



# DIVERSIFYING THE STEM PIPELINE

## RECOMMENDATIONS FROM THE MODEL REPLICATION INSTITUTIONS PROGRAM

**Launched in 2006 to address issues of national competitiveness and equity in science, technology, engineering, and mathematics (STEM) fields, the National Science Foundation-funded Model Replication Institutions (MRI) program sought to improve the quality, availability, and diversity of STEM education. The project offered technical assistance to replicate and disseminate the findings of successful NSF initiatives at Minority-Serving Institutions (MSIs).**

In particular, MRI builds on best practices in STEM undergraduate education identified by the National Science Foundation initiative Model Institutions of Excellence (MIE). In collaboration with the National Aeronautics and Space Administration, this 11-year-old program has developed an effective approach to increasing STEM degrees by identifying and building the necessary components of STEM infrastructure at MSIs. Through MRI, nine MSIs replicated aspects of the Model Institutions of Excellence model to improve their STEM programs. Critical infrastructure components of the model include:

- **PRECOLLEGE INITIATIVES.** Prepare matriculating students to succeed in college and introduce students to STEM disciplines and careers.
- **STUDENT SUPPORT.** Provide social, financial, and academic assistance to students.
- **UNDERGRADUATE RESEARCH.** Enable students to become directly involved in ongoing research.
- **FACULTY DEVELOPMENT.** Support recruitment, retention, and professional development of STEM faculty.
- **CURRICULUM DEVELOPMENT.** Align curricula with accepted content standards and concepts relevant to the marketplace, the community, and the student population.
- **PHYSICAL INFRASTRUCTURE.** Upgrade and maintain facilities and equipment.
- **GRADUATE PROGRAM AND SCIENCE CAREER INITIATIVES.** Facilitate admission to and retention in STEM graduate programs and careers.

The following recommendations are based on their experience in adapting the model to support their STEM goals and may be instructive for other institutions engaged in similar work.

### RECOMMENDATIONS

There is no single solution to the problem of underrepresentation of minority students in STEM disciplines, but the MIE model offers numerous approaches to improve recruitment, retention, graduation, and matriculation into STEM graduate programs or careers. The seven-component MIE 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.

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.**

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.



- MSIs—especially Tribal Colleges and Universities (TCUs)—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 develop better links with K–12 partners to address this deficit.
- Institutions should also revisit traditional approaches to developmental mathematics and experiment with alternative approaches, such as accelerated or modularized courses.

## 3. HIGHER EDUCATION RESEARCHERS SHOULD INVESTIGATE THE LONG-TERM EFFECTS OF THE MIE PROGRAM AND THE MRI PROJECT.

- Additional research is needed 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 meeting 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 should 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.
- In addition, additional resources are needed to support undergraduate research opportunities at MSIs.

Strategic investments in STEM education, such as the MRI project, can have a tremendous effect on increasing the number of minority students in the STEM disciplines. 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. 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.

**For more information about the Model Replication Institutions project please contact IHEP's Programs department. Components of the MIE Model are outlined, in full, in the American Institutes of Research report, *Creating and Maintaining Excellence: The Model Institutions for Excellence Program*. If you are a reporter seeking media opportunities, please contact IHEP's Communications & Marketing department at 202 861 8223 or [communications@ihep.org](mailto:communications@ihep.org).**

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