ADVANCING UNDERREPRESENTED MINORITIES IN STEM EDUCATION AND CAREERS
FEDERAL POLICY SUPPORT FOR MIDDLE-SKILL STEM PATHWAYS AND THE COMMUNITY COLLEGES THAT PROVIDE THEM

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SUMMARY AND RECOMMENDATIONS

Workers in STEM fields—science, technology, engineering, and mathematics—play a critical role in driving economic growth, and STEM employment provides a significant pathway to family-supporting incomes. Yet too many African Americans, Latinos, and Native Americans are underrepresented in the STEM workforce.

Recent research, however, provides the opportunity to open up new avenues to STEM careers for underrepresented populations who access postsecondary education through our nation’s community colleges. New employment and skill data highlight a previously overlooked fact—that one-half of all U.S. STEM jobs are available to workers without a four-year college degree, requiring only a two-year degree or shorter certificate. These “middle-skill” STEM positions pay 10 percent more than other jobs with similar educational requirements and offer the promise of better long-term income and career advancement. Manufacturing, health care, and construction all offer middle-skill technical and production work requiring STEM knowledge. This “second” or “hidden” STEM economy creates significant opportunity for underrepresented minorities, especially those from low-income families, because they enroll disproportionately at community colleges.

Developing an efficient pipeline to train underrepresented minorities for STEM occupations would deliver great benefits to employers and regional economies, while simultaneously helping reduce racial disparities in income, educational attainment, and career opportunities. Unfortunately, community colleges typically have low graduation rates, due to both individual and institutional challenges. In order to open up middle-skill STEM professions for more underrepresented minorities, community colleges need significant transformation in the way they operate and support student success.

Fortunately, educators and policymakers can point to a growing body of research, knowledge, and experience about “best practices” that the highest performing community colleges have used to revamp their programs—from redesign of developmental education to better advising and earlier choices of more structured pathways to credentials. The federal government has an important role to play in helping community colleges and their partners provide more transparent and cost-effective routes to STEM employment. The following are recommendations for federal policy:

1. Use federal innovation and improvement funds—such as the proposed First in the World Competition or Race to the Top for Higher Education—to promote “best practice” strategies to improve middle-skill STEM pathways from community colleges into employment that reduce completion and employment gaps for groups underrepresented in STEM occupations.

2. Promote more effective regional labor market information for use in course design, counseling, curriculum development, and student outcome tracking in middle-skill STEM education and training programs.

3. Use upcoming federal reauthorizations (e.g., the Workforce Investment Act and the Higher Education Act) to promote better middle-skill STEM pathways, including the academic, social, and financial supports that help students persist.

4. Conduct and/or fund research and evaluation on the best and most comprehensive middle-skill STEM initiatives.

5. Balance the federal investment in STEM pathways to place more emphasis on preparation for and success in middle-skill pathways.
INTRODUCTION

Workers in STEM fields—science, technology, engineering, and mathematics—play a critically important role in driving economic growth, and STEM employment represents a significant pathway to family-supporting incomes and financial stability. Yet far too few individuals from underrepresented groups—in particular, African Americans, Latinos, and Native Americans—are among the ranks of STEM workers.

To date, the focus on STEM employment has emphasized jobs that require a Bachelor’s degree or higher—and federal policy and investment have reinforced that focus. New research, however, has helped adjust the national understanding of STEM and the opportunities it presents. New employment and skill data have drawn attention to the large number of STEM jobs that require less than a Bachelor’s degree. The data have also highlighted the critical importance of community colleges as a primary provider of college access for large numbers of underrepresented minorities in this country. The result is a growing national recognition that, with new approaches and support for reform, community colleges can be a launching pad for many more individuals to high-paying, quality careers in STEM fields, particularly for underrepresented minorities.

The federal government can play an important role in helping community colleges and their partners provide more transparent, productive, and cost-effective routes to STEM employment. This paper characterizes the opportunities for underrepresented minorities in STEM fields and existing barriers to successful community college pathways. It concludes with recommendations for federal policymakers for improving preparation for the sub-Bachelor’s degree STEM labor market.

THE ROLE OF COMMUNITY COLLEGES IN PROVIDING STEM OPPORTUNITIES TO INDIVIDUALS FROM UNDERREPRESENTED GROUPS

STEM employment opportunities have doubled from 10 to 20 percent of total U.S. employment in the past century. Over the coming decade, STEM jobs are predicted to continue to grow far more quickly than non-STEM employment fields. STEM wages are far higher on average than wages in other fields. The average salary in STEM employment in 2009 was just under $78,000, compared to $43,000 for non-STEM workers. For Latinos and African Americans, whose average household incomes are $40,000 and $33,000 respectively, increasing their proportion in STEM employment would help reduce racial income inequality in the United States.

Unfortunately, African Americans, Latinos and Native Americans are significantly underrepresented in STEM professions. According to the National Academy of Sciences, these groups comprised 28.5 percent of the U.S. population in 2006 but only 9.1 percent of college-educated individuals employed in science and engineering occupation. To match their share of the overall population, the proportion of underrepresented minorities in STEM careers would need to triple.

Recent research from the Brookings Institution argues that most analyses of STEM employment in the United States have not differentiated sufficiently among STEM jobs by educational requirements. They therefore have missed an important fact about STEM employment: one-half of all STEM jobs are available to workers without a four-year college degree—and these jobs pay $53,000 on average, 10 percent higher than other jobs with similar educational requirements. Many of these jobs can also be stepping stones to higher-skilled positions, many of which require going back to school for further education: over 40 percent of STEM Bachelor’s or Master’s graduates attended a community college at some point. In manufacturing, health care, and construction, a significant number of technical and production jobs require STEM knowledge. This “second” or “hidden” STEM economy, comprising well-paying middle-skill jobs, draws its employees from vocational schools and, in particular, from community colleges.

Underrepresented students, especially those from low-income families, enroll disproportionately in public two-year colleges. The hidden STEM economy—fueled by those educated at community colleges—therefore offers the promise of better income and long-term employment opportunities to groups underrepresented in STEM occupations. A more efficient pipeline from
Community colleges into STEM occupations would deliver great benefits to employers and regional economies while simultaneously helping reduce racial disparities in income, educational attainment, and career opportunities. For example, installation, maintenance, and repair occupations, which can be accessed by those with community college credentials, constitute 12 percent of STEM employment, one of the largest categories. Community colleges are typically the training grounds for high-demand, middle-skill industries such as construction, advanced manufacturing, and allied health.

Unfortunately, while community colleges are an increasingly important entry point to higher education and STEM careers for low-income, first-generation, and students of color, too many community college students fail to complete their chosen program of study, and a surprisingly large number of students never even enroll in a specific major, STEM or otherwise. Fewer than 30 percent of those who enroll in community college succeed in obtaining an Associate’s degree within three years, and fewer than half who enter community college with the goal of earning a college certificate or degree have reached that goal six years later. There are many reasons for the high non-completion rate. Some are student centered, such as poor academic preparation, financial strains, and the difficulty of juggling work, family, and school. Others are institutional challenges, such as dysfunctional placement policies; overreliance on standalone remedial sequences; inadequate advising on careers, programs, and course taking; and limited academic and other supports geared to pushing students to completion. Federal, state, and institutional action can help address both types of challenges to completion.

If students of color and first-generation students in community colleges are to enroll in, persist in, and complete STEM programs in greater numbers, significant transformation of the way colleges operate and support student success will be needed. It is necessary but not sufficient to focus on incoming student preparation and student financial or life barriers to completion. Fortunately, there is a growing body of research, knowledge, and experience on what it takes to help more students from underrepresented populations succeed in STEM (and other) community college programs of study. Colleges and state systems involved in reform initiatives such as Achieving the Dream, Completion By Design, Accelerating Opportunity, Complete College America, the Community College Survey of Student Engagement, and others have gleaned important lessons about how the highest performing community colleges revamp their instructional programs and student supports to help more students enter and succeed in high-value programs. These lessons are being translated into principles that should inform institutional leaders around the country— but should also inform the decisions of policymakers at the state and federal levels.

PRIORITIES FOR IMPROVING MIDDLE-SKILL STEM PATHWAYS AT COMMUNITY COLLEGES

A recent Jobs for the Future report published by the Boston Foundation summarized the latest national research on strategies that community colleges are using to address critical obstacles their students face in progressing and completing academic or technical programs that result in credentials with value in the labor market. These strategies, which emerge from the best available research and programmatic innovation, are summarized in the following table on page 3.

From the perspective of pathways to middle-skill STEM credentials and jobs, these research-based reform strategies can be distilled into the following “best practice” principles:

1. Program design and curriculum is based upon current regional labor market information and analysis that is fine grained, up to date, and informed by employers and regional workforce institutions.

2. Career-focused programs provide more structure and a clearly defined pathway to jobs and careers that are in demand in the regional labor market.

3. Students entering below the necessary level of proficiency receive basic skills support that is accelerated and contextualized for STEM fields, with the goal of minimizing their enrollment in stand alone developmental education courses.
### RESEARCH FINDINGS

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<tr>
<th>FINDINGS</th>
<th>STRATEGIES AND RESPONSES</th>
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<tr>
<td>Students who accumulate credits and enter a program of study early</td>
<td>Move students into program streams and encourage them to declare majors early.</td>
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<td>meet with better outcomes.</td>
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<td>Students need more structure, fewer options, and frequent feedback.</td>
<td>Streamline curriculum; add mandatory orientation, proactive advising, and educational planning.</td>
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<td>Effectiveness of traditional developmental education is unclear.</td>
<td>Reduce, accelerate, and contextualize developmental education.</td>
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<td>Not all academic programs and careers require the same skills.</td>
<td>Build multiple, differentiated pathways aligned with the requirements of academic programs and careers.</td>
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<td>Assessment tests are high stakes, and they are not the best predictors</td>
<td>Use multiple measures to place students, and change test conditions to increase awareness and allow preparation and retest.</td>
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<td>of success in college.</td>
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<td>Interventions are expensive, but there is evidence that they lower</td>
<td>Make the case for upfront investments that lead to higher completion.</td>
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<td>cost-per-completion.</td>
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<td>Small college-level pilots are difficult to scale up.</td>
<td>Begin interventions at scale.</td>
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<tr>
<td>College programs should align with workforce needs, and students</td>
<td>Use labor market information when designing programs and to improve career advising.</td>
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<td>should understand career outcomes.</td>
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<tr>
<td>College programs should align with requirements for transfer with</td>
<td>Faculty disciplinary teams build core curricula for program streams that introduce students to a field and lead students to the goal of choosing a major.</td>
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<td>junior standing, and students should take courses that count</td>
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<td>toward their major.</td>
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4. Students understand their options through advising upon enrollment and are expected to select a broad pathway of study (e.g., STEM, liberal arts) early in their college experience, so they can move quickly and efficiently to completion.

5. Early warning systems, frequent and ongoing advising, and career guidance are routine components of student supports and college experience.

6. Low-income students are connected to effective academic, social and financial supports that promote retention and persistence through STEM programs.

7. Associate’s degree courses and programs are aligned with those of public four-year institutions in the state, so that transfer to senior institutions to pursue higher-skill STEM programs is seamless and credits transfer easily.

8. Student enrollment, persistence, completion, and labor market outcomes are continually monitored—and analyzed by college and major/program—and used for continuous improvement of curricula and support systems.

There is much activity in states and colleges around the country to put these principles (and the requisite institutional infrastructure) in place. Some is foundation-supported (e.g., Achieving the Dream and JFF’s new initiative to promote regional STEM partnerships; Completion By Design). Federal funds through the $2 billion Trade Adjustment Assistance Community College Career Training Act have stimulated institutional, statewide, and industry-focused innovations in STEM pathways. For example, the Massachusetts Transformation Agenda, a statewide TAACCCT grant, includes all 15 of the state’s community colleges, several of which are Achieving the Dream colleges. The three-year initiative is redesigning an accelerated curriculum for nearly 150 career pathways—with an emphasis on STEM fields—and adding significant structure and support for students through “navigators,” who provide academic and career support to students both on campus and in job centers. Other colleges and their partners are moving toward this paradigm shift on their own, based on what they see working elsewhere—and the expectations of both employers and students.
While most community college policy is a state and local responsibility, the federal government can play important roles in supporting and providing incentives for states and institutions to pay more attention to the definition and delivery of high quality middle-skill STEM pathways. Our recommendations follow.

RECOMMENDATIONS FOR FEDERAL POLICY TO IMPROVE MIDDLE-SKILL STEM PATHWAYS

1. **Use federal innovation and program improvement funds to promote “best practice” strategies to improve middle-skill STEM pathways through community colleges into employment that reduce completion and employment gaps for low-income and first-generation students of color.**

   The Administration has proposed a federal Race to the Top for Higher Education, based on the innovation funding of the K-12 Race to the Top competitions. If such a program is funded, or a similar program is constructed, it could encourage states to provide good incentives for institutions, individually and in groups, to develop comprehensive approaches to more productive STEM (and non-STEM) pathways for their students. It could also encourage states to enact policies that would support STEM pathway innovations, such as performance-funding formulas that reward outcomes in high-demand, high-wage fields; metrics that can help students, colleges, and state policymakers understand the education and employment outcomes for students, by major and program; and labor market information systems that capture regional trends more effectively for use by students and institutions.

   A competition promoting innovation and productivity among individual institutions or consortia, such as the Administration’s proposed First in the World Competition or some other version of an institutional innovation competition, would also allow institutions to test out best practices that advance middle-skill STEM pathways, as one of the areas evaluated. Additionally, other existing innovation funds managed by the Departments of Education and Labor, the National Science Foundation, and others (e.g., Workforce Innovation Fund, TAACCCT, the H1B visa program) should be shaped to help advance this middle-skill STEM pathways agenda.

2. **Promote better regional labor market information for use in STEM course design, counseling, curriculum development, and student outcome tracking.**

   As noted above, competitive funding opportunities for innovation and program improvement should be structured to support more effective regional labor market information (combining Bureau of Labor Statistics, real-time labor market information or LMI, and employer feedback) so that programs meet employer needs and are up to date and high value. We recommend the federal government fund pilot programs for postsecondary institutions to use both traditional and real-time LMI to better align their advising and program offerings, and then measure the resulting student completion rates, job placements, and earnings. If the efficacy of better LMI and its use in helping more students prepare for high-demand occupations is demonstrated (resulting in a range of improvements such as higher completion, lower loan default, etc.), use of sophisticated labor market data for program improvement and student advising should be considered as a condition for continued institutional participation in federal programs.

3. **Use upcoming federal education and workforce reauthorizations (e.g., WIA, HEA, Perkins) to promote better middle-skill STEM pathways, including the academic, social, and financial supports that help students persist.**

   A number of major federal education and workforce laws are due for reauthorization. Congressional committees should create incentives and directives for better alignment of the Workforce Investment Act, the Perkins Career and Technical Education Act, the Elementary and Secondary Education Act, and the Higher Education Act reauthorizations to support stronger, more effective middle-skill STEM pathways—from high school or for adults who are unemployed or are looking to advance in their field. Postsecondary outcomes should be measured across all programs, and data reporting required by these
laws should be better aligned through common definitions and metrics across funding streams. Congressional committees should demand that better cross-system alignment be built into these reauthorizations so that sustainable transitions from one to the other—from high school to college or from adult education to credit pathways to good jobs—become the norm rather than the exception.

4. **Conduct and/or fund research and evaluation of middle-skill STEM initiatives.** While the evidence base on practices that have a positive impact on student success in community college pathways is growing, we need more information on the varied programs designed to motivate, attract, and keep students—particularly underrepresented minorities—in STEM pathways. Most research on the efficacy of retention interventions, such as mentoring, financial aid, advising, and work-based learning/apprenticeships, comes from Bachelor’s and graduate-level initiatives. The federal government should fund careful research on the best and most comprehensive middle-skill STEM initiatives. Federal support for research on its innovation and program improvement investments could highlight conditions that promote STEM pathways innovation success—including contextualized on-ramps, early choice of meta-majors, and work-based learning with employers.

5. **Balance the federal investment in STEM pathways to place more emphasis on preparation for and success in middle-skill STEM pathways.** The federal government invests $4.3 billion annually in STEM education and training. But as Jonathan Rothwell of the Brookings Institution notes, while middle-skill STEM jobs constitute about half of all STEM employment, sub-Bachelor’s degree pathways receive only 22 percent of that $4.3 billion. Some rebalancing of these investments toward sub-B.A. pathways is in order.

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**ENDNOTES**

5. Rothwell, op. cit.
7. Rothwell, op. cit.
9. Two excellent sources of new research on what works are the Community College Research Center at Teachers College, Columbia University, and MDRC.