DIVERSIFYING THE STEM PIPELINE
THE MODEL REPLICATION INSTITUTIONS PROGRAM

IHEP

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We also wish to thank the nine MRIs, which committed to improving the quality, quantity, and diversity of the science, technology, engineering, and mathematics (STEM) programs on their campuses. We appreciate their dedication to their students and their willingness to share with us their pursuit of excellence.

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INTRODUCTION

In 2006, the National Science Foundation (NSF) began funding the Model Replication Institutions (MRI) program, which sought to improve the quality, availability, and diversity of science, technology, engineering, and mathematics (STEM) education. Program development began in 2005, when findings of the National Academies-commissioned Committee on Prospering in the Global Economy of the 21st Century raised significant concerns about the educational preparation of the future STEM workforce. Congressional testimony from the committee's chairman in 2005, followed by a full report, *Rising above the Gathering Storm*, in 2007, issued a grave warning about the relative decline of the United States in the science and technology marketplace (Augustine 2005; Committee on Prospering in the Global Economy of the 21st Century 2007). The findings revealed that competitor nations had increased public funding for research and development; made significant investments in higher education; and increased the number of research universities, researchers, patents awarded, and degrees granted.

In addition to identifying challenges to the overall quality and quantity of science, technology, engineering, and mathematics (STEM) education, *Rising Above the Gathering Storm* raised concerns about the participation of minorities in these fields. The proportion of the total population of the United States made up of people of color (including African Americans, Asian Americans, American Indians, and Hispanics) is expected to grow from roughly one-third in 2008 to approximately 54 percent by 2050 (U.S. Census Bureau 2008). As these populations emerge as the new majority, it will be critical that higher education institutions ensure that the nation's future scientists, engineers, information technologists, mathematicians, computer programmers, and health care workers reflect the diversity of the U.S. population.

Across postsecondary education, the current rate of degree completion for non-Asian minority students lags that of White students. According to the U.S. Department of Education, only 36 percent of African American students and 42 percent of Hispanic students who began postsecondary education in 1995 had completed a bachelor's degree after five years, compared with 58 percent of White students (Cook and Cordova 2006). The bachelor's degree completion gap is even wider in the STEM disciplines: nearly 70 percent for White students compared with 42 percent for African Americans and 49 percent for Hispanics (Anderson and Kim 2006). Research indicates that lack of interest is not the primary cause of these achievement gaps; in fact, African American and Hispanic students enter the STEM disciplines at about the same rate as White students. Statistical differences appear in the later years of study, when students of color fail to persist in a timely manner (Anderson and Kim 2006). Disparities in STEM persistence and degree completion can be

attributed largely to economic factors and academic preparation among racial subgroups (Adelman 2006).

Faced with pressing national priorities in the STEM fields and chronic gaps in postsecondary achievement, the MRI project identified Minority Serving Institutions (MSIs) as key intermediaries to improve the quality, availability, and diversity of the STEM educational pipeline. Currently, Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs) are responsible for conferring nearly one-third of the STEM degrees awarded to students of color (National Science Board 2004). MSIs are leaders in educating the nation's African American, Hispanic, and American Indian students, and they are committed to ensuring that minority students have access to and success in higher education. The MSIs participating in the MRI project include the following:

- **HISTORICALLY BLACK COLLEGES AND UNIVERSITIES (HBCUS):** Federally designated institutions that began operating in the 19th century to serve African Americans, that were prohibited from attending predominantly White institutions (O'Brien and Zudak 1998).

- **HISPANIC-SERVING INSTITUTIONS (HSIS):** Institutions defined by federal statute that have at least a 25 percent Hispanic undergraduate full-time equivalent enrollment, and at which at least 50 percent of Hispanic students are low-income persons (Benitez 1998).

- **TRIBAL COLLEGES AND UNIVERSITIES (TCUS):** Institutions chartered by one or more federally recognized American Indian tribes. They are located on reservations or in communities with a large American Indian population (Cunningham and Parker 1998).

Collectively, MSIs have a long history of helping students overcome the major financial and academic barriers to degree completion. MSIs provide educational opportunities tailored to students who have been denied access to adequate elementary and secondary school preparation, particularly first-generation and low-income students. In 2003–04, 46 percent of students attending an HBCU or HSI and 50 percent of those attending a TCU were first-generation college students, compared with 35 percent of students enrolled at all institutions. In addition, 44 percent of HBCU and HSI students were from families in the lowest income quartile, while only 26 percent of students enrolled at all institutions shared that socio-economic status. Up to 80 percent of students who attend TCUs qualify for federal financial aid (Alliance for Equity in Higher Education 2007). Despite these challenges, MSIs educate and graduate a disproportionate share of minority students.

MSIs are well-positioned to reach students of color and to leverage the strategic resources provided by the MRI project to assist these students. The project offered technical assistance to replicate and disseminate the findings of successful NSF initiatives at MSIs. Specifically, MRI builds on best practices in STEM undergraduate education identified by the NSF initiative

Model Institutions of Excellence (MIE). In collaboration with the National Aeronautics and Space Administration (NASA), this 11-year-old program developed an effective approach to increasing STEM degrees by building the necessary components of STEM infrastructure at MSIs. A recent study of the MIE program conducted by the American Institutes for Research identified seven critical infrastructure components of the model that appear to improve student achievement in the STEM disciplines (Rodriguez, et al. 2005).

- **PRECOLLEGE INITIATIVES.** Prepare matriculating students to succeed in college and introduce students to STEM disciplines and careers by training K–12 teachers to improve their content knowledge and teaching ability; introducing young students to the STEM fields through hands-on activities; and bridging the transition into college or university.

- **STUDENT SUPPORT.** Provide social, financial, and academic assistance to students through peer and teacher-student mentoring programs and tutoring; advise students about opportunities for financial aid; coordinate "cohort programs" in which small groups of students take core subjects together; and establish a place where students can meet and study together, especially at commuter campuses.

- **UNDERGRADUATE RESEARCH.** Enable students to become directly involved in ongoing research by encouraging faculty members to include funding for undergraduate researchers in grant proposals; offer student internships; facilitate opportunities for students to write and present research findings; establish liaisons with businesses and other universities to expand opportunities for research; and maintain a supportive environment in which a student can experiment (and possibly fail) without negative consequences.

- **FACULTY DEVELOPMENT.** Support recruitment, retention, and professional development of faculty by funding research, conferences, and professional development; offer mentorship opportunities; set appropriately balanced and rewarded teaching and research agendas; and provide continuing education on interactive classroom methods and how to integrate student participation into faculty research activities.

- **CURRICULUM DEVELOPMENT.** Align curricula with accepted content standards and develop courses that are relevant to the marketplace, the community, and the student population; provide developmental courses that elevate entering students to college-readiness level; integrate the curriculum to help students build connections; introduce relevant history and culture into all courses; ensure culturally responsive pedagogy; and develop new courses and majors.

- **PHYSICAL INFRASTRUCTURE.** Upgrade and maintain facilities and equipment by renovating classrooms and laboratories; purchase, upgrade, and maintain state-of-the-art equipment; and design spaces for students to meet and study.

- **GRADUATE PROGRAM AND SCIENCE CAREER INITIATIVES.** Facilitate admission to and retention in STEM graduate programs and careers by providing graduate school admissions test preparation courses; educate students on academic and professional supply and demand trends in the STEM fields; establish a bridge program for students transitioning out of college; and provide job placement services.

The Institute for Higher Education Policy (IHEP) realized that examining the MIE model was only the first step. It was also necessary to increase the growing cadre of STEM expertise in the MSI community. With funding from NSF, IHEP developed the MRI project to replicate the MIE model at a new cohort of institutions. IHEP managed MRI in partnership with the Alliance for Equity in Higher Education[1] and principal investigators and evaluators from MIE, who served as expert consultants during the project (see appendix A). The MRI project sought to replicate and disseminate the findings of the MIE model. Program activities included the following:

- Identifying nine MSIs—three HBCUs, three HSIs, and three TCUs.
- Offering workshops on technical components of the MIE model and the use of data for institutional decision making.
- Convening two national dissemination and replication conferences to share practical strategies for building campus STEM initiatives and developing institutional action plans.
- Facilitating consultant site visits to support successful implementation of STEM initiatives.

From 2006 to 2009, participating MRI campuses developed plans for institutional change focusing on one or more components of the MIE model to improve recruitment, matriculation, retention, and completion in STEM graduate education or workforce opportunities. To date, the first implementation steps have been taken and short-term improvements have been realized; however, it is too early to assess the long-term outcomes of these efforts. MRI teams continue to push their individual projects forward, drawing on the MIE model strategies, the advice of their consultants, and findings from data to inform their decisions.

This report begins by outlining MRI project activities, providing institutional information about participating campuses, and highlighting campus activities consistent with the components of the MIE model. Subsequent sections analyze self-reported information from the MRIs regarding their evaluation of successful initiatives to improve STEM education, best practices for adopting and adapting lessons learned, and anticipated next steps in the implementation process. The report aims to disseminate the steps for replicating the MIE model to postsecondary institutions that are seeking to improve excellence and diversity in the STEM pipeline.

1 The Alliance for Equity in Higher Education is a national coalition that represents the shared interests of Tribal Colleges and Universities, Hispanic Serving Institutions, and Historically Black Colleges and Universities. Members of the Alliance include the American Indian Higher Education Consortium, the Hispanic Association of Colleges and Universities, and the National Association for Equal Opportunity in Higher Education.

THE MRI PROCESS

The MRI project selected nine institutions—three HBCUs, HSIs, and TCUs—from a pool of MSIs that were interested in improving their STEM initiatives. Because the support would primarily consist of technical assistance over approximately 24 months, with no direct funding to the institutions to support implementation, it was necessary to choose institutions that were already committed to improving STEM outcomes.

IHEP staff and independent evaluators looked for institutions that were actively engaged in improving STEM-related policies and practices—for example, attending an MIE dissemination conference, developing basic STEM infrastructure, or securing buy-in from faculty and staff to improve STEM programming. The selected institutions were also in a position to benefit significantly from consultation and collaboration with other MSIs in the STEM disciplines. The following nine institutions were chosen for the MRI project:

- Alabama A&M University
- Navajo Technical College
- New York City College of Technology
- Northwest Indian College
- Paine College
- Southwestern Indian Polytechnic Institute
- Stillman College
- Texas A&M University Corpus Christi
- Universidad del Turabo

(For profiles of the institutions, see box 1.)

To raise visibility for the MRI project at each selected institution and build buy-in on campus, the first step was to assemble a team of senior administrators, faculty, students, institutional researchers, and staff from various college offices to organize the project. The team completed an agreement of partnership and participation that required the institution president's signature.

Each team conducted a basic analysis of institutional assets, strengths, and barriers to success on its campus. Some of the issues raised were specific to STEM-related departments; others concerned institution-wide practices. This baseline information helped teams—with support from IHEP staff and MRI consultants—develop projects specifically designed to address the most pressing challenges facing students of color in the STEM disciplines on each campus.

To equip teams with the skills and resources to engage in campus change work, IHEP coordinated a series of capacity-building workshops. One set of skills that is increasingly important to all postsecondary institutions is the ability to collect and use data to measure outcomes and demonstrate student success. Institutions are frequently asked by accrediting agencies, federal and state government agencies, and funding sources to measure their effectiveness in serving students. Using data is increasingly necessary not only for external validation and funding opportunities but also for internal analysis and decision making (Del Rios and Leegwater 2008). The workshops offered an introduction

BOX 1 PROFILES OF THE INSTITUTIONS

- **ALABAMA A&M UNIVERSITY**
  - Public HBCU
  - Normal, Alabama
  - Fall 2008 full-time (FT) undergraduate enrollment: 4,297
  - Fall 2008 STEM undergraduate enrollment: 1,468
- **NAVAJO TECHNICAL COLLEGE**
  - Public TCU
  - Crownpoint, New Mexico
  - Fall 2007 FT undergraduate enrollment: 367
- **NEW YORK CITY COLLEGE OF TECHNOLOGY**
  - Public HSI
  - Brooklyn, New York
  - Fall 2008 FT undergraduate enrollment: 14,272
  - Fall 2008 STEM undergraduate enrollment: 4,324
- **NORTHWEST INDIAN COLLEGE**
  - Public TCU
  - Bellingham, Washington
  - Fall 2007 FT undergraduate enrollment: 584
- **PAINE COLLEGE**
  - Private HBCU
  - Augusta, Georgia
  - Fall 2008 FT undergraduate enrollment: 863
  - Fall 2008 STEM undergraduate enrollment: 206
- **SOUTHWESTERN INDIAN POLYTECHNIC INSTITUTE**
  - Public TCU
  - Albuquerque, New Mexico
  - Fall 2007 FT undergraduate enrollment: 600
- **STILLMAN COLLEGE**
  - Private HBCU
  - Tuscaloosa, Alabama
  - Fall 2008 FT undergraduate enrollment: 1,049
  - Fall 2008 STEM undergraduate enrollment: 310
- **TEXAS A&M UNIVERSITY CORPUS CHRISTI**
  - Public HSI
  - Corpus Christi, Texas
  - Fall 2007 FT undergraduate enrollment: 6,719
  - Fall 2007 STEM undergraduate enrollment: 1,461
- **UNIVERSIDAD DEL TURABO**
  - Private HSI
  - Gurabo, Puerto Rico
  - Fall 2008 FT undergraduate enrollment: 12,462
  - Fall 2008 STEM undergraduate enrollment: 2,076

The most recently available data were used to generate these profiles. The MRI Team Survey reported total enrollment and STEM enrollment for the 2007–08 or 2008–09 academic year. All other data reflect total full-time enrollment from the 2007–08 academic year as reported to the Integrated Postsecondary Education Data System (IPEDS). STEM enrollment information is not available from IPEDS.

(Sources: U.S. Department of Education 2007; MRI Team Surveys 2008-09.)

> “BEING A PART OF THE IHEP MRI PROJECT HAS GARNERED GREAT RESPECT AND RECOGNITION FOR OUR EFORTS AT CITY TECH.”
>
> NEW YORK CITY COLLEGE OF TECHNOLOGY

on how to collect meaningful institutional data and suggested specific data points for STEM program improvement (appendix B). The teams later used these data to inform their institutional action plan development work at the national dissemination and replication conference, which occurred concurrently with the 2007 IHEP Summer Academy.[2]

A second set of workshops focused on STEM funding opportunities for institutions of higher education. The work that MRI teams hope to accomplish—such as building new facilities or hiring additional faculty—will require external funding. Discussions covered how to find grant opportunities and how to develop competitive proposals. A third set of workshops introduced MRI teams to powerful online tools—the IHEP WebCenter and the Science Diversity Center—that provided STEM resources and enhanced communication among project participants (see box 2).

MRI teams used the online resources and information from the workshops to prepare preliminary project plans for the national dissemination and replication conference at the IHEP Summer Academy. Teams were asked to select a narrowly focused project goal and to describe the type of assistance they needed to develop their plans further, the strategic importance of the project on their campus, and plans for project assessment.

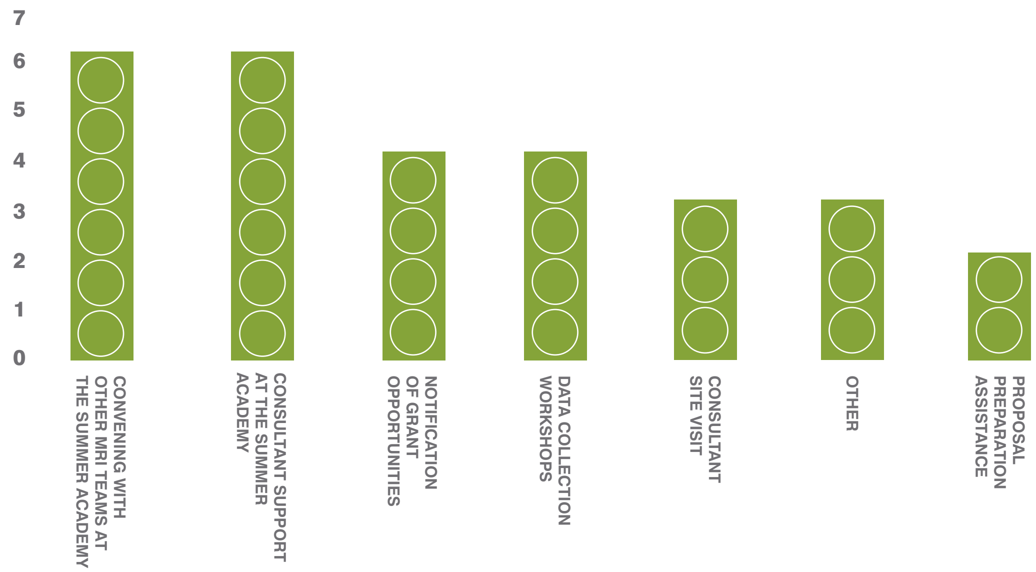
MRI funded a three-member team from each participating institution to attend the Summer Academy in 2007. Three institutions—New York City College of Technology, Alabama A&M University, and Stillman College—returned to the conference in 2008 with support from their institutions.

At the five-day Academy, the MRI campus teams addressed a wide variety of challenges inhibiting access and success for students of color, and developed goals and ideas into actionable plans. The event gave the teams time away from campus to learn from a host of workshop and plenary sessions, engage in strategic planning activities, collaborate with other MSIs engaged in similar projects, and receive one-on-one advising from their assigned consultants. Teams worked through daily assignments that focused on a particular topic; the assignments were designed to develop each stage of action planning. Workshops paid particular attention to promoting minority student success strategies; using data to inform decision making; and developing reliable assessment methods. Sessions dedicated to disseminating and replicating best practices in STEM education included offerings such as:

- “Recruiting, Engaging, and Retaining STEM Students in the First Two Years”;
- “STEM Transfer from, to, and among Minority-Serving Institutions”;

2 The Summer Academy is an annual gathering of college and university teams hosted by IHEP. Designed as a working conference, the Summer Academy is a forum for strategic conversations and action planning, institutional and cross-institutional teamwork, networking opportunities, tailored workshops and plenary sessions, and access to national leaders in higher education. For more information, go to www.ihep.org/summeracademy.cfm.

FIGURE 1 WHAT ASPECTS OF SUPPORT FROM THE MRI PROGRAM HAVE BEEN IMPORTANT FOR YOUR TEAM?



- "Using External and Internal Benchmarks for Data-Informed Decision Making in STEM"; and
- "Grant Writing for STEM Capacity Building."

By the end of the Summer Academy, each team had developed a plan of action that outlined specific implementation strategies to improve STEM recruitment, retention or graduation, as well as a time line and methods for assessing progress.

Back on their campuses, the MRI teams took several months to build broad-based buy-in for their plans and then began implementation. The MRI project arranged additional support for teams during this period through online collaboration and site visits from their consultants. Collaboration via the WebCenter and eMeetings using the Science Diversity Center allowed teams to discuss common challenges and successes as they built support among the MRI cohort. The site visits provided an opportunity to address early challenges to plan implementation, encourage buy-in from senior leadership on campus, and reevaluate the initial action plans.

Figure 1 shows which MRI project support activities were most useful to participating institutions.

BOX 2 **EXAMPLES OF ONLINE RESOURCES**

The **IHEP WebCenter** facilitates an online community by providing communication tools such as resource posting (including the MIE national report, MIE Factbooks, MIE Impact Study, and STEM data collection templates from Systemic Research); chats; program calendars; and listservs for many IHEP initiatives. It is an open-source environment that promotes collaboration among IHEP project participants to improve student access and success, and support ongoing institutional change.

The **Science Diversity Center** is designed to help federal agencies that fund STEM education initiatives share program information with potential grantees; serve as a tool for sharing strategies that address the nation's STEM workforce needs; and increase the participation of racially and ethnically underrepresented persons in the STEM disciplines. The center is also a hub for career and internship information for students. It is supported by the National Science Foundation and is available to the public (http://sciencediversitycenter.org).

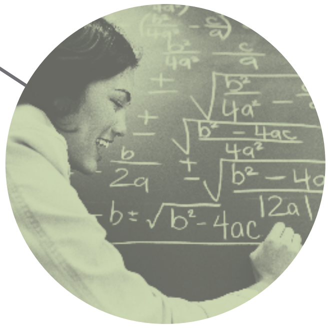
INDIVIDUAL MRI PROJECTS

As institutions went through the MRI replication process, they identified key challenges facing their campuses and developed targeted initiatives to facilitate improvement. MRIs concentrated on the component(s) of the MIE model that best fit their specific challenges. As a result, there is significant diversity among the projects. The following section provides a brief description of each of the MRI projects developed during the grant period of 2006–09.

ALABAMA A&M UNIVERSITY began planning and implementing a major retention program to increase the overall success and graduation rates of undergraduates majoring in STEM disciplines. Using institutional enrollment and persistence data, Alabama A&M identified critical retention shortfalls during the transition of STEM students from sophomore to junior year. The program identified key academic, social, economic, and personal barriers that hinder student success, particularly at this point of transition. Specific project objectives include expansion of the university's peer tutorial program, implementation of a supplemental instruction program, development of an evaluation instrument that provides adequate feedback, and securing necessary funding for program implementation. The retention program is being implemented institution-wide for freshman and for STEM majors at every level in conjunction with the university's Quality Enhancement Plan (QEP). A QEP is a strategic plan to enhance student learning outcomes and accomplish the mission of the institution (Commission on Colleges 2001). Alabama A&M is required by its regional accrediting body, the Southern Association of Colleges and Schools (SACS), to file a QEP and demonstrate progress toward meeting these goals. By tying its MRI project to the QEP, Alabama A&M built broad support and harnessed the motivation for change required by the accreditation process to improve student retention in STEM.

NAVAJO TECHNICAL COLLEGE worked to enhance academic excellence in STEM fields through a combination of active research and service learning methodologies that result in measurable improvements for Navajo communities. Plans for STEM curriculum development were integrated with economic and community development efforts. Plans were also made to implement service learning in all STEM classes. Navajo Tech has worked to establish partnerships in STEM fields with high schools throughout the Navajo Nation, as well as articulation agreements with baccalaureate degree—granting institutions in New Mexico, to ensure a stronger pathway for Navajo student success in STEM fields. The top priorities of the Navajo Tech MRI project are increasing overall STEM enrollment, enhancing online learning and information technology, and conducting better evaluations of current STEM programming.

NEW YORK CITY COLLEGE OF TECHNOLOGY (NYCCT) has worked to increase participation, retention, and graduation rates of Black and Latino students in STEM disciplines by raising academic expectations, prioritizing



specific learning outcomes, and providing role models to STEM students. To achieve these goals, NYCCT has targeted student support programs for first-year students, curriculum development for STEM gateway courses, and faculty development initiatives. The newly implemented Bridge to College Math summer program offers an intensive one-week review course in intermediate algebra for incoming freshmen who are planning to major in one of the STEM disciplines. The program is designed to bridge the gap between high school and college by providing students with the necessary tools to persist and succeed in the STEM fields. Regarding curriculum development, NYCCT has begun implementing a modular approach to mathematics and chemistry. The college has also integrated a peer-led team learning model of instruction, which emphasizes active learning in peer-led workshops for Pre-calculus, Fundamentals of Mathematics, College Algebra and Trigonometry, Calculus I, and Organic Chemistry I. The NYCCT team organized two large faculty development workshops to discuss strategies to create a culture of student success in the STEM disciplines. National experts in STEM course modularization and enhancing undergraduate research were recruited to make presentations at these workshops. The outcome of these efforts will be an improved passing rate for students in STEM gateway courses, increased student credit accumulation, and an increased number of students moving on to graduate school or work in STEM careers.

NORTHWEST INDIAN COLLEGE (NWIC) worked to develop an associate's of science degree program in computer science and a bachelor's of science degree program in electrical engineering and robotics, using a Native American-oriented approach and support system. The NWIC team developed a comprehensive Tribal Colleges and Universities Program (TCUP) proposal to secure external funding for the new programs. Although the TCUP proposal was not funded, the institution was successful in launching its first four-year degree in native environmental sciences. The team also began planning new math and reading programs that are tailored specifically to engineers and scientists, and are culturally relevant and content-oriented. A faculty development series will be implemented to help faculty teach the mathematics and reading competencies necessary for successful completion of science and engineering courses. Within five years, NWIC hopes to achieve high retention and graduation rates in the new STEM programs.

PAINE COLLEGE engaged in curriculum restructuring to enhance and strengthen the content, activities, laboratory exercises, and pedagogical methods in introductory and upper level STEM courses. The Division of Natural Sciences and Mathematics implemented a curriculum project in the introductory biology and mathematics courses to include more problem-based learning activities. A parallel course administration paradigm was used to determine whether an inquiry-based approach using real-world scenarios was more appropriate and useful for mathematics students than traditional teaching methods. Comparative data were collected and analyzed. The goals of this project include incorporation of more problem-based learning assignments

to facilitate the application of science and mathematical concepts; collaborative assignments; and the use of experiment-based laboratory exercises instead of the traditional "cookbook" assignments, so that students can develop strong critical thinking and analytical skills. These revisions are designed to increase retention from the freshman to sophomore years and will prepare students for upper level science and math courses. Faculty are currently implementing these curriculum revisions in College Algebra and Principles of Biology I.

STILLMAN COLLEGE developed steps to establish a Center of Academic Excellence by the year 2011. The purpose of the center is to increase the number of undergraduates who enter and complete STEM graduate programs. The proposed center will improve undergraduate research experiences, student retention, and students' standardized test-taking skills. Stillman aims to centralize, support, and improve undergraduate research experiences in STEM areas, and enhance student test-taking skills to improve their academic performance at both the undergraduate and graduate levels. Once the center is operational, its mission will expand to include academic support, research skills, life skills (e.g., study skills, time management), and career development (e.g., resume writing, professional etiquette) for students in all disciplines. The success of this project will be measured by retention and graduation rates, the number of students who participate in summer research programs or internships, and the number of graduates who go on to graduate or professional schools. Stillman is developing collaborative research internships with three regional graduate schools.

SOUTHWESTERN INDIAN POLYTECHNIC INSTITUTE (SIPI) developed an action plan to implement a comprehensive, student-focused STEM program that integrates classroom, residential, campus, and community life. SIPI plans to establish a residence hall for STEM students that will be a living learning community, with academic support services, mentoring, and STEM peer advisors. SIPI is also executing an enrollment management plan—coordinating recruitment and admissions processes, registration and financial aid processes, and the design of orientation programs to increase the enrollment and retention of STEM students in the critical first years of study. The effectiveness of these efforts will be measured by first semester GPA, gateway course passing rates, first-year retention rates, graduation rates, number of degrees and certificates awarded, and number of years to completion.

TEXAS A&M UNIVERSITY–CORPUS CHRISTI (TAMUCC) is working to establish a Center for Undergraduate Excellence that will support and encourage students by being a unique entry point into mentored research and internships, community outreach, workshops, and professional development activities. The center's goals will be to support and stimulate faculty-mentored undergraduate research and provide research-based labs in biology and chemistry. These initiatives will increase the university's retention and graduation rates, and the number of students matriculating into graduate degrees in science. The center will serve the campus at large by promoting academic success through a variety of student support services for STEM and non-STEM majors, connecting students to faculty through research and internships, and offering preparatory courses for graduate and professional school examinations. The TAMUCC team worked with senior campus leaders to build support for the center and secure its inclusion into a campus-wide Quality Enhancement Program (QEP) for reaccreditation efforts. Although the center was not ultimately included in the QEP, the team continues to pursue the initiative through other channels.

UNIVERSIDAD DEL TURABO created a student support center known as the Hispanic Opportunities Program in Engineering and Sciences (HOPES). The center promotes the use of and access to technology, offers learning skills seminars, and coordinates mentoring for students in the STEM disciplines. It is also a resource for undergraduate research internships, and helps students enhance their basic research skills and improve their scientific writing and presentation skills in English. Graduate students coordinate the activities of the center, and upper division undergraduates serve as tutors. The Office for Freshman and Sophomore Retention works closely with HOPES to identify students in need of assistance in math and science, and refer them to the center. Universidad del Turabo maintains ongoing assessment measures to track the effects of the center's additional student support services on retention rates of students majoring in science, technology, engineering, and math.

THE MIE MODEL IN PRACTICE

The institutions that pioneered the MIE model enjoyed significant increases in STEM enrollment, the number of undergraduate degrees conferred, and the proportion of degrees that were awarded in STEM disciplines. This section describes how the seven components of the MIE model can be operationalized to achieve similar results at various sites. The MRIs employed a number of strategies to implement some or all of the components of the model. By disseminating some of the steps MRIs took to improve underrepresented minority student achievement in STEM, this report highlights ways other institutions might replicate the MIE model on their campuses.

Most of the MRIs were already engaged in many activities to improve their STEM programs, with funding from a variety of internal sources, private foundations, and state and federal agencies. Some of the activities listed below are not directly tied to the MRI project; however, all of them highlight strategies consistent with the MIE model.

MIE MODEL COMPONENT #1: PRECOLLEGE INITIATIVES AND RECRUITMENT

This component focuses on activities that prepare matriculating students to succeed in college and that introduce students to STEM disciplines and careers. For example:

- New York City College of Technology developed the Bridge to College Math and College Now summer bridge programs, which allow students to take college courses or developmental courses in advance of their first semester.
- Northwest Indian College organizes visits to local high schools and performs demonstrations of robotics and other examples of electronics.
- Universidad del Turabo facilitates a program called GeoExplorers, which introduces high school students to careers related to the National Oceanic and Atmospheric Administration, environmental science and research, and environmental business. The program is a collaboration among several institutions of higher education, the Puerto Rico Department of Natural Resources and Environment, and the Puerto Rico Department of Education.

MIE MODEL COMPONENT #2: STUDENT DEVELOPMENT AND SUPPORT

This component focuses on social, financial, and academic assistance to students. Many of the MRIs, including these, targeted this aspect of the model:

- Alabama A&M University offers supplemental instruction in math courses with historically high withdrawal/failure rates. It leverages resources from TRIO programming and taps the Office of Retention and Academic Support to provide peer tutoring and workshops.
- New York City College of Technology runs the STEM Success Program. Participants receive mentoring from STEM faculty and, in turn, mentor middle school

"THE MIE MODEL RECOGNIZES THE IMPORTANCE OF ENABLING STUDENTS TO BECOME DIRECTLY INVOLVED IN RESEARCH."

students. Students also participate in field trips, internships, and cultural activities.

- Paine College provides financial aid to STEM students through the Louis Stokes Alliance for Minority Participation (LSAMP) grant and the Presidential Scholarship program. The college's Division of Natural Sciences and Mathematics Learning Circles Project creates small, diverse communities of students and faculty who have frequent contact to increase motivation and collaborative learning.
- Universidad del Turabo initiated a unique student support center to meet the needs of STEM students. The center offers STEM tutoring and mentoring, computers, and reference materials. Graduate students facilitate services at the center, and faculty use the space to meet with students in small groups for study sessions. The Office for Freshman and Sophomore Retention identifies students in need of assistance in math and science, and refers them to the appropriate support center.

MIE MODEL COMPONENT #3: UNDERGRADUATE RESEARCH AND PROFESSIONAL TRAINING

The MIE model recognizes the importance of enabling students to become directly involved in research. Several MRIs provide such opportunities:

- Northwest Indian College provides research opportunities for students through its new four-year degree program in native environmental science. It also partners with other local postsecondary institutions to expand student research opportunities and facilities.
- Paine College requires biology and chemistry majors to conduct an original experimental research investigation, make an oral presentation of their findings, and write a formal report. Faculty committees provide guidance and support.
- Stillman College leverages the Alabama LSAMP grant to support research opportunities for students and financial assistance to students majoring in STEM fields. The college also supports external research opportunities for students by convening Science Blast Day, which allows science majors who participated in summer research internships and enrichment programs to present their work to faculty, staff, and other students.
- Texas A&M University–Corpus Christi provides research opportunities through the Undergraduate Mentoring in Environmental Biology program and the Research Experiences for Undergraduates program. Additional institutional discretionary funds are dedicated to undergraduate research stipends for students. Undergraduate research programs include seminars and professional skills development, and emphasize presentations at local, state, and national meetings.

MIE MODEL COMPONENT #4: FACULTY DEVELOPMENT AND ENHANCEMENT

Another important facet of the model is the recruitment, retention, and professional development of faculty. For example:

- Alabama A&M University hired three instructors to strengthen its mathematics faculty.
- New York City College of Technology's MRI team

organized two large faculty development workshops to discuss strategies to create a culture of student success in the STEM disciplines. The college recruited national experts in STEM course modularization and enhancing undergraduate research to make presentations at the workshops.

- Texas A&M-Corpus Christi provides startup funds for new faculty members to begin research programs and supports faculty participation in “Write Winning Grants” seminars both on and off campus.
- Universidad del Turabo encourages and sponsors faculty members who hold a master’s degree in a STEM field to pursue a doctorate.

MIE MODEL COMPONENT #5: CURRICULUM DEVELOPMENT

The model demonstrates the importance of aligning curriculum with accepted content standards and developing courses that are relevant to the marketplace, the community, and the student population. Many of the MRIs pursued these goals, including:

- Alabama A&M University is reviewing STEM curricula, using faculty recommendations collected via committees and surveys to streamline biology courses and develop new math courses. Course offerings include more student research and address STEM market demands.
- New York City College of Technology is implementing a modular approach to mathematics and chemistry. The college is also integrating a peer-led team learning model of instruction, which emphasizes active learning in peer-led workshops for Pre-calculus, Fundamentals of Mathematics, College Algebra and Trigonometry, Calculus I, and Organic Chemistry I.
- Paine College’s Division of Natural Sciences and Mathematics implemented a curriculum project in introductory biology and math courses to increase freshman-to-sophomore-year retention and prepare students for upper level STEM courses. The courses include more problem-based/inquiry-based learning activities and more collaborative assignments.

MIE MODEL COMPONENT #6: PHYSICAL INFRASTRUCTURE DEVELOPMENT AND RENOVATION

For most of the MRIs, upgrading and maintaining facilities and equipment is essential for student success and institutional effectiveness. For example:

- Alabama A&M University is seeking additional space for mathematics faculty and additional funding to update heating and cooling systems in STEM facilities.
- Northwest Indian College is undertaking a major infrastructure project, including its first student housing facilities, new student classrooms and faculty office facilities, child care facilities, and traditional longhouse facilities. It is also expanding library facilities and enhancing technology resources for research.
- Stillman College secured external funding to purchase computer equipment and software to increase the use of technology in physics, especially in lab courses.

- Texas A&M University–Corpus Christi secured external funding to purchase various laboratory instruments, including a DNA analyzer, ultracentrifuge, and lyophilizing system.

MIE MODEL COMPONENT #7: GRADUATE SCHOOL AND SCIENCE CAREER PREPARATION

Finally, many of the MRIs are implementing activities designed to facilitate admission and retention in STEM graduate programs or careers. These activities include the following:

- Alabama A&M University facilitates a lecture series with STEM career professionals. The university is also developing collaboration agreements with STEM career partners, including Northrup Grumman Corporation and Siemens.
- Paine College's Pre-Professional Science Program in the Division of Natural Sciences and Mathematics facilitates workshops on standardized test preparation, graduate and professional school applications, and writing scientific resumes and personal statements. The college has also established partnerships with medical and nursing facilities to provide academic enhancement and clinical shadowing opportunities for STEM students.
- Texas A&M University–Corpus Christi requires biology and chemistry students to take a professional skills course in order to graduate.

"MANY OF THE MRIS ARE IMPLEMENTING ACTIVITIES DESIGNED TO FACILITATE ADMISSION AND RETENTION IN STEM GRADUATE PROGRAMS OR CAREERS."

LESSONS FROM THE MRI PROJECT

The MRI project sought to be a national capacity-building initiative and a catalyst for a national dialogue on STEM achievement among underrepresented minority students. MRI teams took on the challenge of expanding the pool of successful graduates in the STEM disciplines in their institutions by implementing comprehensive, well-articulated strategic imperatives based on the MIE model. Each MRI team spent a considerable amount of time studying the MIE model and identifying one or more of the seven elements that were already in place on their campuses. Because replicating all seven elements of the model would be an ambitious task and an expensive proposition, each MRI team has opted to enhance the element(s) that has/have the highest potential for implementation on its campus.

Meaningful change in STEM programming takes time, commitment, and resources, but many lessons have already been learned. The following section offers an analysis of survey information collected from the institutions regarding replication, assessment, evidence of success, and steps for long-term change. The MRI lessons offer replicable pathways for other institutions to join the national imperative to improve STEM education.

REPLICATION AND LESSONS LEARNED

The MRI project helped institutions adopt and adapt best practices in STEM education. Participating institutions believed that similar institutions could learn important lessons from their experiences. Without exception, the MRIs expressed willingness to work with other institutions; most are already planning for the next wave of replication and collaborative activities with other Minority Serving Institutions, primarily in adjacent areas.

Three keys to successful replication are (1) improving pedagogical approaches, (2) understanding new student development perspectives, and (3) enhancing communication to build a community.

IMPROVING PEDAGOGICAL APPROACHES

"Pedagogical approaches" refers broadly to both formal and informal interventions inside and outside the classroom that support student learning. For example, mentoring, counseling, and academic advising are all critical to the academic success of minority students in STEM disciplines. The Universidad del Turabo's student center is an example of the efficacy of out-of-class student support. New York City College of Technology demonstrated that tutoring—peer or otherwise—in STEM disciplines is also necessary to student learning. Such approaches can compensate for poor pedagogical practices and low expectations for minority student ability and performance that creates impediments to success in these disciplines.

With regard to substantive content, mathematics is often the biggest academic hindrance to success in STEM disciplines. Addressing the problem simultaneously on different fronts is an effective strategy; for example, redesigning or modularizing courses and promoting student-centered teaching strategies. Paine College has indicated its willingness to share lessons learned regarding the implementation of inquiry-based activities in STEM gateway courses—specifically, Introductory Biology and College Algebra—with limited funding resources.

Enabling students to conduct research with a caring professor is an excellent way for mentors to build relationships and provide encouragement, as well as professional and academic support. Internships are also an excellent means of increasing exposure to STEM fields. The earlier in their academic journey that students are exposed to and engaged in these disciplines, the more successful they will be.

STUDENT DEVELOPMENT

The MRIs understand that the plight of their Black, Hispanic, and Native American students in STEM disciplines is worse than commonly perceived. Minority students at participating MRIs are as motivated to learn and succeed as anyone else, but as the MRI activities unfolded it became obvious that not everyone at these institutions was eager to increase the access and the success of minority and low-income students. Thus, building community emerged as a theme in student development. As one MRI participant stated,

> "Student scholars need to have a sense of community. They need to see the relevance of their scholarship to community enhancement and nation building. This enables the students to believe in a cause that is bigger than themselves. In turn, this can provide the impetus they need to get to the next level."

A sense of community also matters because minority students, particularly males, often need a vision, hope, and a support group that believes in and encourages them. The MRIs recognized that these students need a space on campus to call home, so they can get involved in peer-assisted learning programs and build their own learning communities. Service to the community can also be engaging, rewarding, and stimulating for students, and should be encouraged. Community (e.g., a sense of place, home, neighborhood) support may be as critical as college support in STEM success. Finally, awareness of career opportunities, scholarships, and graduate school is vital to keep students focused; holistic approaches build interest and motivation in the STEM disciplines.

Exposure to Blacks, Hispanics, and Native Americans who are successful in STEM professions is important to the success of students of color. Institutions should make efforts to expose these students to direct contact with STEM professionals and STEM workplace activities. Connecting with academically successful Black, Hispanic, and Native American role models—in or outside STEM disciplines—can also be very encouraging for these students.

COMMUNICATION AND CONTRIBUTORS TO PROGRAM SUCCESS

One MRI participant posited, “Perhaps the greatest lesson we have learned is in regard to using technology to better communicate with, mentor, and provide instruction to our students. By using technologies other than traditional email and Blackboard—such as Facebook, for example—we are seeing greater use of student support services, an increase in students' knowledge of available services, and a greater satisfaction among students about how they perceive our institution.” Social media and online tools are being used for instruction and as mentoring, advising, and recruiting tools. They enable an MRI to create a 24-7 service to students with no cost increase. The expanded use of technology has had a particularly large impact at institutions with large commuter populations and distance learning programs.

REQUIREMENTS FOR REPLICATION

Analysis of MRIs revealed several common approaches to improve pedagogy, student development, and communication. Additionally, certain basic requirements were identified to ensure successful replication of the MIE model. The following are essential for replication:

1. Faculty and administrative buy-in
2. STEM data collection and assessment
3. Financial support of faculty research
4. Involving students in undergraduate research
5. Enabling students to do research projects at the home institution and during the summer at a research-intensive institution in another city or state
6. Nurturing/mentoring students to increase their self-confidence

The first two requirements—buy-in and assessment—are the most important and are discussed more fully below.

FACULTY AND ADMINISTRATIVE BUY-IN

MRI teams understand that administrative buy-in at the provost or vice chancellor level is fundamental for success. Without the participation of a central administration figure, the long-term sustainability of the project can be in jeopardy.

But even when senior administrators support the new initiatives, buy-in across the campus community can be less than enthusiastic. STEM students must complete many course credits outside STEM disciplines to earn an undergraduate degree, and many non-STEM majors take STEM courses. Proponents of change in the STEM disciplines must remember that any changes in the academic curriculum will have a campus-wide impact and will often require additional project activities (e.g., faculty and staff development) to support faculty, staff, and students to ensure the success of the project.

Academic advisors and mentors of non-STEM majors should be kept abreast of proposed changes in STEM course requirements and content, new technologies, and methodological revisions to help them effectively guide their advisees. Also, all faculty must become advocates and supporters of proposed STEM transitional programs. A lack of open communication and outreach can result in failure to obtain campus-wide support.

With regard to support initiatives outside the classroom (e.g., learning centers, centers of academic excellence, mentoring, tutorials, first-year experience programs),

> “THE MRI TEAMS PERCEIVE ASSESSMENT NOT JUST AS SUMMATIVE BUT ALSO AS A FORMATIVE OPPORTUNITY TO GAUGE PROGRESS AND MAKE INFORMED DECISIONS ON AN ANNUAL BASIS.”

it must be clear to the entire campus which students these initiatives are intended to serve—all students, students in certain departments, or those with particular learning needs. Lines of communication must be open and clear in the planning stages of initiatives, and planning should involve a broad base of participants. If the initiatives are aimed at the entire campus community, early planning should involve all levels of the academic family. Letters of support from on- and off-campus organizations can be helpful.

ASSESSMENT

The MRI teams have used a variety of qualitative and quantitative methodologies to assess STEM achievement. Many are using internally developed surveys to measure student progress and STEM career and graduate school activities, and to evaluate faculty. Some rely on national assessment tools, including the National Survey of Student Engagement (NSSE), the Measure of Academic Proficiency and Progress (MAPP), and the Cooperative Institutional Research Program (CIRP). A number of teams expressed a desire to improve data collection capacities specific to the STEM disciplines, so they can determine exactly when and why students transfer to non-STEM majors, drop out, or stop out.

Most MRIs identified the key indicators they use to measure the impact of the implemented elements of the MIE model. These indicators include size of the entering STEM student cohort, overall STEM student enrollment, and six-year graduation rates of first-time/full-time STEM students. Institutions with a significant nontraditional student population or limited institutional data resources may also use the number of participating students, hours per week dedicated to studying, credit hours attempted and completed, and number of years to degree completion. The MRI teams perceive assessment not just as summative but also as a formative opportunity to gauge progress and make informed decisions on an annual basis. As evaluation methods become more sophisticated, MRI teams will be able to tune expectations, adjust time lines, and revise goals on the basis of hard evidence.

Finally, evaluation instruments that include prefunding baseline information and periodic monitoring throughout the duration of the project play an important role in long-term sustainability. In developing a project, institutions should explore the “whats” and “whys” of evaluation and discuss how they will use evaluation results for decision making to support sustaining or institutionalizing the project. Institutions should incorporate comprehensive formative and summative evaluation in the project, and use collected data to identify ways to improve the evaluation and the evaluation process.

SUSTAINABILITY AND INSTITUTIONALIZATION FOR LONG-TERM CHANGE

The bottom line for any project is the availability of funding support.This is a primary issue confronting MRI implementation. But although financial resources matter, MRI success has not been built with a great infusion of funding but rather on the intent and commitment of a group of dedicated leaders—administrators, faculty, staff, and students who share a common vision to adopt and adapt the MIE best practices.

The teams recognize the need to secure external funds to enhance recognition of the effort and leverage internal support. A viable strategy is to seek funds from federal programs aimed at broadening participation in STEM disciplines. A strong funding proposal will demonstrate a broad impact on the entire campus community rather than a narrowly focused program and will cite support from the various communities in the institution—faculty, students, administrators, and alumni. Institutional support can be garnered through an internal advisory committee that represents all elements of the campus community. A successful program will provide leverage for requesting more funding from new sources.

“Sustainability” refers to the process of maintaining the project by providing it with the resources necessary to survive; “institutionalization” requires the institution to incorporate the major project activities in its ongoing operations and processes. In the latter, the project becomes part of the structure of the institution. Institutionalization requires fundamental changes to the system.

The accreditation process emerged among the MRIs as a driving force in implementing and sustaining MIE model elements. Accreditation is an external process that introduces a campus-wide discussion of student success and can significantly accelerate efforts in that direction. It also promotes the development of quality enhancement plans that, if properly implemented, can refocus campus culture on student-centered learning and success.

Both processes—sustainability and institutionalization—are critical for long-term success. Project sustainability and institutionalization efforts require discussions and concrete strategies regarding how, where, who, and what. For instance, how will funds be obtained to continue the project? Where can these funds be obtained? Who will make these efforts? What structures and routines will have to be modified to accommodate the initiatives? All these questions should be considered and answered in the project planning stages. The same questions should be revisited as the project is implemented, because complex changes to institutional practice require ongoing adaptation to unanticipated challenges or opportunities.

"MRI SUCCESS HAS NOT BEEN BUILT WITH A GREAT INFUSION OF FUNDING BUT RATHER ON THE INTENT AND COMMITMENT OF A GROUP OF DEDICATED LEADERS—ADMINISTRATORS, FACULTY, STAFF, AND STUDENTS WHO SHARE A COMMON VISION TO ADOPT AND ADAPT THE MIE BEST PRACTICES."

RECOMMENDATIONS

There is no single solution to the problem of underrepresentation of minority students in STEM disciplines, but the Model Institutions of Excellence (MIE) model offers numerous approaches to improve recruitment, retention, graduation, and matriculation into STEM graduate programs or careers. The ability to creatively adapt and respond to the specific needs and circumstances of an institution is essential to replicating the MIE model. The seven-component model represents a comprehensive set of essential elements to facilitate STEM educational improvement, but the MRI experience revealed that it is not necessary to implement all components simultaneously—they can be phased in over a number of years. Factors such as limited funding, institutional context and culture, and urgent needs shape the choice of which component is addressed first; and the MRIs have applied the model in myriad creative ways to accommodate practical differences among institutions, campus advocates or detractors, or funding opportunities (Ewell 2002).

Bringing successful STEM education to scale requires concerted action by higher education stakeholders at many levels. Institutions, private foundations, researchers, and state and federal entities can take the following actions to made broad improvements in the quality, quantity, and diversity of the STEM pipeline.

1. INSTITUTIONS MUST INVEST IN BUILDING INSTITUTIONAL DATA CAPACITY. Building institutional data capacity is critical for Minority Serving Institutions. The importance of assessments and data-informed change was noted repeatedly by consultants, staff, and the MRIs. MRIs relied on data to make important decisions with regard to selecting areas of institutional concern, informing project planning, targeting specific student populations, evaluating progress, developing funding proposals, and documenting and sharing outcomes. Unfortunately, many MSIs have limited capacity to track or generate meaningful institutional data. Most MSIs—especially Tribal Colleges and Universities—require substantial investments in technology and staff in their research and assessment offices to improve their data-informed decision-making capacity.

2. INSTITUTIONS SHOULD STRENGTHEN MATHEMATICS PREPARATION THROUGH K–12 PARTNERSHIPS AND IMPROVED DEVELOPMENTAL COURSES. For many underrepresented minority and low-income students, inadequate mathematics preparation at the middle and high school levels is one of the greatest barriers to success in the STEM disciplines. Institutions should build better links with K–12 partners to address this deficit. For example, institutions could initiate teacher-faculty collaborative professional development opportunities and summer bridge programming focused on mathematics needs. Institutions should also revisit traditional approaches to developmental mathematics and experiment with alternative approaches, such as accelerated or modularized courses.

> “THE ABILITY TO CREATIVELY ADAPT AND RESPOND TO THE SPECIFIC NEEDS AND CIRCUMSTANCES OF AN INSTITUTION IS ESSENTIAL TO REPLICATING THE MIE MODEL.”

3. HIGHER EDUCATION RESEARCHERS SHOULD INVESTIGATE THE LONG-TERM EFFECTS OF THE MIE PROGRAM AND THE MRI PROJECT. Additional research should be conducted to track the continued progress of the MRIs and others—including the original MIE institutions—in implementing the MIE model. A follow-up study is necessary to glean more information about the long-term impact of the MIE model on (1) improved entry and retention rates in the STEM disciplines, (2) improved STEM degree completion rates, and (3) matriculation into the STEM workforce or graduate school.

4. STATE SYSTEMS SHOULD PROVIDE OPPORTUNITIES FOR INSTITUTIONS TO SHARE BEST PRACTICES. The MRIs indicated that convening at the Summer Academy with other institutions that are trying to improve STEM education for underrepresented minorities was one of the most beneficial aspects of the project. State systems have both the authority and the resources to convene institutions on a regular basis to promote cross-fertilization of successful initiatives.

5. FOUNDATIONS, CORPORATIONS, AND THE FEDERAL GOVERNMENT MUST INVEST IN STEM RESEARCH CAPACITIES AT MSIS. Additional support from foundations, corporations, and the federal government via Title III and Title V funding, the National Science Foundation, the National Aeronautics and Space Administration, and other agencies is needed to improve STEM research capacities at MSIs. MSIs are chronically underfunded and face particularly difficult capacity challenges in STEM education because of the high cost of research equipment, laboratory facilities, and supplies. The MRI project substantiated the belief that enabling students to conduct research with faculty members improves engagement and encourages success in STEM disciplines, but many MSIs are unable to support substantive research projects for the majority of their students. In fact, many MSIs rely on neighboring institutions or send students to Tier 1 universities during the summer to obtain research experience. Investments to improve research capacities at MSIs would expand access to high-quality research experience to more underrepresented minority students.

Strategic investments in STEM education, such as the MRI project, can have a tremendous effect on halting the erosion of U.S. preeminence in the science and technology marketplace. Faced with pressing national priorities in the STEM fields and chronic racial gaps in postsecondary achievement, the nation must make educational success for minority students a priority. This report has described the important role MSIs can play in targeting underrepresented populations and addressing STEM workforce needs. The nine MRIs that replicated the MIE model to improve recruitment, student support, curriculum, and preparation for STEM graduate programs and careers provided valuable findings about the model’s transferability. Their successful replication of the MIE model can encourage and guide other MSIs interested in improving their STEM programs. It is important to increase STEM capacity at MSIs and build on the lessons learned from the MRI project to recruit, support, and prepare students to succeed in this pressing area of national need.

APPENDIX A

MRI PARTNERS

MRI CONSULTANTS

Juan Arratia, director and principal investigator for the Model Institutions for Excellence (MIE) project, Universidad Metropolitana

Benjamin Flores, professor of electrical and computer engineering, University of Texas at El Paso

Tanya McKinney, former professor of biology, Xavier University of Louisiana

Carlos Rodriguez, principal research analyst, American Institutes of Research

Albert Thompson Jr., professor of chemistry, Spelman College

MRI COLLABORATORS AND ADVISORS

Linda Crasco, executive director, Systemic Research, Inc.

Elaine J. Davis, associate professor of biology, Bowie State University

Stacy Phelps, chair, Department of Math and Science, Oglala Lakota College

Tony Leiva, former director of capacity-building initiatives, Hispanic Association of Colleges and Universities

Carrie Billy, president and CEO, American Indian Higher Education Consortium (AIHEC)

Lezli Baskerville, president and CEO, National Association for Equal Opportunity in Higher Education (NAFEO)

Antonio Flores, president and CEO, Hispanic Association of Colleges and Universities (HACU)

ORGANIZATIONAL PARTNERS

The Institute for Higher Education Policy managed the MRI project, with guidance from the Alliance for Equity in Higher Education and informed by studies from the American Institutes of Research and Systemic Research, Inc. The following are brief descriptions of these valuable partners.

Alliance for Equity in Higher Education, established in 1999, is a coalition of the three major associations for Minority Serving Institutions (MSIs), coordinated by the Institute for Higher Education Policy. The organizations that make up the alliance include the American Indian Higher Education Consortium (AIHEC), the Hispanic Association of Colleges and Universities (HACU), and the National Association for Equal Opportunity in Higher Education (NAFEO). The Alliance helped nominate and evaluate candidates to participate in the MRI project.

The American Indian Higher Education Consortium (AIHEC) was founded in 1972 by the presidents of the first six TCUs. AIHEC has grown to represent 34 colleges in the United States and one Canadian institution. AIHEC's mission identifies four objectives: (1) maintain commonly held standards of quality in American Indian education, (2) support the development of new tribally controlled colleges, (3) promote and assist in the development of legislation to support American Indian higher education, and (4) encourage greater participation by American Indians in the development of higher education policy. (www.AIHEC.org)

The Hispanic Association for Colleges and Universities (HACU) was established in 1986 with a membership of 18 institutions; currently, it represents 224 Hispanic Serving Institutions (HSIs) in 14 states and Puerto Rico. HACU's mission states three objectives: (1) to promote the development of member colleges and universities; (2) to improve access to and the quality of postsecondary educational opportunities for Hispanic students; and (3) to meet the needs of business, industry, and government through the development and sharing of resources, information, and expertise. (www.HACU.net)

The National Association for Equal Opportunity in Higher Education (NAFEO) was founded in 1969 as the professional association of the presidents and chancellors of the nation's Historically Black Colleges and Universities (HBCUs) and Predominantly Black Institutions (PBIs); currently, it represents 116 institutions. Its mission is to champion the interests of HBCUs and PBIs with the executive, legislative, regulatory, and judicial branches of federal and state government, and with corporations, foundations, associations, and non-government organizations; provide services to NAFEO members; build the capacity of HBCUs and their executives, administrators, faculty, staff, and students; and serve as an international voice and advocate for the preservation and enhancement of HBCUs and PBIs and for Blacks in higher education. (www.NAFEO.org)

American Institutes of Research (AIR). In 2005, the AIR produced a study to document the impact of MIE. By combining quantitative and qualitative approaches, AIR identified and described the seven-component MIE model. This is the model for replication at other MSIs.

Systemic Research, Inc., synthesized and produced numerous quantitative reports during the MIE program. In collaboration with the institutional research offices of the MIE schools, Systemic Research helped those schools paint a picture of the trends in areas such as student enrollment, student retention, degrees earned, faculty hiring, student research, and the pursuit of graduate degrees.

APPENDIX B

MRI TEAM ASSIGNMENT: INTRODUCTORY STEM DATA COLLECTION

Data collection is essential to institutional change. To equip teams with the skills and resources to engage in campus change work, IHEP asked each team to collect and use data to measure outcomes and demonstrate student success. As part of the technical assistance offered through the MRI program, IHEP offered an introductory look at how to collect meaningful institutional data and suggested specific data points that might inform STEM program improvement. Teams later used these data to inform their MRI action plan.

MRI teams were asked to gather the following data:

- Number of students enrolled in STEM majors by race/ethnicity, gender, and major (e.g., chemistry, mathematics). (This is declared majors, not courses.)
- Number of STEM degrees conferred by race/ethnicity, gender, and major.
- Retention rates for STEM majors (or institution-wide if retention rates of STEM majors not available)
- Enrollment in and successful completion (grade C or above) of STEM gateway courses
- Time to graduation by program of study.

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IHEP

INSTITUTE FOR HIGHER EDUCATION POLICY
1320 19TH STREET, NW, SUITE 400
WASHINGTON, DC 20036
202 861 8227 **TELEPHONE**
202 861 9307 **FACSIMILE**
www.ihep.org **WEB**

The Institute for Higher Education Policy (IHEP) is an independent, nonprofit organization that is dedicated to access and success in postsecondary education around the world. Established in 1993, the Washington, D.C.-based organization uses unique research and innovative programs to inform key decision makers who shape public policy and support economic and social development. IHEP's Web site, www.ihep.org, features an expansive collection of higher education information available free of charge and provides access to some of the most respected professionals in the fields of public policy and research.

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