college teaching. Many people drawn to teaching find the community college environment a positive and exciting workplace. Dissemination of this research could illustrate the community college commitment to maintaining high-quality teaching and learning standards. Use of data could spur more interest about the need for a coordinated campaign to attract new faculty and encourage community colleges to offer more professional development opportunities for community college leaders.

Partnerships with professional societies, graduate schools, K-12 schools, business, industry, and other interested parties should help with research costs and dissemination. These collaborative relationships could promote mentoring and other professional development programs. Partnerships among these groups could help focus research, set goals, and establish benchmarks for recruiting, retaining, and developing community college STEM faculty. They could also venture into assessments of materials and programs as well as policy issues related to the national need.

### NATIONAL PATHWAYS RECOMMENDATIONS

- Gather baseline information about community college STEM faculty employment.

- Conduct ongoing research on the recruitment, retention, and professional development of full-time and adjunct community college STEM faculty.

- Develop national goals regarding the recruitment, retention, and professional development of STEM faculty based on quantitative and qualitative data.

- Establish national coalitions to influence policies that develop exemplary STEM faculties at community colleges.

- Market community colleges nationally to potential faculty, students, parents, guidance counselors, and employers.

10

Community colleges must continually seek ways to recruit, retain, and develop diverse, exemplary faculty who are not only well-versed in their STEM subject areas but also able to share their knowledge with their students enthusiastically and effectively. Twenty-first century faculty must keep pace with the rapid changes in the STEM fields, inspire students with cutting edge theory and practice, and demonstrate how the current and emerging subject matter applies to the personal and professional lives of an increasingly diverse student population. This is a daunting task that requires creativity, commitment to lifelong learning, and a willingness, repeatedly, to redesign the classroom.

The recommendations presented in this report challenge community college leaders and faculty to foster professional environments that will attract and retain a diverse, exemplary faculty in STEM disciplines. Leaders in business, industry, and professional organizations must also step forward to secure U.S. global technical competitiveness. Solid collaborations between community colleges and their partners that promote careers in STEM teaching can move the nation forward.

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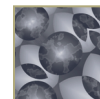
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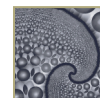
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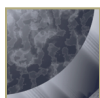Community Colleges
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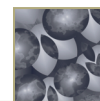Indian River Community College
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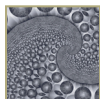
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