Creating a Critical Mass for Change in STEM Participation

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Introduction to Prosperity Games™

Prosperity Games™ are fast-paced, interactive simulations designed to meet challenges in industries, communities, organizations, and national sectors by helping to create and sustain productive change. In these events, players plan and construct strategies and implement these through negotiation, joint ventures, alliances, policy setting, and resource development.

Players are organized into teams, representing a network of diverse stakeholder groups within a system. The “Rest of the World” (ROW) team helps maintain the momentum of the play while being available to represent any stakeholder group not actually present. The tightly packed agenda keeps action moving, while players explore cooperation and confrontation in a setting where many strategies are underway simultaneously.

Games provide a place and process in which
• you can experience current realities and construct alternative futures in a safe learning environment;
• you can engage in long-range planning and interaction; and
• you can model the complex world of values, actions, and communication.

Games enable you to
• develop teamwork;
• view the whole system at once;
• manage conflict productively;
• create long-term strategies and actions; and
• learn about human relations, community building, and collaboration.

Gaming has been used successfully in many planning arenas, including
• Tribal College and University technology;
• water quality;
• imaging industry;
• industrial ecology;
• critical United States infrastructure; and
• bio-medical development and health care.
The Game at a Glance

<table>
<thead>
<tr>
<th>February 3, 2014</th>
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<tbody>
<tr>
<td>8:00 am \textit{Registration and Continental Breakfast}</td>
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<tr>
<td>9:00 am \textit{Welcome and Inbriefing}</td>
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<tr>
<td>9:30 am \textit{Team Meeting}</td>
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<td>11:00 am \textit{Elevator Speech}</td>
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<tr>
<td>11:15 am \textit{Team Meeting}</td>
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<tr>
<td>noon \textit{Lunch}</td>
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<tr>
<td>1:00 pm \textit{Interact in the System}</td>
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<td>2:00 pm \textit{Team Meeting}</td>
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<tr>
<td>3:30 pm \textit{Guided Tour}</td>
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<tr>
<td>4:30 pm \textit{Team Meeting}</td>
</tr>
<tr>
<td>5:30 pm \textit{Voting}</td>
</tr>
<tr>
<td>6:00–8:00 pm \textit{Dinner}</td>
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<tr>
<th>February 4, 2014</th>
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<tbody>
<tr>
<td>8:00 am \textit{Continental Breakfast}</td>
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<tr>
<td>9:00 am \textit{Opening and ROW Reflections}</td>
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<tr>
<td>9:30 am \textit{Team Meeting}</td>
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<tr>
<td>10:00 am \textit{Elevator Speech}</td>
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<tr>
<td>10:30 am \textit{Team Meeting}</td>
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<tr>
<td>11:30 am \textit{Interact in the System}</td>
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<tr>
<td>12:30 pm \textit{Team Meeting and Lunch}</td>
</tr>
<tr>
<td>1:30 pm \textit{Final Recommendations}</td>
</tr>
<tr>
<td>2:30 pm \textit{Closing ROW Reflections}</td>
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<tr>
<td>3:00 pm \textit{Adjourn}</td>
</tr>
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Prosperity Game Context and Objectives

The Broadening Participation RP2 Prosperity Game participants will be exploring a set of issues that are critical to addressing one of today’s significant challenges: How can we more systemically broaden participation of underrepresented populations in STEM? With your help, we hope to develop the framework for a broadening participation network of stakeholder relationships, the purpose of which will be to significantly increase the responsiveness of STEM education programs and initiatives focusing on underrepresented populations to relevant research findings, program evaluations, and recommendations derived from them.

The collection of stakeholders that manage, support, and operate within the STEM education-to-workforce pipeline can be thought of as an ecosystem. Each stakeholder and stakeholder group works within a resource environment defined by their position in this ecosystem. Resources include money, people, facilities, and information. Each group has interests both in terms of maintaining access to these resources and how those resources are to be used to promote diversity in STEM. Consistent with Darwinian principles, the current configuration of stakeholders and resources is just one solution within the entire landscape of possible solutions that the system has “settled into.” Critically, this solution is perpetuated by a set of assumptions on the part of all stakeholders regarding how the system works and what a different solution might look like. These assumptions constrain the ability of the system to explore and eventually settle into a different, and possibly better solution. We want you to explore new solutions within the Prosperity Game ecosystem that to the extent possible challenge constraining assumptions.

We hope that together we can sketch out a framework for more effectively managing our collective resources such that knowledge creation (research) leads more seamlessly to more effective application of knowledge (practice), not just in situations where researchers and practitioners happen to be in close collaboration, but throughout the system. This framework can provide the basis for designing a different, improved system, not the one that defines the connections between research and practice, but the entire STEM education to workforce ecosystem.

Keeping in mind that the system we will be “enacting” will be most successful when it is allowed to generate its own priorities with respect to outcomes, a set of possible general objectives for the Prosperity Game include ideas and recommendations for:

1. Redefining the research/practice connection
2. Strengthening and expanding key stakeholder relationships
3. Establishing new stakeholder relationships
4. Allocating existing resources more effectively
5. Exploring new synergies at critical points in the system
6. Capacity building at the programmatic level
7. Redefining distributed leadership and coordination roles throughout the system
The RP² Problem Environment: Broadening Participation in STEM

The following provides a clear summary of the issues motivating this project:

Domestic science, technology, engineering, and mathematics (STEM) degree production is not keeping pace with the demand for STEM talent. As a nation, our STEM education and workforce development infrastructure have realized a poor return on investment. Women, racial and ethnic minorities and persons with disabilities are underrepresented in the STEM disciplines. They represent the largest untapped STEM talent pools in the United States. According to U.S. Census estimates, women represent a larger proportion of the U.S. population than men, and projections indicate that 54 percent of the population will be a member of a racial or ethnic minority group by 2050. Given the shifting demographic landscape, failing to broaden participation in STEM—that is, failing to cultivate these pools of potential STEM expertise—is a waste of our domestic human resources and, therefore, imposes an opportunity cost on national security interests, the U.S. economy, and our quality of life (Broadening Participation in STEM: A Call to Action, 2012. American Institutes for Research).

Bridging Research to Practice

The National Academy of Sciences recommendations suggest that the resources necessary for broadening participation in STEM involve effective education programs with new and emerging technologies, evidence-based pedagogies, and a well-trained teacher corps. Additional resources include strong recruitment mechanisms that place students on a STEM career path, funding that will enable students from low-income families to attend college, and the provision of a supportive learning environment at the nation’s colleges and universities within which underrepresented minority students successfully complete challenging STEM academic programs.

Each of these recommendations presupposes an evidence-based body of knowledge from which the design of specific programmatic interventions to achieve broader participation should be derived. This body of knowledge encompasses pedagogies, student support models, learning environments, educational technologies, and educational policy associated with early childhood, K-12, and higher education programs and institutions. Clearly, connecting research to practice within this broad range of components of the STEM education pipeline is both critical and well beyond the scope of a single collaborative problem solving exercise. The project design team therefore identified a manageable subset of the research to practice bridging problem and associated stakeholder community: the adoption and institutionalization of evidence-based practices that support broader participation in STEM at Minority Serving Institutions within the current economic, funding, technology, and policy environment.
# Prosperity Game Agenda

**February 3, 2014**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>8:00 am</td>
<td><strong>Registration and Continental Breakfast</strong></td>
</tr>
<tr>
<td>9:00 am</td>
<td><strong>WELCOME AND INBRIEFING</strong></td>
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<tr>
<td></td>
<td>Players gather in Plenary area</td>
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<tr>
<td></td>
<td>• Welcome: Carrie Billy, AIHEC President &amp; CEO</td>
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<tr>
<td></td>
<td>• Overview of project: Al Kuslikis, AIHEC</td>
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<tr>
<td></td>
<td>• Agenda Overview: Kathy Isaacson, Facilitator</td>
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<tr>
<td>9:30 am</td>
<td><strong>TEAM MEETING</strong></td>
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<tr>
<td></td>
<td>Players gather with their assigned teams and address <strong>Worksheet #1</strong></td>
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<tr>
<td>11:00 am</td>
<td><strong>ELEVATOR SPEECH</strong></td>
</tr>
<tr>
<td></td>
<td>Each team gathers in the middle of the room and listens to one minute speeches addressing the question: <em>What does this system need to know about you?</em></td>
</tr>
<tr>
<td>11:15 am</td>
<td><strong>TEAM MEETING</strong></td>
</tr>
<tr>
<td></td>
<td>Teams adapt to what they heard in the system scan and decide how they want to interact in the system. Interactions could include: craft agreements, forge alliances, get information or accomplish other outcomes. <strong>Worksheet #2</strong></td>
</tr>
<tr>
<td>noon</td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>1:00 pm</td>
<td><strong>INTERACTING IN THE SYSTEM</strong></td>
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<td></td>
<td>Engage the system and record activities using the “Interacting in the System” forms. <strong>Worksheet #3</strong></td>
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<tr>
<td>2:00 pm</td>
<td><strong>TEAM MEETING</strong></td>
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<td></td>
<td>Based on the outcome of the interactions within the system, teams meet to reflect on the “system in action” and draft a set of starter recommendations. <strong>Worksheets #4 &amp; #5</strong></td>
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<tr>
<td>3:30 pm</td>
<td><strong>GUIDED TOUR</strong></td>
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<td>Teams stay at their table, and the rest of the system “visits” each. Teams share their starter recommendations (5 minutes). Curious questions may be asked but team members do not respond.</td>
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<tr>
<td>4:30 pm</td>
<td><strong>TEAM MEETING</strong></td>
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<td>Teams meet to adjust their recommendations, after hearing from the system. Put priority recommendations on a flip chart for voting</td>
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<tr>
<td>5:30 pm</td>
<td><strong>SYSTEM PREFERENCES</strong></td>
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<tr>
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<td>Using dot voting, the players indicate their preferred recommendations.</td>
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<tr>
<td>6:00 pm</td>
<td><strong>Dinner</strong></td>
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<td></td>
<td>ROW Reflections</td>
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<tr>
<td>8:00 pm</td>
<td><strong>Adjourn</strong></td>
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## February 4, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>8:00 am</td>
<td>Continental Breakfast</td>
</tr>
<tr>
<td>9:00 am</td>
<td>OPENING: Presentation of Emerging Priorities ROW Reflections</td>
</tr>
<tr>
<td>9:30 am</td>
<td>TEAM MEETING&lt;br&gt;Teams meet to further reflect on the results of the first day and refine their recommendations, preparing to interact in the system. <strong>Worksheet #2</strong></td>
</tr>
<tr>
<td>10:00 am</td>
<td>ELEVATOR SPEECH&lt;br&gt;Each team gathers in the middle of the room to listen to one minute speeches that make announcements, or alert the system to the plans that affect the system.</td>
</tr>
<tr>
<td>10:30 am</td>
<td>TEAM MEETING&lt;br&gt;Teams adapt to what they heard in the system scan and decide how they want to interact in the system. They can craft agreements, forge alliances, get information or accomplish other outcomes as they refine their recommendations. Again, use the Interaction Report Forms.</td>
</tr>
<tr>
<td>11:30 am</td>
<td>INTERACTING IN THE SYSTEM&lt;br&gt;Engage the system and record activities using the “Interacting in the System” forms. <strong>Worksheet #3</strong></td>
</tr>
<tr>
<td>12:30 pm</td>
<td>TEAM MEETING&lt;br&gt;Teams meet through the working lunch (12 noon) to prepare their final recommendations. <strong>Worksheet #6</strong></td>
</tr>
<tr>
<td>1:30 pm</td>
<td>FINAL RECOMMENDATIONS&lt;br&gt;Five minute presentations are given.</td>
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<tr>
<td>2:30 pm</td>
<td>CLOSING REFLECTIONS</td>
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<td>3:00 pm</td>
<td>Adjourn</td>
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Team 1—Minority Serving Institutions

Minority Serving Institutions (MSI) are institutions of higher education that are defined by threshold levels of enrollment of minority students (or by specific designation). A commitment to the success of Underrepresented Minorities (URMs) is (explicitly or implicitly) a component of the mission of every MSI. MSIs serve a wide range of underrepresented minority (URM) groups. For this Prosperity Game, this stakeholder group will include MSIs as defined by the U.S. Department of Education, to include: Historically Black Colleges and Universities (HBCU), Predominantly Black Institutions (PBI) at least 40% African American, Hispanic Serving Institutions (HSI), at least 25% Hispanic, Tribal Colleges and Universities (TCU) at least 51% enrolled Tribal members, and Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs), with at least 10% Asian American and Pacific Islander student enrollment. (U.S. Department of Education [ED] n.d.). To date, there are 78 AANAPISIs, 356 HSIs, 106 HBCUs, 37 TCUs, and 75 PBIs in the United States.

Minority Serving Institutions emerged in response to a history of inequity, lack of minority people’s access to majority institutions, and significant demographic changes in the country. Now an integral part of American higher education, MSIs —specifically Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), Hispanic Serving Institutions (HSIs), and Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs) —have carved out a unique niche in the nation: serving the needs of low-income and underrepresented students of color. These institutions boast diverse faculties and staffs, provide environments that significantly enhance student learning and cultivate leadership skills, offer role models of various racial and ethnic backgrounds, provide programs of study that challenge students, address deficiencies resulting from inadequate preparation in primary and secondary school, and prepare students to succeed in the workforce in graduate and professional education. Because MSIs enroll a substantial share of minority students, many of whom might not otherwise attend college, the continuous development and success of these institutions is critical for realizing our nation’s higher education and workforce goals and for the benefit of American society. MSIs play vital roles for the nation’s economy, especially with respect to elevating the workforce prospects of disadvantaged populations and reducing the underrepresentation of minorities and disadvantaged people in graduate and professional schools and the careers that require post baccalaureate education and training. (Gasman & Conrad; 2013)

MSIs enroll over 20 percent of all college students in the United States, and for decades they have been doing the majority of the work of educating and empowering minority and low-income students, particularly in STEM fields.

- 10 HBCUs are among the top 20 institutions that award science and engineering degrees to blacks/African Americans.
The RP2 Prosperity Game: Creating a Critical Mass for Change in STEM Participation

10 HSIs are among the top 20 institutions that award science and engineering degrees to Hispanics/Latinos.

The broadening participation in STEM focus issues for this group of representative stakeholders span a range as wide as that of the educational (and research) roles these institutions have assumed. The majority of MSIs are two and four-year institutions with a range of admission requirements, from open-admission to highly selective. Two and four-year institutions serve different needs. Two-year institutions are a primary source of remedial education where students with developmental education issues can prepare to do college-level work. They are places STEM students can cost-effectively complete introductory courses in a field in preparation for transferring to a four-year institution. They are also institutions of choice for students wishing to quickly enter the workforce with competitive skills as they are often a source of vocational training and certifications. Meanwhile, in addition to preparing students for professional STEM careers, four-year institutions prepare students to pursue advanced degrees involving a strong focus on scientific research. Researcher bias in favor of bachelor degrees over associate degrees and vocational certificates has contributed to a deficiency in the amount of research on the contributions of two-year MSIs toward increasing URM participation in STEM subjects (AIR 2012).

HBCUs, TCUs, PBIs, and HSIs show different degrees of success compared to the national average in granting minority students STEM degrees. Hispanic students at HSIs are about as likely to graduate with a STEM degree as the national average, black students at HBCUs are more likely to graduate with a STEM degree than the national average while black students at PBIs are less likely to graduate with a STEM degree than the national average. The likelihood of a Native American student at a TCU graduating with a STEM degree has been steadily increasing (AIR 2012). This range of educational roles within the MSI stakeholder group may impact the interests of the representative stakeholders.

Despite these differences, MSIs have some key similarities. MSIs all have as practically a defining characteristic the ability to create a welcoming educational environment for URM students interested in pursuing a career in STEM. “Research suggests that a feeling of isolation and a lack of social connections within their learning environments is one reason for lower STEM retention rates among underrepresented groups” (AIR 2012, p 43). MSIs are able to address this issue by creating a sense of community and support that encourages student success. MSIs also tend to have lower levels of funding than non-MSIs (Chu Clewell 2010; 20 U.S.C. §§ 1059e & 1101a; Santos 2003) and are typically called upon to do more with less.

**Historically Black Colleges and Universities**

An HBCU is “any historically black college or university that was established prior to 1964, whose principal mission was, and is, the education of black Americans, and that is accredited by a nationally recognized accrediting agency or association determined by the Secretary of Education to be a reliable authority as to the quality of training offered or is, according to such an agency or association, making reasonable progress toward
accreditation” (White House n.d.). HBCUs have a unique and important history—providing an education for black people when such an education would have otherwise been impossible—and continue to serve a vital role in educating the black community (Chu Clewell 2010). Approximately 75% of undergraduate enrollment at HBCUs is black (Gasman n.d.). HBCUs are primarily located in the South. Black students at HBCUs have higher graduation rates and are more likely to pursue graduate STEM degrees than black students at non-MSIs (Chu Clewell 2010).

One of the programs to improve STEM education for URMs at HBCUs is through the National Science Foundation’s HBCU Undergraduate Program (HBCU-UP), established in 1998 (Chu Clewell 2010). HBCU-UP provides grants for HBCUs for Targeted Infusion Projects (improvements focused on specific programs/issues), Broadening Participation in STEM Education (exploring strategies for strengthening URM STEM education), Research Initiation Awards (funding for faculty research), and Achieving Competitive Excellence Implementation Projects (meant to make strong programs better) (National Science Foundation n.d.). Recent projects supported under this program include:

- A three part study at Lincoln University designed to improve engagement of URMs in STEM fields. The second and third studies are intended to build upon the results of the first study (Lincoln University 2013);
- A project to “expand the current theory on effective career development and management interventions for minority STEM students” (Tennessee State University 2012);
- A study of “the interplay between psycho-social and academic structural factors that

Percentage of bachelor’s degrees that were awarded to black students that were in STEM fields over a twenty-year period at non-MSIs, HBCUs, and PBIs (AIR 2012).
affect retention of minority students at HBCUs” in STEM programs and develop new policies that take the findings into account (Tuskegee University).

**Predominantly Black Institutions**

PBIs are defined as non-HBCUs where at least 40% of the student body is black, have low average per full-time student expenditures and at least 50% of whose student population is composed of low-income or first generation college students. (ED Nov. 2012). Since an institution’s designation as a PBI is dependent on its enrollment, an institution’s status as a PBI can change from year to year. The Department of Education has not published an official list of PBIs. Unlike HBCUs, PBIs have lower than average rates of URM students receiving STEM degrees (AIR 2012).

The most prominent grant program that provides funding for improving STEM education at PBIs is the Predominantly Black Institutions Program (PBIP). Improving STEM education is only one of the five goals of the program (ED 2012b). The most recent available award data is for fiscal year 2011, when a total of 27 awards were made totaling $15 million. Approximately one third of the project abstracts discussed all three topics: STEM, remedial education, and research to practice methods (ED 2011). The Department of Education also has a six year grant program “to improve graduate education opportunities at the master’s level in” STEM fields (ED 2012a). Six institutions in New York, Chicago, and a suburb of Washington D.C. (ED Feb. 2012a) are eligible to apply to this program.

**Hispanic Serving Institutions**

HSIs are “institution[s] of higher education that . . . ha[ve] an enrollment of undergraduate full-time equivalent students that is at least 25 percent Hispanic,” have a high number of low income students, and have low average per full-time student expenditures (20 U.S.C. § 1105a). Percentage of STEM bachelor’s degrees that were awarded to Hispanic students that were in STEM fields over a twenty-year period at non-MSIs and HSIs. (AIR 2012).
In the 2011-12 academic year, 47% of HSIs were public two year institutions, 28% were private not-for-profit four year institutions, 20% were public four-year institutions, and 5% were private not-for-profit two year institutions (Excelencia in Education [Excelencia] n.d.c). Approximately the same percentage of Hispanic students complete their bachelor’s degrees in STEM at HSIs as at non-MSIs.

HSIs are more likely to be within the top 25 degree granting institutions (Top 25) for Hispanic students at the associate’s and bachelor’s degree level than at the graduate level. Broken down by subject area, 52% of the Top 25 for undergraduate degrees were HSIs, while 38% of the Top 25 for master’s degrees were HSIs, and only 12% of the Top 25 for PhDs are HSIs (Data from Santiago 2012).

Excelencia in Education maintains a database of programs to improve the education of Hispanic students at institutions of higher education across the country (Excelencia n.d.b.). These programs include:

- Miami Dade College: Miami Dade College has institutionalized a program designed to “[i]ncrease the passing rates of students enrolled in Intermediate Algebra . . . [i]ncrease continuous enrollment of math courses . . . [and r]educe levels of math anxiety.” A key component to the program was that it involved different areas of the college (Excelencia n.d.d).

- East Los Angeles College: Since East Los Angeles College instituted its Green Science and Technology Curriculum Project (GSTCP) it has seen a significant increase in enrollment of Hispanic/Latino students, an increase in transfer-level math enrollment, and a 60% increase in STEM transfers to four-year institutions. The program included revamping STEM courses “based on environmental and technological trends” and improving relationships with four-year colleges and local high schools (Excelencia n.d.a).
Tribal Colleges and Universities

TCUs are institutions of higher education that are “chartered by their respective Tribal governments,” and enroll a predominantly American Indian population. Central to the mission of each TCU is a commitment to serving their community (American Indian Higher Education Consortium [AIHEC] n.d.). There are 37 TCUs with more than 75 campuses. Thirty-four TCUs have degree programs in STEM and Natural Resources Management. Fifteen offer four-year degrees and four offer master’s degrees. Eighty-four percent of students enrolled at TCUs are American Indian (Santos). “TCUs did not begin conferring STEM bachelor’s degrees until 1996,” but have been steadily increasing the number of degrees that they grant in STEM fields (AIR 2012, p. 30).

The National Science Foundation provides grants through the Tribal Colleges and Universities Program (TCUP) to improve STEM education at TCUs. This program has been critical to the development of TCU STEM programs. Projects recently supported by TCUP include:

- The Research on American Indian Science Education (RAISE) project. RAISE is intended to “investigate the efficacy of culturally congruent instruction (CCI) for improving American Indian College students’ science achievement.” The project builds on an earlier study on CCI that examined the impact of incorporating CCI into STEM courses (Salish Kootenai College 2013).

- Northwest Indian College is implementing a broad set of improvements to the STEM program that includes hiring new faculty, adding upper level courses at extended campuses, and training its professors in “learning models . . . that have been shown to be successful with Native American students.” (Northwest Indian College 2013).
Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs)

AANAPISIs, in addition to being accredited institutions that enroll at least 10 percent Asian American and Native American Pacific Islander students, are required to have at least 50 percent of students receiving federal aid, which provides a measure of the socioeconomic status of students. The majority of AANAPISIs are urban community colleges located on the West Coast, Texas, Massachusetts, Illinois, New York, and Guam. One hundred fifty-four institutions are eligible to be AANAPISIs, 78 are designated as such. Over 13 percent of all Asian American and Native American Pacific Islander students are enrolled at AANAPISIs, compared with under 5 percent less than five years ago (National Commission on Asian American and Pacific Islander Research in Education, 2013).

The University of Illinois at Chicago recently established the UIC AANAPISI Initiative, which involves focused curriculum development, co-curricular activities, and community engagement opportunities. The project also involves AANAPI scholarships and student support. In 2011, UIC received a $2 Million grant from the US Department of Education's Asian American and Native American Pacific Islander-Serving Institution program for this initiative.
References


Excelencia in Education. (n.d.b). Growing what works database. Retrieved from http://www.edexcelencia.org/examples?field_prog_academlvl_value=All&field_prog_state_value_many_to_one=All&field_prog_designation_value_1=All&field_prog_nomyear_value_many_to_one=All&institution=All&field_prog_issuearea_value=All


The RP² Prosperity Game: Creating a Critical Mass for Change in STEM Participation


The RP² Prosperity Game: Creating a Critical Mass for Change in STEM Participation


Team 2—MSI Partners

For this Prosperity Game, MSI Partners (Partners) are institutions of higher education that are not minority serving institutions (MSI), as well as research centers and institutes that have made a commitment to increasing minority involvement in STEM fields, and have established specific initiatives that involve working with MSIs. There are hundreds of institutions of higher education that are not MSIs that are being represented by this stakeholder group. All of the nation’s National Laboratories and NASA Centers have in place efforts to engage URMs in research and education opportunities.

Partners—particularly non-MSI higher education institutions—are critical for expanding URM presence in STEM, “[t]he challenge of increasing [URM] participation and success in STEM is so substantial that it requires every institution to step up to the plate regardless of its size or type” (Committee 2011, p. 150). Non-MSIs grant significantly more bachelor’s degrees in STEM fields than MSIs. (AIR 2011). URM students interested in STEM fields at non-MSIs are significantly more likely to drop out than Asian American and white students. Reducing the URM student dropout rate so that it approaches the Asian American and white dropout rates would significantly increase URM presence in STEM fields (Expanding 150-51).

The interests of the representative stakeholders in this group vary with their educational role. Partners include two-year institutions, liberal arts colleges, Master’s focused institutions, and research institutions. Most URMs start their college careers at two-year colleges. These colleges are often cheaper, closer to home, and offer more remedial education than the other Partners. They offer technician training, two-year degrees, remedial courses, and allow students to take introductory classes that can transfer to four-year institutions. They also “act as a bridge to four-year institutions and should be the place to institute transition programs; they also reach

Total STEM bachelor degree production by institution type (AIR 2012).
out in the other direction as well, to work with K-12 through articulation agreements, summer bridge programs, and individual outreach” (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline et al. [Committee] 2011, p. 159-60). Liberal arts colleges can prepare students to pursue graduate education; Master’s focused institutions can prepare students to pursue graduate education and offer Master’s degrees that can either be taken directly into the workforce or can be used as preparation for a doctoral degree; research institutions can offer the same education as Master’s focused institutions while also offering doctoral degrees (Committee 2011, p.154).

Many non-MSIs have established programs specifically to recruit and support URM students. These programs are contributing to the knowledge base of effective practices for strengthening the STEM career pipeline. Here are some representative examples:

- The Computational and Applied Mathematics Program (CAAM) at Rice University has been successful at producing URM PhD graduates. The success of the program has led to it being expanded across the University and has served as a model for a program at the University of Wisconsin-Madison. CAAM admission decisions are made with input from a standing committee that is dedicated to diversity. The committee has control over some funding sources. All students admitted under the program, across departments, start the summer before the program begins. This is primarily to build a sense of community among the students (Committee 2011).

- Georgia Tech’s FOCUS program is a graduate school recruitment program for URM students. Every year Georgia Tech invites top black undergraduate and high school students to its campus for a weekend to encourage the students to pursue a graduate degree. Georgia Tech now ranks first in graduate degrees awarded to black students and one third of those students attended a FOCUS weekend. The program started out only in the engineering department, but has been expanded university wide and has served as a model for other institutions (FOCUS).

- The Meyerhoff Scholars Program at the University of Maryland Baltimore County (UMBC) has proven successful at encouraging URM students to pursue a graduate degree in STEM. Students that enroll in the program are 5.3 times more likely to attend a STEM PhD program than students that are admitted, but choose to attend a different university (University of Maryland Baltimore County [UMBC] n.d.b). The program enrolls students that are committed to diversity in STEM fields and plan on pursuing a graduate education (UMBC n.d.a). The program includes a summer bridge program to build a sense of community among the students and prepare them for college, full scholarships that cover living expenses, organized study groups, and lots of oversight over the students for their undergraduate years (UMBC n.d.c).

MSI Partners, in collaboration with MSIs, have developed a wide range of programs that are helping to strengthen the career pipeline through...
activities such as collaborative research, summer bridge programs, internships, and academic program partnerships. These are a few examples of successful MSI Partnerships:

- Oak Ridge National Laboratory (ORNL), through the Oak Ridge Associated Universities (ORAU) involves over 27 MSIs in a wide range of research collaborations, internships, and faculty development opportunities;

- The NASA Science and Technology Institute for Minority Institutions has given students and researchers the opportunity to collaborate with government, the private sector, other majority institutions, and research and technical organization through research and development collaborations, fellowships, internships, co-ops and grants;

- North Dakota State University, funded through the EPSCoR program, has developed innovative STEM career pathways for American Indian undergraduate students in collaboration with North Dakota’s five Tribal Colleges;

- The National Institute of Aerospace (NIA), has established sustained research collaborations involving MSIs (such as Hampton University and North Carolina A&T State University) and non-MSIs such as the College of William and Mary and Georgia Tech;

- The UC San Diego Howard Partnership for Graduate Success offers a summer research experience for Howard undergraduates intended to help prepare them for successful application to graduate school;

- Arizona State University’s Mary Lou Fulton Teachers College worked with Diné College to establish a Master of Education program within the Diné Center for Teacher Education that involves faculty from both ASU and Diné College.

- A partnership between the Educational Testing Service (ETS) and Howard University is providing training to Howard graduate students in psychometric test construction and evaluation, and advanced statistical analysis.

- UCLA School of Education is providing training in education research to Howard University undergraduates through a summer program.
References


Team 3—K-12

The K-12 stakeholder group consists of organizations that create and drive K-12 educational policy, but do not directly implement it. For the purposes of this Prosperity Game it includes the Department of Education (ED), state departments of education (SDE), and local school districts (LSD). These organizations all have the power to influence curriculum decisions, teacher quality standards, and how schools and policies are assessed.

K-12 curriculum decisions play a central role in student preparation for pursuing STEM fields in post-secondary education. For instance, the presence of core class requirements and the availability of AP classes significantly impact student performance on college entrance exams. URM high school students are less likely to take AP courses or pre-calculus than white and Asian students. Teacher quality is considered to be one of “the most critical factor[s] in affecting academic achievement.” Schools with high minority populations are more likely to have STEM teachers that do not have degrees in STEM fields than schools with smaller minority populations (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, et al. [Committee] 2011, p. 79-80).
In 2012, American Indian students were the most underrepresented population of students taking AP exams. American Indian students taking AP exams were only 55% of the number that would be predicted based on the share of total student population. African American students were second at 63%. African American students had the poorest success rates with the AP exams, with less than half of the students scoring a 3 or higher on the exam than would be predicted based on share of the total examinee population (College Board n.d.).

The Department of Education

The ED is a cabinet level federal agency responsible for promoting education in the United States. It accomplishes this by establishing policies related to federal education funding, administering distribution of funds and monitoring their use; collecting data and overseeing research on America’s schools; identifying major issues in education and focusing national attention on them; and enforcing federal laws prohibiting discrimination in programs that receive federal funds (U.S. Department of Education [ED] n.d.a). The No Child Left Behind Act (NCLB) ties federal education funding to school performance. NCLB also authorized ED to tie federal funding to teacher quality in core classes (Committee 2011). The Obama administration is restructuring the role of federal agencies in STEM education. “[ED] will lead several new initiatives, including: STEM Innovation Networks, ... STEM Teacher Pathways, ... [and] STEM Master Teacher Corps.” STEM Innovation Networks are “networks of school districts, colleges, and other regional partners” (with an interest in STEM education). STEM Teacher Pathways and Master Teacher Corps make grant awards that support programs that recruit STEM teachers, and maintains a network of STEM teachers to serve as instructional leaders (ED n.d.b). ED also has programs encouraging STEM in postsecondary education (ED n.d.c).

The El Paso Collaborative for Academic Excellence resembles a STEM Innovation Network. It is a citywide collaboration between education, business, and civic leaders that focuses on “teacher and administrator professional development that is intensive, long term, and site based; rigorous and aligned curriculum, instruction, and assessment;” capacity building; and ensuring the changes will be able to work long term (Committee 2011, p. 71).

State Departments of Education

SDEs’ exact roles vary by state, but they are basically “responsible for policies that promote educational quality throughout the state.” They are normally responsible for:

- Setting statewide curriculum standards;
- establishing high school graduation requirements; determining qualifications for professional education personnel;
- establishing state accountability and assessment programs; establishing standards for accreditation of local school districts and preparation programs for teachers and administrators; implementing the No Child Left Behind Act and administering federal assistance programs; and developing rules and regulations for the administration of state programs (National Association of State Boards of Education n.d.).
Clearly, SDEs play a critical role in STEM education in their states.

The Maryland State Department of Education’s (MSDE) STEM program provides an example of how SDEs can influence STEM education. Maryland’s public school system is about 48% URMs (35% black, 13% Hispanic, and <1% American Indian) (Maryland Report Card 2013). MSDE has implemented STEM Standards of Practice to establish the knowledge and skills students should be able to demonstrate at different grade levels. These Standards were developed with input from all school districts in the state, businesses, and government agencies (Maryland State Department of Education [MDE] 2013). MSDE was awarded a four-year, $250 million grant from the federal government to boost student achievement, turn around struggling schools, improve the teaching profession, and reduce the achievement gap (MDE n.d.a). The grant funds two educator professional development academies that must be attended by at least one teacher from each school. The state now also requires that all students take a technology course in order to graduate (MDE n.d.b).

Local School Districts

Within boundaries established by state boards and federal governments, LSDs are responsible for “overseeing the development of and adopting policies; setting a direction for and adopting the curriculum; [and] establishing budget priorities, adopting the budget and overseeing facilities issues” (National School Boards Association n.d.). These responsibilities give LSDs a significant degree of control over K-12 STEM education.

LSDs are in a unique position to take advantage of RP2. By working with researchers in long term alliances, LSDs are able to address their districts’ specific educational issues through measures developed specifically in response to research recommendations generated from work with the schools in their districts. LSDs are able to provide researchers access to large amounts of relevant student and program data necessary for both research and evaluation (Coburn, Penuel & Geil 2013).

• The Chicago Public School system (CPS) has announced plans to offer at least one computer science course at every public high school in Chicago. The class will eventually be able to count as a core graduation requirement. The new plans are an extension of CPS’ existing computer science program (Mayor of Chicago’s Press Office 2013).

• The Research Alliance for New York City Schools is an alliance between the city’s LSD, NYU, and other stakeholder groups. The alliance evaluates current educational program performance, maintains a database of program information, conducts research on a range of educational issues, and administers a survey intended to inform educational policies (Coburn, et al. 2013).

• A national coalition of 25 LSDs formed the Minority Student Achievement Network (MSAN) to study and share methods to reduce the racial achievement gap. MSAN organized a project involving teachers, social psychologists, and education researchers to develop a better way to teach algebra to 9th graders. It has also developed a peer reviewed process for identifying programs that are successful (Committee 2011).
References


Team 4—Rest of World (ROW)

Standing for the Rest of the World, the ROW Team will have four responsibilities:

1. They will be a resource for teams needing additional information. The ROW team represents a variety of areas of expertise, and at least one member will probably have—or know how to get—any information requested.

2. They will take the role of various stakeholder groups not represented by other teams. If a team wishes to negotiate with a group not included in the game, members of ROW will be designated to take that role.

3. They will be a game reflecting team. ROW is the one team with an overview of the whole system and the opportunity to observe the system in action. They will meet regularly throughout the game to discuss their perceptions, analyze what is emerging during the game, and plan a public reflection.

4. They will explore possible ways to frame and format the plans as they emerge from the game.
Team 5—Communities

The Community team for this Prosperity Game consists of groups and individuals (generally but not necessarily) within the service area of an institution that have a stake in and are in a position to have an impact on minority participation in STEM fields. There are four main types of stakeholder in this group: community organizations, STEM professionals, families, and public educational institutions (PEI).

“[Researchers] agree that family and community differences, school context, low expectations and lack of exposure to role models, insufficient information about career opportunities, and availability of advanced courses affect minority students’ success in [STEM]” (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, et al. [Committee] 2011, p. 65-66). Members of the community group are able to mitigate these factors by encouraging and supporting student interest in STEM subjects, supporting STEM education, providing access to extracurricular STEM activities, and sharing information necessary to pursue a STEM career.

Community Organizations

Community organizations include churches, community groups, youth organizations, local chapters of national organizations, and local advocacy groups. A lack of exposure to STEM careers and a lack of knowledge about the pathway to college contributes to the underrepresentation of URMs in STEM fields. Community organizations can provide this information to students and help guide them into careers in STEM (Committee 2011).

- Project Exploration (PE) is an award winning Chicago organization that works to make science accessible to URM middle and high school students. They work with almost 250 students every year in free after school science programs. PE focuses on encouraging enthusiasm for science among students that are struggling academically. 98% of participants are either black or Latino students (Project Exploration n.d.).

- The Coalition for Excellence in Science and Math Education (CESE) is a New Mexico organization dedicated to improving “science education and science literacy.” CESE works to improve state science standards, provides support for K-12 educators, and actively works to inform the public about the benefits of science (Coalition for Excellence in Science and Math Education [CESE] n.d.).

- The Boys and Girls Club of San Diego recently expanded its STEM offerings to include “weeks of fun scientific activities” (Boys and Girls Club of San Diego [BGCSD] n.d.a). The program was piloted at two teen centers in Fall 2012 and will be expanded to additional sites following some modifications to the program design. Subject areas covered include robotics, energy issues, and botany (BGCSD n.d.b).

STEM Professionals

Local STEM professionals are in a position to make a significant impact on URM involvement in STEM fields by serving as mentors to students and young professionals. Mentoring programs
help to build a sense of community that can encourage URMs to not only enter, but persist on STEM career tracks. Mentoring programs can have a positive impact at all educational levels and for young professionals (American Institutes for Research [AIR] 2012; Committee 2011; Simard n.d.). Recruitment of professionals within the community willing to commit to serve as mentors is crucial to the success of any mentorship program.

Families

“[A] family’s attitude that learning is a positive, even joyful, experience is the single most important predictor of student success.” Families can encourage interest in STEM fields by searching for and enrolling their children in extracurricular STEM activities and participating in STEM activities with their children (Dusenbery 2013). The National Council of La Raza has a six-week program to encourage parent involvement in their children’s STEM success. The goals of the program are for parents to “[d]emonstrate increased support and raised academic expectations; [b]ecome empowered through small-group instruction, hands-on activities, role-playing, problem solving of real life situations, discussions, and honest dialogue; [and g]aining access to a learning environment that is meaningful to Latino parents” (National Council of La Raza n.d.).

Public Educational Institutions

PEIs are institutions—such as museums, zoos, botanical gardens, and libraries—that provide informal science education (ISE) to members of the public. “[ISE] can make science accessible, meaningful, and relevant for diverse students by connecting their home and community cultures to science.” PEIs are able to offer intergenerational experiences (Committee 2011, p. 72).

- “The Chicago Zoological Society (CZS) in collaboration with Eden Place Nature Center, the Fuller Park Community Corporation, and the University of Illinois at Chicago (UIC)” has received a grant to study how “a large informal science learning institution work[s] with a community-based organization to support environmental scientific literacy and agency.” The project involves establishing programs for community members that provide hands on experiences, field trips, and other educational opportunities, and modifying existing programs according to evaluations of their efficacy (Chicago Zoological Society 2013).

- Atlanta Public Schools is partnering with local PEIs to provide after school programs for local elementary students. The Fernbank Museum of Natural History sends museum staff to local elementary schools to serve as instructors for 2-week educational experiences. The final day is spent at the museum. The Atlanta Botanical Gardens After-School Program invites students to the Gardens for a four-week after-school environmental sciences program (Atlanta Public Schools n.d.).
References


Team 6—Policy and Advocacy

For the purpose of this Prosperity Game, Policy and Advocacy Groups (PAG) are organizations—both governmental and nongovernmental—that are involved with developing and/or implementing policies that encourage minority representation in STEM fields, working on both regional and national levels. PAGs can be divided into three general groups: Associations of MSIs (AMSI), Educational Policy Groups (EPG), and entities of the Federal Government (agencies).

PAGs fund, or advocate for funding of URM-focused programs and research, encourage MSI involvement in URM-focused opportunities, provide a variety of student-focused opportunities, and disseminate information on successful strategies and programs. PAGs (particularly federal agencies) support Underrepresented Minorities (URM) STEM education research, the implementation of activities and initiatives supported by the research, institutional capacity-building, and MSI faculty research projects. Student-focused opportunities provided by PAGs include scholarships, internships, professional development and networking, and mentoring programs. Research experiences, professional development, and mentoring opportunities have all been shown to be effective methods of increasing URM involvement in STEM fields. Financial support has also been shown to be critical in increasing degree completion rates and improving student focus on their studies (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, et al. [Committee] 2011).

Associations of Minority Serving Institutions

AMSIs are organizations that exist to further the interests of MSIs. AMSIs that represent the MSIs involved in this Prosperity Game include: the National Association for Equal Opportunity in Higher Education (NAFEO), the Hispanic Association of Colleges and Universities (HACU) the American Indian Higher Education Consortium (AIHEC), and the Asian American & Pacific Islander Association of Colleges and Universities (APIACU). Some of the ways AMSIs support STEM education include securing funding for specific MSI-based initiatives, providing technical support and training for capacity building, researching and disseminating educational methods, and supporting collaborations between their member institutions and other STEM education, research, and workforce stakeholders.

NAFEO was founded in 1967 and represents the presidents and chancellors of more than 100 HBCUs and PBIs. It is dedicated to improving higher education opportunities for blacks in higher education while specifically focusing on HBCUs and PBIs (National Association for Equal Opportunity in Higher Education [NAFEO] n.d.). One important way that NAFEO helps improve STEM education for blacks is by advocating on behalf of its member institutions for federal funding (Fields 2013).

HACU was founded in 1986 to represent institutions with a high percentage of Hispanic students. It played an important role in the creation of the congressional designation of
HSIs and focuses on advocating on their behalf. HACU currently represents more than 400 institutions that collectively enroll two-thirds of the nation’s Hispanic college students (Hispanic Association of Colleges and Universities [HACU] n.d.a).

- In 2004, the HACU Hispanic Higher Education Research Collective (H3ERC) was formed to research Hispanic higher education. One of the goals of H3ERC is to improve Hispanic student success in STEM fields (HACU n.d.b).

- HACU is a partner in the Computing Alliance of HSIs which works with multiple HSIs and other organizations to increase Hispanic involvement in computer science (HACU n.d.c).

AIHEC was founded in 1973 by the six original tribally controlled colleges to provide leadership and coordination of the Tribal College movement. AIHEC serves and represents its Tribal College and University membership by advocating on their behalf on a national level, conducting research, providing data management services, and providing a variety of technical assistance services focusing on institutional capacity building. (American Indian Higher Education Consortium [AIHEC] n.d.a).

- AIHEC recently established the TCU STEM Student Success Collaborative, intended to disseminate culturally resonant instructional models to improve STEM education at least six TCUs. The models build on successful strategies used at the Navajo Technical University (AIHEC 2013).

- AIHEC is active in the development and implementation of a wide range of STEM projects and activities, involving student internships, course and curriculum development, research partnerships, and faculty professional development opportunities, often in partnership with federal agencies including NASA, the EPA, the Department of the Interior, the US Department of Agriculture, and the National Science Foundation (AIHEC n.d.b).

APIACU was established for the purpose of addressing the complex set of social realities facing students in the underrepresented and underserved Asian American and Pacific Islander (AAPI) community. APIACU’s mission has four components: To promote the development of member APIACU colleges and universities; to improve the quality of postsecondary educational opportunities and access by AAPI students; to meet the needs of business, industry, and government through the development and sharing of resources, information, and expertise, and to support and advocate for the success of AANAPISIs through the development of programmatic activities at AANAPISIs.

**Educational Policy Groups**

EPGs are organizations that are involved in programs that focus on improving education, both through advocacy and direct services. Examples of EPGs include the American Indian Science and Engineering Society (AISES), Excelencia in Education (Excelencia), the United Negro College Fund (UNCF), and the Bill and Melinda Gates Foundation (Gates). These organizations work to improve STEM education through advocacy, dissemination of information...
on education programs and opportunities, providing scholarships, managing internship and mentoring programs, and through grant-making.

AISES was established in 1977 to “substantially increase the representation of American Indians and Alaskan Natives in engineering, science, and other related technology disciplines. It does this by working at multiple levels to improve STEM education and professional development for American Indians (American Indian Science and Engineering Society [AISES] n.b.a).

- AISES’ Pre-College: STEM Awareness and Retention Initiative ensures that American Indian students are exposed to STEM activities such as the National American Indian Science and Engineering Fair (AISES n.d.b).

- AISES’ College and Early Career: STEM Access and Success program provides college students, graduate students, and young professionals with scholarship, internship, and networking opportunities (AISES n.b.c).

- AISES also works to encourage American Indians to stay in STEM fields through its Professionals: STEM Leadership and Change program. It does this through networking and professional development programs (AISES n.b.d).

Excelencia was established in 2004 as an information source on the status and successful methods of Latino educational achievement (Excelencia in Education [Excelencia] n.b.a).

- Excelencia’s “Growing What Works” database is a searchable database of programs that have been effective in improving Latino education (Excelencia n.b.b).

- Excelencia’s “Examples of Excelencia” is an annual compendium of programs that have shown to improve Latino student success at the associate, baccalaureate, and graduate levels. This program is intended to encourage educators and policymakers to adopt successful practices. Highlighted programs often involve or relate to STEM education (Excelencia 2013).

UNCF was founded in 1944 to support African American higher education. UNCF provides scholarship and internship programs and “financial support for its 37 member [HBCUs] for scholarships and capacity building, advocating the importance of education, and studying “the issues that face minority education” (United Negro College Fund [UNCF] n.d.a).

UNCF’s STEM Solution addresses minority STEM education with a two-pronged approach. The UNCF STEM Scholars Program offers scholarships, internships, and mentoring. The UNCF Math and Science Teacher Education Program offers scholarships, loan forgiveness, teacher certification preparation, and a new teacher mentoring program. (UNCF n.d.b).

The Gates Foundation funds projects designed to improve the American educational system (Bill and Melinda Gates Foundation. [Gates] n.d.d). The grant recipients include projects designed to improve STEM education (Gates n.d.a).

- Gates’ educational grants focus on designing and implementing the Common Core State Standards for pre-college education, researching obstacles to student success at a college level, and increasing the amount
of technology involved in education (Gates n.d.b; Gates n.d.c).

- The Gates Millennium Scholars Program provides college scholarships to low income ethnic minorities. The program includes graduate school funding for Millennium Scholars that pursue certain STEM graduate degrees (Gates Millennium Scholars n.d.a). The program is administered by the UNCF (Gates Millennium Scholars n.d.b).

Entities of the Federal Government

For the purposes of this Prosperity Game, agencies are arms of the federal government that implement federal STEM-related policy. Agencies are in a position to encourage minority participation in a variety of ways. They offer important research and work experience opportunities through internships. They support capacity building by entering into research partnerships with MSIs and encouraging MSI/non-MSI collaborations. They fund specific efforts to increase diversity, as well as research on STEM diversity issues. The National Science Foundation (NSF) and Department of Energy (DOE) are two agencies that attempt to address diversity in STEM fields.

NSF is an independent federal agency established in 1950 “to promote the progress of science.” It is a major source of federal STEM research and education funding (National Science Foundation [NSF] n.d.).

- NSF’s Louis Stokes Alliance for Minority Participation (LSAMP) program was established to support institutions of higher education collaborating to increase diversity in the STEM work force. LSAMP-funded projects focus on increasing minority attainment of baccalaureate and advanced STEM, and include research of strategies for increasing diversity in STEM fields (NSF 2009).

- NSF’s Historically Black Colleges and Universities Undergraduate Program and Tribal Colleges and Universities Program are designed to increase STEM opportunities at HBCUs and TCUs. They support a wide range of activities associated with the establishment and improvement of STEM programs, including infrastructure improvements, faculty development, student research opportunities, curriculum development, and faculty research. Both programs also fund research on broadening participation in STEM (NSF 2013a and NSF 2013b).

- DOE is the agency responsible for finding scientific and technological solutions to energy challenges (Department of Energy [DOE] n.d.).

- DOE’s Minority Educational Institution Student Partnership Program offers summer internships to college students where they gain technical experience and important networking opportunities (DOE 2013).

- DOE’s Diversity in Science and Technology Advances National Clean Energy in Solar program provides funding for MSIs to increase solar energy research.
References


For this Prosperity Game, Practitioners are individuals, groups, academic departments and organizations that are in a position to further Underrepresented Minorities (URM) involvement in STEM through the entire range of recruitment, student support, and academic programs that constitute the totality of programmatic interactions that students experience as they progress along a STEM career pathway. This stakeholder group includes: deans and department heads (DDH), student affairs departments (SAD), teachers and professors. Practitioners are providers of direct services to students, or are closely associated with those who do. Practitioners by definition play a most critical role in URM students’ educational development.

Fewer than 25% of URM students that enter four-year institutions pursuing a degree in a STEM field successfully complete their program within 5 years of matriculation. There are both institutional and student preparedness factors associated with this (American Institutes for Research 2012). Practitioners are in the best position to mitigate these factors. DDHs can change institutional limitations through their control over budget distributions, program development, curricular decisions, and assessments (American Conference of Academic Deans [ACAD] n.d.; Hecht, Higgerson, Gmelch, & Tucker, 1999). SADs promote student success by offering mentorship opportunities, tutoring programs, and counseling services that specifically target their needs (University of New Mexico Student Affairs [UNM SA] n.d.; University of New Mexico Center for Academic Program Support [UNM CAPS] 2013).

Teachers and professors can prepare students to succeed by adopting effective teaching methods (Jump Math n.d.a), coordinating with student services personnel to ensure their students take advantage of mentoring, tutoring, and internship programs, and by providing students with research opportunities (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline 2011).

**Deans and Department Heads**

DDHs have administrative and curricular responsibilities that directly affect the quality of STEM programs. Deans are the chief academic administrators for their college (e.g. the College of Arts and Sciences) while department heads are faculty members in individual departments that serve as an intermediary between the administrators and other faculty members. Both types of DDH have budgetary, program development/management, curricular, and assessment responsibilities. Deans also have fundraising responsibilities while department heads are also responsible for recruiting and retaining students, overseeing departmental student groups, and collecting data (ACAD n.d.; Hecht, et al. 1999).

DDHs at non-MSIs are working to increase minority participation in STEM fields through the development of programs that specifically recruit URM students with targeted resources during their college years.

North Carolina State University’s Minority Engineering Program Office that works
to develop “programs that assist in the recruitment, retention and graduation of African-American, Native American and Hispanic students within the College of Engineering” (North Carolina State University Engineering [NCSUE] n.d.a). These programs include recruitment visits, a summer transition program, peer mentoring, and freshman orientation courses (NCSUE n.d.b).

Student Affairs Departments

The SAD representatives to this stakeholder group include college and university student services departments and high school academic and career counselors. They provide resources that help students deal with both the academic and extra-curricular challenges they typically face. While they vary by institution, SAD programs and activities may include: behavioral health counseling, offices of learning communities, offices of multicultural affairs, first year program offices, career services, mentoring programs, tutoring services and student activities (Kantrowitz n.d.; see also Florida State University Division of Student Affairs n.d.; UNM SA n.d.; UNM CAPS 2013).

Counseling programs in high schools have four main goals: “helping students prepare for work after high school, helping students with personal growth and development, helping students prepare for college, and helping students with academic achievement in high school” (McDonough 2005, p. 18). Counselors can help URM students decide which classes they need to take and to understand the importance of academic performance in preparing for a career in STEM (Committee 2011). However, schools with high URM populations often are not able to afford the number of counselors needed to adequately serve all of their students. While existing research shows that counseling programs can have a strong impact, there are too few studies that examine the impact of improving high school counseling programs for this to emerge as a priority for policy makers.

- The Mentoring Institute at the University of New Mexico “coordinates and integrates research and training activities in mentoring best practices ... in a centralized effort to recruit, train and develop qualified mentors” (University of New Mexico Mentoring Institute n.d.).
- The Center for Academic Retention and Enhancement (CARE) at the Florida State University “is designed to provide transition, engagement, and academic support services for traditionally underrepresented and disadvantaged populations. CARE includes a summer bridge program, tutoring, and high school outreach programs (Florida State University n.d.).

Teachers and Professors

Teachers and professors have a profound impact on URM STEM achievement. In addition to their instructional duties, professors can provide URM students with research opportunities and mentoring relationships, both of which have a demonstrated impact on URM student success in STEM fields. Teacher quality has been shown to be one of the most important factors in URM student success in STEM fields (Committee 2011). STEM teaching methods can vary significantly in terms of educational outcomes...
for students, even after controlling for teacher
group of public and land grant institutions
teaching methods and their effectiveness with specific populations
research on teaching methods and their effectiveness with specific populations can help teachers identify and adopt the most
effective methods for their students.

- A group of public and land grant institutions has formed the Science and Mathematics Teacher Imperative in an effort to “substantially increase the number and diversity of high quality mathematics and science teachers in middle schools and high schools.” They are developing an information sharing network focusing on best practices to increase teacher quality (Committee 2011, p. 80).

- The JUMP Math program is a comprehensive math teaching method based on cognitive science and evaluations of prior math programs. It has been shown to improve student math performance (Jump Math n.d.b).
References


Florida State University Division of Student Affairs. (n.d.) Our departments. Retrieved from http://studentaffairs.fsu.edu/about/departments


The RP² Prosperity Game: Creating a Critical Mass for Change in STEM Participation

University of New Mexico Student Affairs. (n.d.). Departments within the division of student affairs. Retrieved from http://studentaffairs.unm.edu/departments.html
For this Prosperity Game, the Researcher stakeholder group members are researchers whose work involves issues associated with factors that impact Underrepresented Minorities (URM) involvement in STEM. They may be currently involved in, or are considering joining an RP^2 team. RP^2 here implies a collaborative relationship that is synergistic in furthering both the practice of promoting STEM diversity and the practice of research on STEM diversity. The practitioners receive valuable information (e.g. process recommendations) specific to their work and empirical data that can be used to justify their programs to funding sources and policymakers (Urban & Trochim 2009). Researchers receive not only access to rich qualitative and quantitative data sources, they gain research collaborators whose experience with and understanding of the students involved in the studies can be invaluable for both research design and interpretation of results. Researchers who work closely with practitioners are much more likely to have the products of their work put into practice, which in turn generates more data, facilitating a larger research agenda. Finally, the interactions with implementers broadens the researcher’s understanding and knowledge of the subject (Urban & Trochim 2009). RP^2 can take many shapes, including: research alliances, design research, and networked improvement communities (NIC).

A few examples of topics on which more research is needed include: design of informal science education programs that effectively target URMs; aspects of institutional culture important for recruitment and retention of URMs; and the impact of specific intervention strategies on student achievement (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline [Committee] 2011).

Research Alliances

Research alliances are a form of RP^2 where the researchers and the implementers “maintain distinct and fairly conventional roles” and “collaborat[e] most intensively at the start and end of a given study.” They have a primary focus on coming up with a local solution and a secondary focus on publishing results. This primary focus on local solutions increases the focus on the area over time and allows the researchers to develop a fuller understanding of the issues in the area and their potential solutions (Coburn, Penuel, & Geil 2013, p. 8).

The Research Alliance for New York City Schools was established in 2008 to improve education in New York. Researchers “conduct evaluation studies . . .have developed a longitudinal data archive, and conduct an annual survey on the educational environment that is then used to guide their effort to improve education (Committee 2011, p. 7).

Design Research

Design research is a highly interactive form of RP^2. The overall purpose of the project is defined collaboratively and multiple parties are involved in all subsequent stages of the project. This degree of collaboration allows the researchers
and implementers to “bring diverse kinds of expertise to bear on persistent problems of educational practice.” Design research projects tend to be focused on a single location and issues associated with that site. Even though the projects tend to be more focused on a specific location, researchers tend to put equal weight on addressing local issues and publishing data to contribute to the overall body of knowledge (Coburn et al. 2013, p. 10).

The Bellevue School District and the University of Washington have entered into a design partnership to improve STEM education through professional development and curricular improvements. The partnership’s goals are: “(1) to develop curriculum units and professional development that are attuned to local issues and contexts and (2) to contribute to research knowledge by developing theories of and evidence related to individual, group, and organizational learning.” Two research teams from the University of Washington are involved in this project. Researchers design new curriculum materials and make suggestions, teachers review the recommendations and comment on their practicality. Use of the materials and implementation of recommendations begins a new design cycle (Coburn 2013, p. 9).

Networked Improvement Communities

NICs are RP² networks formed between researchers and a range of entities that have an interest in the overarching research goals. The entities working with researchers can include individual schools, school districts, universities, community organizations, and museums, among others. The number and variety of entities involved in a NIC allows the research to investigate and address issues on a systemic level. Research projects are broken up into many small pieces and the project is analyzed after each step. Changes to a program or activity suggested by the research can first be implemented in a small part of the NIC and if it appears to be having a positive benefit, can be rapidly scaled up throughout the NIC. Implementers are in the best position to gather data about the projects, which often puts researchers in a facilitator role. NICs are highly focused on the local system to the point that reporting the research and findings outside the system is not a priority (Coburn et al. 2013).

The El Paso Collaborative for Academic Excellence (EPCAE) includes 12 school districts, 200 schools, the local community college, and the University of Texas El Paso (Committee 2011). It is an NIC that has been working on improving minority STEM education in El Paso since the early 1990’s. El Paso County is 78% Hispanic and 3% black. (El Paso Collaborative for Academic Excellence [El Paso] n.d.a) EPCAE has projects on professional development, curricular improvements, and creating a “culture of accountability” (El Paso n.d.b). EPCAE maintains educational data and uses it to fund outreach efforts, inform the creation of goals as well as other decisions, and “to assess progress towards those goals” (El Paso n.d.c). Since EPCAE began, El Paso student achievement has gone up across the board, the high school graduation rate has drastically increased, and many more students are taking STEM college preparatory classes (Committee 2011).
References


Team 9—Employers

The Employers stakeholder group encompasses all public and private entities that employ people to work in STEM fields, or fields that require some background in STEM. Reducing the STEM achievement gap is crucial for employers for several reasons. Collectively, URMs are the fastest growing demographic group in the country. A proportional increase in URMs in STEM fields is necessary for the nation to meet future workforce needs, and relieve our reliance on international students to meet the nation’s demand for STEM professionals (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline 2011; Simard n.d.). Also, a diverse STEM workforce is a more effective workforce.

Diverse work teams are generally better at solving problems innovatively and therefore more adaptive (in defined work contexts) than homogenous ones (Page 2007). STEM workforce diversity by its very nature creates opportunities for innovation.

URM populations are severely underrepresented in STEM professions. This underrepresentation creates the conditions for different forms of social isolation within the work environment for URM STEM professionals. One factor that contributes to the disparity is that at many places of STEM employment URM applicants and employees are evaluated through the socio-cultural lens of the evaluator, who is more

![Chart 1a. Proportion of underrepresented minority employees in technical positions by rank level](chart.png)

Percentage of URM and Non-URM employees in technical positions (Simard n.d., p. 7). Only 8.3% of entry level, 6.5% of mid-level, and 5.6% of high level employees are URMs, which is very low when compared with the Census estimate that over 30% of the country’s population is either black, Hispanic, or an American Indian (United States Census [Census] 2013).
often than not a middle aged white male. This culturally diffracted evaluation can obscure the URM employee’s strengths while highlighting perceived weaknesses, affecting the individual’s career trajectory. This is one important argument for having more URM in the managerial ranks (Simard n.d.).

URM STEM employees tend to consider employee development practices extremely important in determining job satisfaction. Mentoring and networking opportunities are employee development practices that are especially important, but are not as prevalent as they could be. “[M]entors tend to seek protégés who resemble them in background, race, and gender.” This implies a shortage not necessarily of mentors, but of mentors that are able to help with adapting to the organizational culture of the workplace. Racial barriers can impact the landscape of available networking opportunities, which could significantly affect URM employees’ career advancement opportunities (Simard n.d., p. 4).

Many major corporations are working to improve internal diversity through programs such as: diversity councils, employee groups, URM-focused professional development opportunities, and community outreach (Alcoa n.d.; Intel n.d.a; General Electric [GE] n.d.c; Bayer n.d.a).

- As parts of Alcoa’s efforts to improve racial diversity in its workforce, it has implemented: a Diversity Inclusion Council; affinity groups, including the Alcoa African Heritage Network; and has developed a relationship with the National Society of Black Engineers. Alcoa requires all managers to take diversity and inclusion training.

- Intel’s diversity efforts include: leadership councils for minority employees; supporting STEM education; sponsoring employee group programs for Latinos, blacks, and American Indians; and diversity initiatives that organize leadership conferences and mentorships to black and Hispanic students.

(Data from Intel 2013; Census 2013) With the exception of American Indian technicians, none of Intel’s employee categories are close to their population percentages.
(Intel n.d.) Even with these diversity initiatives, Intel is still seeing a large disparity within their different job categories between demographic groups.

- General Electric [GE] attends black, Hispanic, and American Indian focused career fairs to recruit minority students (GE n.d.a). In addition to attending career fairs, GE sponsors an African American forum for professional development, career management, and mentoring, and was named a “Top Corporate Supporter of Black Engineering Schools,” (GE n.d.b). GE also conducts an annual Hispanic forum, has memoranda of understanding with Hispanic professional organizations, and established the GE Talent Assessment Program to accelerate Hispanic career growth (GE n.d.c).

- Bayer established the African American Employee Network, to “improve the lines of communication and create greater cultural diversity awareness,” and the African American/Hispanic Association, to improve Bayer’s recruitment efforts (Bayer n.d.a). Bayer has established diversity councils around the country, (Bayer n.d.b), and provides funds to support K-12 education programs and education research (Bayer n.d.c).
References


The RP2 Prosperity Game: Creating a Critical Mass for Change in STEM Participation 51
Appendix A: NAS Report Summary

Expanding Underrepresented Minority Participation: America’s Science and Technology Talent at the Crossroads

Summary

A TRANSFORMATIONAL MOMENT

Our ability to meet the challenges and achieve the opportunities of our time depends in large measure on our science and engineering (S&E) enterprise. Yet, while our S&E capability is as strong as ever, the dominance of the United States in these fields has lessened as the rest of the world has invested in and grown their research and education capacities. Rising Above the Gathering Storm documented this global leveling and argued that the United States was at a crossroads: For the United States to maintain the global leadership and competitiveness in science and technology that are critical to achieving national goals today, we must invest in research, encourage innovation, and grow a strong, talented, and innovative science and technology workforce.\(^1\)

Gathering Storm resonated strongly in both the executive and legislative branches of government, resulting in the American Competitive Incentive Act, the America COMPETES Act, and substantial appropriations through the American Recovery and Reinvestment Act of 2009.

The importance of S&E to the United States has been documented in a series of reports over more than half a century. Nevertheless, critical issues for the nation’s S&E infrastructure remain unsettled. Among them, America faces a demographic challenge with regard to its S&E workforce: Minorities are seriously underrepresented in science and engineering, yet they are also the most rapidly growing segment of the population. Gathering Storm provided compelling recommendations for sustaining and increasing our knowledge workforce as part of a larger plan to sustain the nation’s scientific and technological leadership. These workforce recommendations focused on improving K-12 STEM education as well as providing incentives for students to pursue S&E education at the undergraduate and graduate levels.\(^2\)

We fully support these recommendations, but they are insufficient to meet the emerging demographic realities. The United States stands again at the crossroads: A national effort to sustain and strengthen S&E must also include a strategy for ensuring that we draw on the minds and talents of all Americans, including minorities who are underrepresented in S&E and currently embody a vastly underused resource and a lost opportunity for meeting our nation’s technology needs.

Citing the need to develop a strong and diverse S&E workforce, U.S. Senators Edward Kennedy, Barbara Mikulski, Patty Murray, and Hillary Clinton requested in November 2006 a study of underrepresented minority participation in S&E. The U.S. Congress later included this request as a mandate in the 2007 America COMPETES Act, charging the study committee to explore the role of diversity in the STEM workforce and its value in keeping America innovative and competitive, analyze the rate of change and the challenges the nation currently faces in developing a strong and diverse workforce, and identify best practices and the characteristics of these practices that make them effective and sustainable.

\(^{1}\)Institute of Medicine, National Academy of Sciences, and National Academy of Engineering. 2007. Rising Above the Gathering Storm: Energizing and Employing.

\(^{2}\)Ibid. pp. 5-7, 9-10.
Broad Participation Matters

A strategy to increase the participation of underrepresented minorities in science and engineering should play a central role in our approach to sustaining America’s research and innovation capacity for at least three reasons:

1. Our sources for the future S&E workforce are uncertain: For many years, the nation relied on an S&E workforce that was predominantly male and overwhelmingly white and Asian. In the more recent past, as the proportion of the S&E workforce that is white and male has fluctuated, we have seen gains for women in some fields and an increasing reliance on international students in others. Non-U.S. citizens, particularly those from China and India, have accounted for almost all growth in STEM doctorate awards and in some engineering fields comprise the majority of new doctorates. Yet, we are coming to understand that relying on non-U.S. citizens for our S&E workforce is an increasingly uncertain proposition.

2. The demographics of our domestic population are shifting dramatically: If the uncertainty about the future participation of international students suggests that we need to ensure that we draw on all demographic sources, the dramatic changes in the demographics of the domestic population, especially the school-age population, suggest that the problem is all the more urgent: Those groups that are most underrepresented in S&E are also the fastest growing in the general population.

3. Diversity is an asset: Increasing the participation and success of underrepresented minorities in S&E contributes to the health of the nation by expanding the S&E talent pool, enhancing innovation, and improving the nation’s global economic leadership.

Dimensions of the Problem

The S&E workforce is large and fast-growing: more than 5 million strong and projected by the U.S. Bureau of Labor Statistics to grow faster than any other sector in coming years. This growth rate provides an opportunity as well as an obligation to draw on new sources of talent to make the S&E workforce as robust and dynamic as possible. But we start from a challenging position: Underrepresented minority groups comprised 28.5 percent of our national population in 2006, yet just 9.1 percent of college-educated Americans in science and engineering occupations (academic and nonacademic), suggesting the proportion of underrepresented minorities in S&E would need to triple to match their share of the overall U.S. population.

Underrepresentation of this magnitude in the S&E workforce stems from the underproduction of minorities in S&E at every level of postsecondary education, with a progressive loss of representation as we proceed up the academic ladder. In 2007, underrepresented minorities comprised 38.8 percent of K-12 public enrollment, 33.2 percent of the U.S. college age population, 26.2 percent of undergraduate enrollment, and 17.7 percent of those earning science and engineering bachelor’s degrees. In graduate school, underrepresented minorities comprise 17.7 percent of overall enrollment but are awarded just 14.6 percent of S&E master’s degrees and a miniscule 5.4 percent of S&E doctorates.

Historically, there has been a strong connection between increasing educational attainment in the United States and the growth in and global leadership of the economy. Consequently, there have been calls—from the College Board, the Lumina and Gates Foundations, and the administration—to increase the postsecondary completion rate in the United States from 39 percent to 55 or 60 percent. The challenge is greatest for underrepresented minorities: In 2006 only 26 percent of African Americans, 18 percent of American Indians, and 16 percent of Hispanics in the 25- to 29-year-old cohort had attained at least an associate degree. The news is even worse in S&E fields. In 2000, as noted in Gathering Storm, the United States ranked 20 out of 24 countries in the percentage of 24-year-olds who had earned a first

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degree in the natural sciences or engineering. Based on these data, Gathering Storm recommended efforts to increase the percentage of 24-year-olds with these degrees from 6 percent to at least 10 percent, the benchmark already attained by several countries. But again, the statistics are even more alarming for underrepresented minorities. These students would need to triple, quadruple, or even quintuple their proportions with a first university degree in these fields in order to achieve this 10 percent goal: At present, just 2.7 percent of African Americans, 3.3 percent of Native Americans and Alaska Natives, and 2.2 percent of Hispanics and Latinos who are 24 years old have earned a first university degree in the natural sciences or engineering.

Recent data from the Higher Education Research Institute (HERI) at UCLA show that underrepresented minorities aspire to major in STEM in college at the same rates as their white and Asian American peers, and have done so since the late 1980s. Yet, these underrepresented minorities have lower four- and five-year completion rates relative to those of whites and Asian Americans. That a similar picture previously was seen in data in the mid-1990s signals that, although we have been aware of these problems for some time, we, as a nation, have made little collective progress in addressing them.

Fixing the Problem

No single career pathway or pipeline exists in STEM education. Students start from diverse places, with different family backgrounds and schools and communities with different resources and traditions. There also is substantial variation in K-12 mathematics and science education across schools, districts, and states. STEM courses, moreover, serve varied purposes for students on different tracks.

Although a set of pathways may be difficult to describe in detail, the ingredients for success in STEM are the acquisition of knowledge, skills, and habits of mind; opportunities to put these into practice; a developing sense of competence and progress; motivation to be in, a sense of belonging to, or self-identification with the field; and information about stages, requirements, and opportunities. These ingredients require attention in some measure for all students at every stage along the STEM educational continuum. However, there are issues that are specific to underrepresented minorities, in general and in STEM, focused on preparation, access and motivation, financial aid, academic support, and social integration.

Preparation

The education children receive from preschool through high school is foundational and critical. For STEM, quality preparation is a prerequisite for later success. From "A Nation at Risk" 25 years ago to current debates over reauthorization of the No Child Left Behind Act, interventions have been a subject of contention. Yet today, the nation remains faced with many of the same issues it has grappled with for years: failing schools, inequitable distributions of resources across schools, achievement gaps, and increasing demand for skilled workers in science, technology, and other knowledge-intensive fields. Moreover, substantial growth in the nation's Hispanic population has increased pressure on our nation's schools by increasing the number of nonnative English speakers.

Researchers offer many explanations for the persistent achievement gaps while recognizing that there are many interrelated factors. They agree that family and community differences, school context, low expectations, and lack of exposure to role models, information about career opportunities, and advanced courses affect minority students' success in mathematics and science. Although there is considerable disagreement over solutions such as school choice, testing, and teacher pay, there is
substantial agreement about the need for strong preschool programs, more qualified mathematics and science teachers in predominantly minority and low-income schools, and challenging high school curricula that prepare underrepresented minorities for college.

Access and Motivation

The S&E workforce in the United States is drawn primarily from among our nation’s undergraduates who complete at least a bachelor’s degree. Undergraduate enrollment of underrepresented minorities has increased substantially over the past three decades and at a rate faster than for whites. As a result, they now comprise 26.2 percent of all undergraduates. While this falls short of their proportion in the college age population (33.2 percent), this increase in their numbers and proportions nonetheless represents a significant national achievement.

However, we must do much more to attract and retain underrepresented minorities, low-income students, and first-generation undergraduates who aspire to a major in STEM. Specifically, we can do the following: (1) improve college awareness activities for prospective college students, (2) focus on college admissions policies that support the postsecondary matriculation of qualified underrepresented minority students, (3) raise awareness of STEM careers through K-12 activities, improved counseling for science and mathematics, and activities that promote STEM, and (4) promote STEM outreach that specifically targets underrepresented minorities.

Affordability

College affordability is an issue for all students, especially as tuition continues to increase above the rate of inflation, and is affected by federal, state, and institutional policies. Financial support that meets student need is strongly correlated with student attendance and persistence. For underrepresented minorities in STEM, financial support can come from a range of programs, including need-based financial aid programs (e.g., Pell Grants), general programs supporting underrepresented minorities (e.g., Gates Millennium Scholarships), financial aid that targets students in STEM (e.g., SMART Grants), and programs that target underrepresented minorities in STEM (e.g., NIH’s MARC program). While some financial assistance may be need-based, programs that target underrepresented minorities in STEM are necessary. Researchers have shown that financial incentives are most effective in reducing attrition among low-income and minority students when provided in conjunction with academic support and campus integration programs.

Academic and Social Support

A study of undergraduate persistence by the National Center for Education Statistics (NCES) found that although women were less likely to major in STEM than men, they had similar or higher persistence rates. By contrast, they found that underrepresented minorities majored in STEM at the same rate as others, but their completion rate was lower, a finding recently corroborated by HERI. NCES concluded that underrepresented minorities faced greater barriers to persistence and completion. Other researchers note also that the culture and climate of institutions, including the diversity of faculty, impact the entire process from entry to graduation.

Several practical steps can be taken to increase the completion of minorities: Make student success a priority, track student achievement, identify “choke points” such as course availability, make course transfer easier, and ensure that courses are structured to properly support students. Only higher education institutions can address these issues and only they can ensure the academic and social support necessary for underrepresented minority students in STEM. To address issues of self-confidence and inclusion that are profoundly salient, institutions can play a pivotal role, through formal and informal actions, to encourage persistence through:

• Strong leadership from trustees and regents, the president, provost, deans, and department chairs;
• A campus-wide commitment to inclusiveness;
• A deliberate process of self-appraisal focused on campus climate;
• Development of a plan to implement constructive change; and
• Ongoing evaluation of implementation efforts.

THE JOURNEY BEYOND THE CROSSROADS

Principles

Six principles have informed the development of our recommendations to move “beyond the crossroads” to the implementation of actions designed to increase the participation and success of underrepresented minorities in STEM education. Given how long it takes to realize gains from educational reform, the national effort must be urgent, sustained, comprehensive, intensive, coordinated, and informed:

1. The problem is urgent and will continue to be for the foreseeable future.
2. A successful national effort to address underrepresented minority participation and success in STEM will be sustained.
3. The potential for losing students along all segments of the pathway from preschool through graduate school necessitates a comprehensive approach that focuses on all segments of the pathway, all stakeholders, and the potential of all programs, targeted or nontargeted.
4. Students who have not had the same degree of exposure to STEM and to postsecondary education require more intensive efforts at each level to provide adequate preparation, financial support, mentoring, social integration, and professional development.
5. A coordinated approach to existing federal STEM programs can leverage resources while supporting programs tailored to the specific missions, histories, cultures, student populations, and geographic locations of institutions with demonstrated success.
6. Evaluation of STEM programs and increased research on the many dimensions of underrepresented minorities’ experience in STEM help ensure that programs are well informed, well designed, and successful.

Institutional Roles

The diversity of American higher education institutions is a competitive advantage in the global knowledge economy as different types of institutions address the varied needs of students who find themselves at different places in their educational journey with a range of life and career goals. This institutional diversity could be, but is not yet, effective in addressing the varied needs of the nation’s underrepresented minority students in STEM. For our recommended action to be successful, every institution of higher education should take steps to address the problem of underrepresented minority participation in STEM. Currently, only a small number of institutions are doing so. They are diverse and can be found among all institutional types and categories; they are successful because they are doing something special to support the retention and completion of underrepresented minority undergraduates in the natural sciences and engineering. Their actions can be replicated, and when they are, with a focus on both numbers and quality, it will pay off significantly:

• Predominantly White Institutions: The best way to increase the retention of underrepresented minorities in STEM is to replicate programs of the successful PWIs at a very large number of similar institutions, especially large state flagships.
• Minority-Serving Institutions: MSIs have a legacy of recruiting, retaining, and graduating a disproportionate number of minorities, especially at the undergraduate level. With additional support, MSIs can expand their effectiveness in recruiting, retaining, and graduating an increased number of minorities, especially at the baccalaureate level.
• Community Colleges: To facilitate and increase the successful transfer of underrepresented minorities in STEM to four-year institutions, an increased emphasis on and support for articulation agreements, summer bridge programs, mentoring, academic and career counseling, peer support, and undergraduate research at two-year institutions are recommended.
Leadership

Leadership is key to the successful transformation of institutions and the development of sustainable programs:

- **Sectoral Leadership:** Leadership in identifying and articulating minority participation and success as an institutional goal is essential at all levels for all stakeholders: the federal government, state and local governments, employers, philanthropy, professional societies, educational institutions, programs, faculty, and students.

- **Institutional Leadership:** At each higher education institution, the academic leadership—regents, trustees, presidents, provosts, deans, and department chairs—should articulate underrepresented minority participation as a key commitment to set a tone that raises awareness and effort. Faculty buy-in is essential. Institutional leaders also should be more aggressive in investing in the development of underrepresented minority teachers, faculty, and administrators who can serve as role models and leaders.

- **Programmatic Leadership:** A champion at the program level providing leadership dedicated to long-term improvement is typically critical to the success of underrepresented minority programs at the undergraduate and graduate levels.

Program Development

The literature on best practices for increasing minority participation in STEM education provides guidance for the development and execution of the policies and programs that are designed to change the academic culture and sustain programs so as to encourage student retention, persistence, and completion. Below are key elements for developing a program that are necessary to transform goals into reality:

- **Resources and Sustainability:** The development of programs to stimulate student interest and success in STEM, in general and for programs that target minorities, requires substantial and sustained resources.

- **Coordination and Integration:** Coordination and integration of efforts can make the aggregate of individual programs greater than the sum of their parts.

- **Focus on the Pipeline, Career Pathways, and Transition Points:** A corollary to coordination and integration is programs and strategies that focus on career pathways and critical pipeline transition points.

- **Program Design:** A successful program may be innovative or replicative and will draw on the lessons of best and worst practices in program development and implementation, but it will be tailored to its particular institutional and disciplinary context.

- **Program Execution:** Even if a program is well designed, well resourced, and appropriately targeted, without proper execution it has little chance of full success.

- **Program Evaluation:** Whether a program meets or exceeds organizational goals is subject to examination. Programs designed to increase the participation of underrepresented minorities benefit themselves and others by engaging in ongoing, constructive evaluation.

- **Knowledge Sharing:** A corollary to the importance of program evaluation is the dissemination of information about practice derived from these evaluations and other research.

Program Characteristics

While many strategies for academic support and social integration apply equally to students in STEM fields regardless of their racial or ethnic background, for underrepresented minority students these can be critical for opening doors of opportunity. Proven, intensive interventions for underrepresented minorities in STEM include:

- **Summer Programs:** Summer programs that include or target minority middle and high school and undergraduate students provide experiences that stimulate interest in these fields through study, hands-on research, and the development of a cadre of students who support each other in their interests.
• **Research Experiences:** At the undergraduate and graduate level, engagement in rich research experiences allows for the further development of interest and competence in and identification with STEM and enhances academic competitiveness.

• **Professional Development Activities:** Opportunities for undergraduate and graduate students to engage in networking, participation in conferences, and presentation of research provide opportunities to develop and socialize students within a discipline and profession.

• **Academic Support and Social Integration:** Success may also hinge on the extent to which undergraduate and graduate students participate in activities—such as peer-to-peer support, study groups, social activities, tutoring, and mentoring programs—that can promote academic success and social integration.

• **Mentoring:** Engaged mentors can provide undergraduate and graduate students with information, advice, and guidance and support generally and at critical decision points. Students should also have access to proper facilities and equipment, and course curricula should be formulated to encourage student learning and progress—something that seems self-evident, except that many introductory courses in the sciences have traditionally sought to “weed out” students rather than encourage them.

**Recommendations and Implementation Actions**

A successful national effort to increase the participation and success of underrepresented minorities in STEM will be urgent, sustained, comprehensive, intensive, coordinated, and informed. It will also cut across all educational stages and stakeholder groups. With these principles in mind, the committee has developed six broad recommendations followed by implementation actions that should be taken by specific stakeholders. Following the six broad recommendations, we propose two top priorities that should serve as the near-term focal point for national policies for broadening participation.

**Preparation**

**Recommendation 1: Preschool through Grade 3 Education**

Prepare America’s children for school through preschool and early education programs that develop reading readiness, provide early mathematics skills, and introduce concepts of creativity and discovery.

**Recommendation 2: K to 12 Mathematics and Science**

Increase America’s talent pool by vastly improving K-12 mathematics and science education for underrepresented minorities.

**Recommendation 3: K-12 Teacher Preparation and Retention**

Improve K-12 mathematics and science education for underrepresented minorities overall by improving the preparedness of those who teach them those subjects.

**Postsecondary Success**

**Recommendation 4: Access and Motivation**

Improve access to all postsecondary education and technical training and increase underrepresented minority student awareness of and motivation for STEM education and careers through improved information, counseling, and outreach.

**Recommendation 5: Affordability**

Develop America’s advanced STEM workforce by providing adequate financial support to underrepresented minority students in undergraduate and graduate STEM education.

**Recommendation 6: Academic and Social Support**

Take coordinated action to transform the nation’s higher education institutions to increase inclusion.
of and college completion and success in STEM education for underrepresented minorities.

**Top-Priority Actions**

Out of the recommendations and implementation actions that span the entire educational system and full spectrum of stakeholders, we have identified two areas of highest priority for near-term action. We chose them because we believe they can have the most immediate impact on the critical transition points in the STEM education pathway for underrepresented minorities.

Priority 1: Undergraduate Retention and Completion: We propose, as a short-term focus for increasing the participation and success of underrepresented minorities in STEM, policies and programs that seek to increase undergraduate retention and completion through strong academic, social, and financial support. Financial support for underrepresented minorities that allows them to focus on and succeed in STEM will increase completion and better prepare them for the path ahead. This financial assistance should be provided through higher education institutions along with programs that simultaneously integrate academic, social, and professional development.

The success of such an effort is made possible by the existence of a cadre of qualified underrepresented minorities who already attend college, declared an interest in majoring in the natural sciences or engineering, and either did not complete a degree or switched out of STEM before graduating. An increase in the STEM completion rate for these students may, for example, increase interest in STEM on the part of younger cohorts and also increase the number of underrepresented minorities who may consider graduate education in STEM.

Financial support for underrepresented minorities that allows them to focus on and succeed in STEM will increase completion and better prepare them for the path ahead. This financial assistance should be provided through higher education institutions along with programs that simultaneously provide academic support, social integration, and professional development. Given the scale of the problem, an effort to double the number of underrepresented minorities who complete undergraduate STEM degrees is a near-term, reasonable, and attainable down payment on a longer-term effort to achieve greater parity overall.

Priority 2: Teacher Preparation, College Preparatory Programs, and Transition to Graduate Study: We propose also an emphasis on teacher preparation, secondary school programs that support preparation for college STEM education, and programs that support the transition from undergraduate to graduate work.

We note the particular importance at the K-12 level of teacher preparation and secondary school programs that support preparation for college STEM education. Secondary school programs that ensure students have access to advanced courses and proper academic advising will support the goal of undergraduate persistence and completion by ensuring that matriculating freshmen are fully prepared for college study.

At the other end of the undergraduate years, programs that support the transition from undergraduate to graduate work are likewise important. The transition of underrepresented minorities to graduate work at top research universities where they can contribute to research and leadership in our nation's science and engineering enterprise is also critical. A significant proportion of new graduate students who are supported through portable fellowships, research assistantships, or institutional grants should be underrepresented minorities in order to increase their overall representation and to move greater numbers into top graduate programs.
# Appendix B: RP² Prosperity Game Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Affiliation</th>
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<tbody>
<tr>
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<td>Dean of College of Science, Engineering and Technology, Jackson State University</td>
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<tr>
<td>Larry Anderson</td>
<td>President, Fond du Lac Tribal and Community College</td>
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<td>Kevin Barge</td>
<td>Professor and Head of Communication, Texas A &amp; M University</td>
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<td>Tom Davis</td>
<td>Provost, Navajo Technical University</td>
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<tr>
<td>Jaclyn DeCicco</td>
<td>University Programs Specialist, Google, Inc.</td>
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<tr>
<td>Joshua Falleaf</td>
<td>Vice President for Academic Affairs, Haskell Indian Nations University</td>
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<tr>
<td>Leslie Fagre</td>
<td>Board Member, Academy of Technology and the Classics</td>
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<tr>
<td>Benjamin Flores</td>
<td>Dean of the Graduate School, The University of Texas at El Paso</td>
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<tr>
<td>Anne S. Fullerton</td>
<td>Wellness Counselor, Health, Wellness and Fitness, Santa Fe, New Mexico</td>
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<tr>
<td>Reese Fullerton</td>
<td>Senior Change Facilitator, Strategic Engagement, Santa Fe, New Mexico</td>
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<tr>
<td>Victoria Garcia</td>
<td>Statewide Interoperability Coordinator, State of Hawaii Office of Information Management and Technology</td>
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<tr>
<td>Jodi Gillette</td>
<td>Senior Policy Advisor for Native American Affairs, White House Domestic Policy Council</td>
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<tr>
<td>René A. González</td>
<td>Sr. Ex. Director of Student Services, Corp. Internship Program, Hispanic Association of Colleges and Universities</td>
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<tr>
<td>Cynthia Graddy</td>
<td>Project Director, National Dental Association</td>
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<tr>
<td>Julio Guillen</td>
<td>Professor of Mathematics, New Jersey City University</td>
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<tr>
<td>Elmer Guy</td>
<td>President, Navajo Technical University</td>
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<tr>
<td>Nia Haynes</td>
<td>Ph.D. Candidate, University of Florida</td>
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<tr>
<td>Deborah His Horse is Thunder</td>
<td>Project Director Student Success Collaborative, American Indian Higher Education Consortium</td>
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<tr>
<td>Stafford Hood</td>
<td>Professor, Associate Dean for Research and Research Education, University of Illinois at Urbana-Champaign</td>
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<tr>
<td>Gerunda Hughes</td>
<td>Professor/Director, Howard University</td>
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<tr>
<td>Kathy Isaacson</td>
<td>President, Strategic Engagement</td>
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<tr>
<td>Torry Johnson</td>
<td>Assistant Deputy Director for Hydrospheric and Biospheric Sciences, NASA</td>
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<tr>
<td>Al Kuslikis</td>
<td>Senior Associate for Strategic Initiatives, American Indian Higher Education Consortium</td>
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<tr>
<td>Joan LaFrance</td>
<td>President, Mekinak Consulting</td>
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<tr>
<td>John Michael Lee Jr.</td>
<td>Vice President, Association of Public and Land-grant Universities</td>
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<tr>
<td>Damon Lester</td>
<td>President, National Association of Minority Automobile Dealers</td>
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<tr>
<td>Name</td>
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<tr>
<td>Beverly Louie</td>
<td>Director, Teaching &amp; Learning Initiatives, University of Colorado Boulder</td>
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<tr>
<td>Sheila McNamee</td>
<td>Professor, Communication/Organizational Culture, Univ. of New Hampshire/Tilburg University, The Netherlands</td>
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<tr>
<td>Juanita Mendoza</td>
<td>Program Analyst, Bureau of Indian Education</td>
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<tr>
<td>Abby Miller</td>
<td>Director of Applied Research, Institute for Higher Education Policy</td>
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<tr>
<td>Stanley Mims</td>
<td>Dean of the Division of Education, Wiley College</td>
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<tr>
<td>Antoinette Mitchell</td>
<td>Assistant Superintendent-Postsecondary &amp; Career Education, D.C. Office of the State Superintendent of Ed.</td>
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<tr>
<td>Janie Nall</td>
<td>Education Director, NASA</td>
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<tr>
<td>John Oetzel</td>
<td>Professor, Department of Management Communication, University of Waikato in Hamilton, New Zealand</td>
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<tr>
<td>CJ Ondek</td>
<td>Nonprofit Writing and Editing Professional, Albuquerque, New Mexico</td>
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<tr>
<td>Tim Podkul</td>
<td>Research Social Scientist, Center for Technology in Learning, SRI International</td>
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<tr>
<td>Phil Pohl</td>
<td>Technical Staff, Sandia National Laboratories</td>
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<tr>
<td>Scott Poole</td>
<td>Department of Communications, University of Illinois Urbana-Champaign</td>
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<tr>
<td>Iris PrettyPaint</td>
<td>Director of Native Aspirations, Kauffman and Associates</td>
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<tr>
<td>Glenda Prime</td>
<td>Professor, Morgan State University</td>
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<tr>
<td>Greg Roberts</td>
<td>CEO, GCR Consulting</td>
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<tr>
<td>Harriett Romo</td>
<td>Director of the CAPRI/Mexico Center, The University of Texas at San Antonio</td>
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<tr>
<td>Nora Sabelli</td>
<td>Senior Science Advisor, Stanford Research Institute</td>
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<tr>
<td>Sherry Sanchez Tibbetts</td>
<td>Director Institutional Research, Planning &amp; Grants, Fond du Lac Tribal and Community College</td>
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<tr>
<td>David Sanders</td>
<td>Research Director, American Indian College Fund</td>
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<tr>
<td>Nikki Santos</td>
<td>Federal Tribal Relations/Special Initiatives Associate, American Indian Higher Education Consortium</td>
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<tr>
<td>Delisa Saunders</td>
<td>Human Rights and Community Relations, American Federation of Teachers</td>
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<tr>
<td>Regina Sievert</td>
<td>Director, Bachelor of Science in Secondary Education, Salish Kootenai College</td>
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<tr>
<td>Kee Straits</td>
<td>Clinical Psychologist/Proprietor, Tinkuy Life Community Transformations, LLC</td>
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<tr>
<td>Jody TallBear</td>
<td>Attorney Advisor, U.S. Department of Energy</td>
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<tr>
<td>Courtney Tanenbaum</td>
<td>Senior Researcher, American Institutes for Research</td>
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<tr>
<td>Ivory Toldson</td>
<td>Deputy Director, for the White House Initiative on Historically Black Colleges and Universities, Depart. of Education</td>
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<tr>
<td>Wayne Trottier</td>
<td>Superintendent of Schools, Standing Rock Community/Fort Yates Public School</td>
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<tr>
<td>Nader Vadier</td>
<td>Faculty, Southwestern Indian Polytechnic Institute</td>
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<tr>
<td>Carlos Felipe Villar-Guhl</td>
<td>Organizational Change and Development Consultant, Colombia</td>
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<tr>
<td>Malia Villegas</td>
<td>Director, NCAI Policy Research Center, National Congress of American Indians</td>
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<tr>
<td>Dara Wald</td>
<td>Postdoctoral Fellow in the Center for Policy Informatics, Arizona State University</td>
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<tr>
<td>Richard Weibl</td>
<td>Chief Learning Officer, Association for Women in Science</td>
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<tr>
<td>Brenda Welburn</td>
<td>President, Resource Institute for Strategic Engagement</td>
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<tr>
<td>Boyce C. Williams</td>
<td>President &amp; CEO, National Alliance for Learning, Inc.</td>
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<tr>
<td>David Wilson</td>
<td>Deputy Director of American Indian Affairs &amp; Policy, SACNAS</td>
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Appendix C: Biographies

A. Wade Boykin, Ph.D.

A. Wade Boykin is a professor and director of the Graduate Program in the Department of Psychology at Howard University, Washington, D.C. From 1994–2004, he served as co-director of the National Center for Research on the Education of Students Placed At Risk (CRESPAR). The work of CRESPAR continues at Howard University as the Capstone Institute. Capstone’s mission is to provide a comprehensive range of world-class educational services to schools and other learning institutions and in doing so promote the position that all people, regardless of background or circumstances, can learn and perform at the highest levels when the necessary programs, practices, and supports are sufficiently evident.

Dr. Boykin has done extensive work in the area of research methodology; the interface of culture, context, motivation and cognition; Black child development; and academic achievement in the American social context. He is co-editor of the book Research Directions of Black Psychologists (Russell Sage Press), which was a finalist for the American Psychological Association's Book of the Year. He recently co-authored the book Creating the Opportunity to Learn: Moving from Research to Practice to Close the Achievement Gap (ASCD Press) and wrote an article on “Human Diversity, Assessment in Education & the Achievement of Excellence and Equity” featured in The Gordon Commission on the Future of Assessment in Education. He has published numerous research and theoretical journal articles, and book chapters relevant to his interests.

He received his doctoral degree in experimental psychology from the University of Michigan, Ann Arbor. Before coming to Howard, he was a tenured associate professor of psychology at Cornell University, Ithaca, NY.
René A. González

René A. González is senior executive director of Student Services and the Corporate Internship Program for the Hispanic Association of Colleges and Universities (HACU), a national advocacy organization for Hispanics in higher education and Hispanic-Serving Institutions (HSIs) based in San Antonio, Texas. In addition to overseeing the Corporate Internship Program he is the project director for the American Legacy Foundation funded Hispanic/Latino College Health Initiative which examines the attitudes of Latino students toward smoking; the Walmart Foundation funded MSI Strategies for Success in collaboration with the American Indian Higher Education Consortium and the National Association for Equal Opportunity; and the Office of Minority Health funded National Umbrella Cooperative Agreement. He also manages the Student Track career development conference for over 375 students that is part of HACU’s annual conference.

In addition, Mr. Gonzalez develops and reviews grant proposals and federal and corporate partnerships and initiatives for HACU. He has secured and managed over $13 million dollars in grant funds since joining HACU in 1994 and has directed several national projects and initiatives funded by the National Science Foundation, NASA, the National Institutes of Health, Microsoft, the Department of Health and Human Services, the Department of Labor, and the Department of Commerce. These programs have included faculty training, development, and research opportunities; pre-collegiate math, science, technology and engineering programs; science research experience for undergraduates; workforce development; college preparation and financial aid awareness programs for middle school students and their parents, and HSI workforce development initiatives. He has represented HACU on several national task forces and study groups examining Hispanic and other minority challenges in higher education. Prior to joining HACU, he worked in student affairs at the University of Texas at Austin, TX, and the University of Pennsylvania, Philadelphia, PA. Mr. Gonzalez was the founding director of the Greenfield Intercultural Center at the University of Pennsylvania from 1983–1993 and served as a speaker for the Pennsylvania Humanities Council.
Deborah His Horse is Thunder, Ed.D.

Deborah His Horse is Thunder has served as the American Indian Higher Education Consortium (AIHEC) project director of the Walmart Foundation, AIHEC, HACU, and NAFEO Student Success Collaborative since October 2010. Dr. His Horse is Thunder has previously served as the chief academic officer at three tribal colleges: Haskell Indian Nations University, Fort Peck Community College, and Aaniiih Nakoda College. Her familiarity with tribal colleges and the challenges that American Indian students face in these institutions provides her with the essential foundation to effectively work with this project.

His Horse is Thunder holds a doctorate in education, a master’s degree in higher education, and a bachelor’s degree in sociology. She has previous experience working with her own tribal community, held a tenure track faculty position at the University of Montana, Missoula, MT, and provided training and technical assistance to over half of the tribal colleges. She was appointed by President Bush to serve on the President’s Advisory Council on Tribal Colleges and Universities and she was appointed by Governor Racicot to serve on the Montana University System’s Board of Regents. His Horse is Thunder is a tribally enrolled member of the Assiniboine (Nakoda) Nation and lives on the Standing Rock Indian Reservation in North Dakota with her husband, Ron.

Nora Sabelli, Ph.D.

Nora Sabelli is a senior science advisor at the Stanford Research Institute in Menlo Park, CA. Her focus is on improving science education through innovation and inquiry and also on the needs of education and the workforce created by evolving cyberinfrastructure.

Dr. Sabelli was senior program director for the National Science Foundation’s (NSF) Directorate for Education and Human Resources, and worked on many NSF-wide and cross-agency initiatives related to education, technology and science, such as the Learning and Intelligent Systems Initiative and the Interagency Education Research Initiative. She has a doctoral degree in chemistry (theoretical organic) from the University of Buenos Aires, Argentina, for research performed at the University of Chicago.
Dara Wald, Ph.D.

Dara Wald is a postdoctoral fellow in the Center for Policy Informatics at Arizona State University, Tempe, AZ. She received her doctoral degree in human dimensions of ecology from the Department of Wildlife Ecology and Conservation at the University of Florida, Gainesville, FL.

Dr. Wald is interested in the development of simulations and role-playing games to build consensus among diverse groups and is currently coordinating a project focused on generating synthetic empathy using an interactive computer simulation.

Dr. Wald previously served as a GK-12 STEM educator in underserved rural and urban communities, worked as an environmental justice intern in Roxbury, MA, and as a grant coordinator for the New England Aquarium’s Underserved Constituent Initiative. She is a member of the Global Women Scholars Network and co-author of a life-cycle analysis of minority underrepresentation in natural resource jobs. She lives in Phoenix, AZ, with her husband and young daughter.
Design Team

Boyce C. Williams, Ph.D.

Dr. Boyce Courtney Williams is currently president and CEO of the National Alliance for Learning, Inc. (NAL) in Washington, D.C., where she plays a central role in the executive leadership of the organization and is responsible for the primary programmatic thrusts.

Dr. Williams lends expertise to institutions in the following areas in which she has developed expertise over the course of the past 20 years: college, university and department accreditation; teaching and learning (generally); transforming teacher education through clinical practice; building/strengthening a PK-16 education pathway; identifying/leading members in undertaking best retention practices; and campus internationalization and globalization.

Dr. Williams was senior vice president and chief of staff for the National Association for Equal Opportunity in Higher Education (NAFEO) in Washington, D.C. Before NAFEO, she served as vice president at the National Council for the Accreditation of Teacher Education (NCATE), where she directed NCATE’s Historically black colleges and universities (HBCUs) technical support initiative, and was project director for the Reading First Teacher Education Network, a $5 million grant from the U.S. Department of Education.

In 2009 and 2010, Dr. Williams spent a year and a half in the Middle East conducting a feasibility study to determine the readiness of higher education institutions in the Middle East-North Africa to pursue accreditation. The study concluded that education in the MENA region would not sustain improvement until the preparation of educators improved. In addition to officially introducing NCATE to the region, the study concluded with the signing of Letters of Intent with Jordan, Egypt, Saudi Arabia, Kuwait and the United Arab Emirates.

Dr. Williams received a bachelor’s degree in English education from Lincoln University (Pennsylvania), the nation’s first historically Black college and university. She received her master’s degree in urban counseling/psychology and a doctoral degree in counseling psychology from Michigan State University, East Lansing, MI.

Dr. Williams is an educator and a visionary leader who received national acclaim for her contributions to the field of education, especially for her leadership in teacher education and accreditation. The breadth and scope of her recognized excellence and leadership is reflected in the number of honorary doctorate degrees she has received from diverse colleges and universities: Cheyney University of Pennsylvania, Virginia Union University, University of Arkansas Pine Bluff, Stillman College, Lincoln University of Missouri, Lincoln University (Pennsylvania) and Kentucky State University.
Facilitation Team

Josh Barbour, Ph.D.

Josh Barbour is assistant professor in the Department of Communication at Texas A&M University, College Station, TX. His specialty is organizational communication.

Dr. Barbour’s research interests center on the confluence of the macromorphic and communicative in organizational life. His work is concerned with how and why individuals, groups, and organizations manage information and meaning and how we can (re)design conversations, change groups, and help individuals to do so with more sophistication. His past projects have focused on collaborative, engaged scholarship in organizations including a toxic waste storage facility; nuclear power plants; organizations involved in disaster preparation, response and recovery; and healthcare organizations, where the management and interplay of information and meaning have important societal consequences. His work has appeared in Communication Monographs, Management Communication Quarterly, Communication Theory, the Journal of Health Communication, and the Journal of Communication.

He received his doctoral degree from University of Illinois at Urbana-Champaign.

Leslie Fagre

Leslie Fagre is a communication consultant and educator based in Santa Fe, NM. She has worked on game design, research, and facilitation in prosperity games for clients such as the President’s Commission on Critical Infrastructure, Kodak Corporation, the Tribal Colleges Technology Initiative, and Sandia National Laboratories. Ms. Fagre has taught in the Communication Department at the University of New Mexico as a graduate student and later as adjunct faculty. She has also worked in project management for several non-profits including the Public Dialogue Consortium where she co-designed and facilitated forums on public issues management and strategic planning. She currently serves on the governing board of the Academy of Technology and the Classics, a 7–12th grade public charter school.
Reese Fullerton was appointed deputy director of the New Mexico State Personnel Office in April of 2009. Beginning in June of 2006, he was deputy cabinet secretary for the New Mexico Energy, Minerals and Natural Resources Department. Previously, he served as the executive director of the Governor’s Office of Workforce Training and Development.

Mr. Fullerton is a professional facilitator, trainer and mediator. He works to bring people together who have a variety of perspectives and roles in areas of environment, water and land use, education, health, and community development. His goal is to assist people in finding solutions to issues facing the public, local, state or federal decision makers. A major focus has always been on families, education, corrections and natural resources policy. In the past, he worked for the U.S. EEOC; the U.S. Commission on Civil Rights; and the New Mexico Attorney General’s Office. He directed the study into the causes of the New Mexico Prison Riot of 1980; managed Senator Jeff Bingaman’s first campaign for U.S. Senate; led the legislative efforts of the New Mexico conference of churches on family and human services issues; trained teams of parents, teachers and administrators on special education issues; facilitated the Southwest Strategy—a collaboration of federal, state and Native American executives involved in natural resource issues, such as energy, fire, healthy watershed, and urban-wildlife interface; led the facilitation of the Pecos River consensus plan for the State of New Mexico; and facilitated the collaborative program for the silvery minnow on the Rio Grande.

Mr. Fullerton has a political science and law degree from Georgetown University, Washington, D.C.
Victoria B. Garcia

Social change facilitator
Victoria Garcia currently works for the State of Hawaii in public safety communications. Before moving to Hawaii, she was of counsel to the law firm Catalano and Plache, PLLC, Washington, D.C., a firm practicing primarily in telecommunications law.

Prior experience includes serving as municipal judge for the Village of Los Ranchos de Albuquerque and vice chair of the Municipal Judges Association of the New Mexico Municipal League. She completed the Municipal Official Leadership Institute and taught for that program in matters of ethics for elected officials and, occasionally, the structure of the New Mexico court system.

Ms. Garcia also worked full-time as general counsel for the New Mexico Department of Information Technology since it was legislatively created on July 1, 2007. Prior to that, she worked at the state district court in New Mexico first, as director of the Court Alternatives Program, and later as chief staff attorney to the chief judge.

She has also worked as a communications consultant for the Prosperity Institute and Strategic Engagement participating in numerous prosperity games since the 1990’s.

Sheila McNamee, Ph.D.

Sheila McNamee is professor of communication at the University of New Hampshire and professor of organizational culture, faculty of humanities, Tilburg University, The Netherlands. She is co-founder and vice president of the Taos Institute (taosinstitute.net) and she has held visiting professorships at City University (Hong Kong), Utrecht University (The Netherlands), the University of Sao Paulo (Brazil), and the University of Parma (Italy).

Her work is focused on dialogic transformation within a variety of social and institutional contexts including psychotherapy, organizations, and communities. Her most recent book is Research and Social Change: A Relational Constructionist Approach, with Dian Marie Hosking (Routledge, 2012). Previous books include: Therapy as Social Construction (with Kenneth Gergen), Relational Responsibility (with Kenneth Gergen), and The Social Construction of Organization (with Dian Marie Hosking).

She actively engages constructionist practices in a variety of contexts, bringing communities of participants with diverse and often opposing viewpoints together to create livable futures.
John G. Oetzel, Ph.D.

John Oetzel is a professor in the Department of Management Communication in the Waikato Management School at the University of Waikato in Hamilton, New Zealand. He teaches courses in conflict, intercultural communication, health communication, and research methods and is a trained mediator. His research program centers on understanding and improving challenging communication among people with different group identities (particularly cultural identities). Dr. Oetzel uses quantitative survey methods and/or mixed method designs to address three areas: 1) conflict in culturally diverse work groups and organisations, 2) communication in the health care delivery process, and 3) partnerships between community members and academics to address community health.

Dr. Oetzel earned a doctoral degree from the University of Iowa (small group and intercultural communication), a master’s degree from the University of Iowa, and Master of Public Health and bachelor degrees from the University of New Mexico.

Kee J.E. Straits, Ph.D.

Clinical psychologist Kee Straits is Quechua (Indigenous), born in Peru and raised in the United States. She received her bachelor’s degree in psychology from Williams College, her master’s degree in special education from the University of New Mexico, and her doctoral degree in psychology from Utah State University. Dr. Straits is the sole proprietor of Tinkuy Life Community Transformations, LLC. Through her business, she offers direct clinical services, consultations, trainings, and research/evaluations. Throughout her career, she has focused on reducing behavioral health disparities in Native American and Latino communities, increasing the effectiveness of mental health systems that serve youth, and increasing the number of competent Native and Latino health professionals. Dr. Straits brought together experts in the field to publish a set of guiding principles that advance research in partnership with Native communities towards more conscientious implementation. As a part of her consultation with the New Mexico Tribal Prevention Project, she recently co-developed trainings on strength-based community change that addresses historical trauma and colonization. She is married to a Navajo flutist and enjoys travelling, taking care of her llamas and chickens, hosting sweatlodges and women’s circles, and spending time with her extended family.
Carlos Felipe Villar-Guhl

Carlos Felipe Villar-Guhl holds Master of Science degrees in organizational change and development from the University of Manchester, and systemic practice from Universidad Central in Bogotá. He has two bachelor degrees in psychology and in anthropology from the Universidad de los Andes in Bogotá Colombia.

Driven towards the constant creation of new and innovative approaches to work within organizations and industries, Mr. Villar-Guhl has developed skills in facilitating and designing change processes within organizations. As a global change facilitator and design consultant, he assisted Ramboll Management Consulting in Denmark, supporting the design and development of various projects related to coaching, change and organization development.

Mr. Villar-Guhl lives and works in Colombia as an organizational consultant. He is working with a variety of institutions and organizations designing collaborative change processes.
J. Kevin Barge, Ph.D.

J. Kevin Barge is professor and head of communication at Texas A&M University and an associate with the Taos Institute. He is also a member of the planning team for the Aspen Conference, a community of engaged organizational communication scholars focused on developing practical theory and collaborative research that bridge academic-practitioner interests.

Dr. Barge’s major research interests center on developing a social constructionist approach to leadership, articulating the connections between appreciative practice and organizational change, as well as exploring the relationship between discourse and public deliberation, specifically practices that facilitate communities working through polarized and polarizing issues. Other research interests include investigating the role of reflexivity in leadership and management practice, examining ways to develop effective academic-practitioner collaborations, and developing practical theory. His research is inspired by interpretive and discursive research approaches and he is keenly interested in how collaborative research methods can be used to generate usable knowledge and forward movement in organizations and communities.

Dr. Barge has published articles on leadership, dialogue, and organizational change in The Academy of Management Review, Management Communication Quarterly, Human Relations, Communication Theory, Journal of Applied Communication Research, and Communication Monographs. He has served on a number of national and international editorial boards for journals such as Management Communication Quarterly, Journal of Applied Communication Research, Human Relations, and Journal of Management Studies. Dr. Barge is a former editor of Communication Studies and a former president of the Central States Communication Association.
Anne Fullerton has practiced as a counselor, founded and led not-for-profit organizations, directed strategic planning and executive search committees, and facilitated community groups, working primarily in the areas of education, health and behavioral health and gender issues.

Ms. Fullerton has Master’s degrees in Education and Counseling, has worked at the Santa Fe Indian School, public schools in Santa Fe and community schools in Washington, D.C. She researched and wrote the first statewide poverty report for the state of New Mexico. Most of her career has been devoted to providing support and access for individuals and groups whose lives have been marginalized or isolated.
Kathy Isaacson

Kathy Isaacson is the founder and president of Strategic Engagement, a communication consulting organization in Albuquerque, New Mexico. She serves as a transformational change specialist, mediator, facilitator, and trainer.

She works with groups and individuals, organizations, institutions, leaders, governments, and industries in the United States and abroad through her partnership in Implement Change Partners (Stockholm Sweden) and Sistemas Humanos (Bogota Colombia). Her decades of experience in facilitating social change enables empowerment for individuals, organizations, communities and systems of all sizes.

Ms. Isaacson has 20 years of academic work experience in conflict and communication and over 25 years experience in communication and strategic issue management. She is the author of four books and numerous articles and videos, including the following with co-author Stephen Littlejohn: Communication, Conflict, and the Management of Difference; Facework: Bridging Theory and Practice; Engaging Communication in Conflict: Systemic Practice; and Mediation: Empowerment in Conflict Resolution. She received her master’s degree in communication from the University of New Mexico and is currently in the doctoral program at Tilburg University.
Al Kuslikis

Al Kuslikis is Senior Associate for Strategic Initiatives at the American Indian Higher Education Consortium, the association of the nation’s 37 Tribal Colleges and Universities (TCUs). An important part of Mr. Kuslikis’ work involves identifying strategies for supporting science, technology, engineering, and mathematics education and research programming at the nation’s TCUs particularly through partnerships among the Tribal Colleges, as well as within the larger science and engineering communities. Mr. Kuslikis has accumulated over twenty years of experience in American Indian higher education, beginning with his work at Diné College on the Navajo Nation.

CJ Ondek

CJ Ondek has over 28 years of experience in a wide range of communication disciplines, including intercultural communication, mass communication, health communication, and organizational communication. Ms. Ondek is a skilled writer and editor who crosses genres and styles with ease, from journalism to grant writing, from promotions to medical writing. She is adept at building relationships and collaborating with partners to accomplish project and organizational goals. Other capacities include facilitation, qualitative research and analysis, non-profit capacity building, fundraising, evaluation, grant management, report writing, and teaching.

Some of Ms. Ondek’s client list includes: Big Brothers Big Sisters, Circles New Mexico, New Day Youth and Family Services, National Indian Youth Leadership Program, Art of the Song Creativity Radio, Albuquerque Arts magazine, NM Department of Health, NM Public Education Department, NM Center on Law and Poverty, Sandia National Laboratories, Native American Water Management, FEMA, Oglala (Lakota) Sioux Housing Authority, St. Martin’s Hospitality Center, and RigDzin Dharma Foundation.

Ms. Ondek earned a master’s degree in intercultural communication from the University of New Mexico and a bachelor’s degree in marketing from Pennsylvania State University.