

National Science Foundation-Sponsored Colloquy on Minority Males in STEM

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Recent reports by the College Board¹ and the National Center for Educational Statistics² have highlighted the educational challenges facing minority males. The Research on Gender in Science and Engineering (GSE) program of the National Science Foundation's (NSF's) Directorate for Education and Human Resources (EHR) in collaboration with two other NSF programs—the Historically Black Colleges and Universities Program (HBCU-UP) and the Social Psychology program of the NSF Directorate for Social, Behavioral and Economic Sciences—decided to gather input from the community on how to frame approaches to investigating gender-based factors that impact learning and choice in STEM education and the workforce. There was particular interest in framing research studies of how societal and (formal and informal) educational systems' interactions with individuals encourage or discourage interest and persistence in study or careers in science, technology, engineering, and mathematics (STEM) fields by underrepresented minority males.

During August 9-12, 2010, the Center for the Advancement of Scholarship on Engineering Education (CASEE) of the National Academy of Engineering hosted the NSF-sponsored Colloquy on Minority Males in STEM in support of NSF's objectives in gaining community input into the parameters of a future research program³. The Colloquy was held at the historic Mt. Washington Conference Center in suburban Baltimore with 36 invited attendees drawn from such fields as education, psychology, sociology, mathematics, and physics (see list of attendees in the Appendix). It was conducted over a period of three and one-half days.

¹ The College Board, *The Educational Crisis Facing Young Men of Color*, January, 2010. Available at <http://professionals.collegeboard.com/profdownload/educational-crisis-facing-young-men-of-color.pdf>

² National Center for Educational Statistics, *Status and Trends in the Education of Racial and Ethnic Groups*, July 2010. Available at http://www.air.org/files/AIR-NCESracial_stats_trends1.pdf

³ Support was provided via a supplement to award GSE-0533520.

COLLOQUY GOALS

The Colloquy was designed to provide a forum for discussion of research questions, theories, and methodologies that, while recognizing and acknowledging the differences within and between specific minority male populations, would frame a research agenda on underrepresented minority males in STEM:

- What do we know?
- What do we want to know?
- What should be the balance between research and implementation?

The colloquy was also designed to build bridges among researchers operating in different subspecialties with the aim of stimulating productive research collaborations.

While the Colloquy was originally designed with specific reference to framing a research agenda with respect to underrepresented minority males (African Americans, Hispanic Americans, and Native Americans), discussions during the colloquy expanded the populations of concerns to include Native Pacific Islanders (Native Hawaiians, Polynesians, Indonesians), Southeast Asian (e.g., Vietnamese and Thai), and Filipino populations.

COLLOQUY PRODUCTS

Major products produced by the colloquy include (a) summaries of major areas of inquiry with respect to access, participation, and success of minority males in STEM, and (b) detailed research questions along with discussion of theories and methodologies that frame their resolution.

Summaries of major areas of inquiry

Over the 3.5 days of the Colloquy, attendees identified major areas of inquiry on minority males in STEM. Major areas of inquiry identified include investigating, discovering, and understanding:

- Descriptions and explications of the challenges to the access, participation, and success of minority males in STEM.
- Descriptions and explications of the challenges facing minority males in STEM and their educational, intellectual, political, social, and economic manifestations.
- Descriptions and explications of the underlying causes and mechanisms of the challenges facing minority males in STEM.
- Descriptions and explications of models of success in STEM by minority males, both as organic wholes and collections of “best” or promising practices.

Colloquy attendees also placed a high premium on the translation of understandings gained from the research program into guidance for practitioner communities (interpreted broadly to include all those with influence on minority males who are or could be in STEM).

Major Research Foci and Questions

Colloquy attendees identified major research questions within each major area of inquiry.

3.2.1 Challenges

- What defines academic and professional success in STEM by minority males? What levels of representation and performance represent “threshold” levels for self-sustainability? How does the definition vary from comparable definitions for majority males? How does the definition vary among various ethnic minority populations?
- Are efforts to enhance participation, representation and performance in STEM by minority males more productively directed at sustaining, nurturing and enhancing capacity among those with demonstrated interest or building awareness and interest among those with latent talent? What costs or trade-offs, if any, are imposed by pursuing both strategies?
- How do we identify STEM potential among minority males? How do we sustain, nurture, and enhance capacity in STEM among minority males?
- What efforts can productively be made to re-engage in educational systems, and STEM learning, boys and men who are leaving or have left systems of formal and informal education (drop-outs, migrant workers, transients, homeless, etc.)? What has been learned since “The Forgotten Half” (1998)?
- What are the impediments to academic and professional participation and performance in STEM by minority males overall and by various ethnic minority populations?
- What are the complementarities between the learning and teaching experiences that occur in-school and those that occur out of school with respect to interest in, learning of and mastery of STEM disciplines and professions by minority males?
- What is the philosophical basis for conceptualizing challenges to the academic and professional representation, participation, and performance of minority males in STEM (e.g., How is the problem framed in terms of the goals and philosophies of W.E.B. DuBois, Booker T. Washington, etc.)? What analogs exist from conceptualizations of women and girls in STEM?
- What are the differentials in societal and institutional expectations (as intended, as they exist, and as they are perceived) of minority males vis-à-vis majority males with respect to academic and professional participation and performance in STEM?
- What would constitute full representation and participation in STEM by minority males overall and by various ethnic subpopulations? What are the capacities of educational and professional institutions and systems to accommodate full participation in STEM by minority males?
- How can transformational rather than incremental progress toward academic and professional representation, participation, and performance in STEM be achieved by minority males?

Manifestations of the Challenges

Within the Target Population

- What are epistemologies on the visibility and perception of minority males in STEM?
- What are the experiences of boys of color within groups and across groups with respect to various aspects of identity as it correlates with stage in the decision making process for degree and career aspiration in STEM?

- What are the Implications of class and other societal distinctions (e.g., immigration status, etc.) on the academic and professional participation and performance of minority males in STEM?
- What pathways are followed by minority males in pursuit of STEM education and careers?
- Where are the most significant losses along educational and career pathways by minority males and how does the answer change for various ethnic minority populations?
- Why do so few minority males graduate from high school despite the large number who enter with high aspirations?
- How does the participation and performance in STEM by minority males within systems of formal or informal education vary with respect to content, pedagogy, curricula, educational environment, teacher training, teacher experience, mentor presence and prevalence, etc.?
- How does participation and performance in STEM education and careers by minority males vary with the nature and extent of social and cultural support (e.g., reservation-based American Indians versus those who are not reservation-based, or those who maintain traditional values and lifestyles versus those who do not)?
- What causes sudden and unexpected failures to perform or sudden departures from STEM pathways among minority males who appeared to be doing well?
- What motivates changes in interest in pursuing STEM careers among collegiate minority males with demonstrated skill and proficiency in STEM?
- What are the effects of limited learning in foundational disciplines such as English in impeding STEM interest, performance, and proficiency?

Within institutions and systems

- What are the capacities of existing educational and professional systems to accommodate new minority male entrants?
- What incentives exist for existing systems to accommodate new entrants?

Underlying Causes and Mechanisms of the Challenges

- How are impediments to the participation and performance of minority males in STEM related to and influenced by dominant political, economic and social contexts?
- Is understanding advanced by alternative conceptualizations of possible associations or causal relations in the underrepresentation of minority group males among persons who study and excel in STEM disciplines and professions? Are there differentials in associations or causal relations among the various ethnic minority groups?
- What learning environments (including consideration of context, content, pedagogy, and curriculum) have been demonstrated effective by teachers and faculty in adjusting to the evolving needs in STEM pathways of an increasing number and variety of minority male groups? How many of these are dependent upon or consistent with relevant cultural knowledge and understanding? How is knowledge of such practices continually updated through on-going professional development and lifelong learning?

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- How might students at all levels be provided with systematic exposure to structured inquiry (including basic and applied research) inside and outside formal educational systems?
- What systemic, organizational or individual models (both evidence-based and theoretical) might guide efforts to intervene on behalf of increased participation and performance in STEM education and professions by minority males?
- What models might be particularly derived from the roles of professional STEM societies in engaging and encouraging students in STEM (e.g., the American Indian Science and Engineering Society [AISES] and the Society for the Advancement of Chicanos and Native Americans in Science [SACNAS] have been effective in supporting American Indian students)?
- What is the effect on minority male participation and performance in STEM of the social organization of learning environments (including formal and informal education) and the policy contexts of such environments?

Models of Success in Surmounting the Challenges

- What demonstrated models exist of systems, organizations, or individuals who significantly increased the academic and professional representation and performance in STEM by minority males? By what means did they do so and were these means immune to the underlying impediments or did they counteract the impediments?
- What fundamental and applicable knowledge can be extracted and distilled from extant research on the promotion, teaching and learning of STEM subject matter from US mission agencies (e.g., Department of Defense) and other countries (e.g., United Kingdom) that are known to have made progress on the inclusion of under-represented groups in the mastery of STEM disciplines and professions?

COLLOQUY DISCUSSIONS

Colloquy attendees engaged in a series of breakout discussions as they sought to identify research strands. This section summarizes key points raised in the breakout discussions.

Discussions on Ethnicity, Educational Level, and Influence of Educational Level on Questions by Ethnicity.

Attendees were divided into groups based upon the ethnic populations that are their primary areas of research. There were two groups focused on African Americans, one group focused on Hispanic Americans, and, because the number of researchers in each group was so small, a single combined group focused on Native Americans and Asian Pacific Islanders. Each group was first asked to consider three sets of questions with respect to their research population (African American, Hispanic American, and Asian Pacific Islander). Groups were then re-formed based on educational focus level of research (K-8, middle school, high school, graduate education/professional) and asked to consider what refinements in research questions are necessitated by issues particular to a given educational level. Finally, attendees returned to their original groups to re-consider the answers to the original questions framed in terms of ethnicity in light of their discussions looking at issues by educational level.

The original and final set of questions looked at by each group with respect to their target research population were as follows:

- **IN WHAT AREAS DO GENDER DIFFERENCES EXIST?** What significant gaps exist in the research base with respect to the discovery and description of gender-based differences and preferences in learning STEM at K-16 levels?
- **WHAT IS CAUSING THE GENDER DIFFERENCES?** What significant gaps exist in the research base with respect to understanding factors affecting interest, performance, and choice of STEM study and careers in those fields where significant differences in performance by gender exist?
- **HOW ARE THE GENDER DIFFERENCES EXACERBATED BY EDUCATIONAL SETTINGS?** What significant gaps exist in the research base with respect to discovering and understanding how experiences and interactions in informal and formal educational settings either inhibit or encourage interest and performance of learners based on gender?

In discussing these questions attendees explicitly rejected deficit models. The issue is not how to “fix” minority males, but rather how to create environments more conducive to their participation and performance. Discussants were also strongly motivated to have research findings inform practice and to have the challenges of practice inform future research. They emphasized the need to recognize that research questions and practice approaches will likely differ between and among various minority groups.

A key outcome from this set of breakouts was the observation that ethnicity was not well defined. Attendees did not believe that Native Americans and Asian Pacific Islander should have been lumped into a single group, rather there should have been three groups—Native American, Native Pacific Islander, and Asian—in recognition of their unique issues. Native Americans are not only ethnically distinct, but also have prerogatives of sovereignty which must be considered. Native Pacific Islanders lack federally recognized sovereignty. Asian Pacific Islanders are often not considered a minority and have to struggle with recognition issues. This is a particular problem with some Southeast Asian groups (e.g., Vietnamese, Hmong, etc.) whose underrepresentation is hidden in the larger representation of the catchall category of Asian. There is the additional challenge of recognizing the increasing underrepresentation of native-born Asians. Similar issues (subgroup underrepresentation and distinction between native-born and immigrant communities) exist within the Hispanic-American community. Other key points made by the breakout groups are noted by breakout group:

African American

Discussion in this group was aligned with the educational levels identified by the Colloquy planners: K-8, high school, undergraduate, and graduate/professional.

K-8

To be more effective, different approaches need to be taken to the conduct of research on younger boys of color. Scale-based research might not be as helpful at the younger ages. There is a need for more qualitative studies for younger boys. Research at this level should take into consideration age-appropriate developmental perspectives of identity (e.g., gender, race, masculinity, socioeconomic status, and academic) as well as the ecological domains of examination (e.g., parental/home, community, peer, school, media, etc.).

Key research objectives include understanding where are the leverage points for effective intervention to enhance academic performance and STEM interest. Peer connections may particularly merit investigation as one such point of leverage. There is a need for more comparative and longitudinal studies on effective content and pedagogy associated with content, particularly those that may create earlier orientations toward STEM. Based on their current social prominence, two candidates for such studies include (a) examination of to what extent are STEM concepts present in communications technologies and social media (iPods, TV watching, video games, Facebook, etc.), and (b) examination of when within the educational continuum same-sex schools are more effective.

High School

Key research questions at this level include understanding what characterizes an educational culture of success and what pathways toward “success” are enabled or precluded by a child’s elementary and middle school experiences, behaviors, and assessments. What are empowering culturally relevant pedagogies that positively impact STEM achievement in what (in-school and out-of-school) learning spaces are they practiced?

Ultimately, researchers need to understand the interaction of identity and social capital efficacy. But in order to achieve this aim, researchers must first better understand the multiple dimensions of identity within males of color at this level (including how peer, community, school, political, and intra/inter racial contexts impact the student, teacher, counselor, and administrator sense of self). Researchers must also better understand how social and cultural capital develop and manifest in the academic and life trajectories of males of color.

Undergraduate

Research at this level is necessarily coupled with understanding pre-college experiences (academic, advisory, social, and cultural) which either do or do not adequately prepare African American males for pursuing STEM study and careers. Questions to be addressed initially at the pre-college levels include assessment of the nature and effectiveness of advisement in high school as well as the effectiveness of various school administration models (e.g., magnet schools, learning communities within conventional schools, etc.).

Ultimately, the desire should be to have holistic approaches to understanding undergraduate recruitment, matriculation, retention, progression, and graduation by African American males. Beyond understanding African American male performance in each of these dimensions, holistic approaches may necessarily need to treat individual STEM disciplines as vectors of analysis in order to understand movement across STEM disciplines as well as movement from STEM to non-STEM disciplines.

Research at this level also provides bridges to consideration of preparation and success for graduate study and professional practice. Researchers need to better understand how the curricular, co-curricular, and extracurricular experiences encourage or discourage interest in STEM careers. For example, what role is played by mathematics in either inhibiting or promoting career interest in various STEM fields? And, how do research internships build career interest? One goal of research at this level is to contribute to providing academic and psychosocial profiles of successful STEM majors. For example, how do successful STEM majors balance the various aspects of their lives? Do they rely heavily on others in STEM for

support, and/or is it just as important for them to have connections outside of STEM to provide balance?

Graduate/Professional

Key questions at this level involve choice and persistence. How are talented STEM graduates encouraged to persist to graduate study rather than immediately entering industry? Encouragement may not be sufficient; as indicated above, stakeholders need to better understand the nature and extent of educational experiences that inhibit receptivity to consideration of graduate study. Beyond encouragement to pursue STEM study, how is resilience to persist attained?

While researchers are concerned with a wide array of STEM professions, the future of the fields is highly dependent on having a robust professoriate with diverse role models. Thus, a key challenge is understanding how to recruit and retain minority male faculty through reappointment and tenure within various institutional contexts (and the implied emphases on research, teaching, mentorship, and service). What support structures are available to ease their transitions through these milestones?

Hispanic American

This group identified seven major research strands with respect to Hispanic Males in STEM: academic preparation, institutional and career pathways, institutional policies and practices, understanding resiliency, identify formation, effective pedagogy and instruction, and mentoring.

K-8 Academic Preparation

Hispanic males enter the academic pipeline with high aspirations but too often leave with failure. Researchers need to understand why. There appear to be challenges with the mathematics core: algebra, geometry, trigonometry, and pre-calculus. Inadequate parental knowledge of academic requirements appears to be a contributory issue. Language of instruction can be a challenge for second language learners. Researchers need to better understand the effect of standardized testing and accelerated/advanced courses in imposing systemic inequity and barriers to further STEM study.

Undergraduate Institutional and Career Pathways

Researchers should seek to better understand the messages students are getting in high school as undergraduates about STEM study and STEM career fields. Those studying Hispanic males (actually all students in higher education) need a much better understanding of transfers from community colleges by sub-field. It would be good to understand better if the assumed graduate pathways of the NSF Research Experiences for Undergraduates programs serve Hispanics as well as they serve the general population. What is the nature of anticipatory socialization to enter graduate degree programs versus immediate employment in industry?

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Institutional Policies and Practices

Researchers need to better understand what models exist of institutions and programs that are effective at engaging Hispanic males at the K-12 and undergraduate levels. How scalable are such programs and how might they be moved from *ad hoc* pilots to institutionalized programs? It is especially important to understand what policies and procedures encourage or inhibit faculty support for the recruitment and retention of graduate students of color through mentoring/supportive activities.

Understanding Resiliency

Studies are needed to identify the characteristics of STEM achievers. What are their educational experiences and their home environments? Within that set of experiences, which ones build and further resiliency?

Identity Formation

Identity formation needs to be much better understood. How do male students see themselves as scientists? Are such views congruent with their views of masculinity? What effect do teacher/coach interactions have, and how are those interactions themselves affected by the identity roles assumed by the students and the teacher/coaches? What is the influence of early immersion programs in mathematics in science in science identity development? What role is played by social and political contexts?

Effective Pedagogy and Instruction

We should seek to better understand models of success. What is the role of culturally relevant pedagogy? How important are early immersion research opportunities? What are particularly effective models of foundation mathematics and English instruction within the context of STEM?

Mentoring

The most significant questions relate to how mentors can be better prepared and how effective mentors can be better leveraged. How are teachers and faculty best prepared to mentor Latino men? How might miscommunications based on class differences be minimized between faculty and students? What incentives exist for teachers and faculty, especially senior ones, to serve as mentors and how effective are such incentives? Who are the effective mentors and how might they best be replicated? How are teacher and faculty mentors best used without endangering their own psychological, physical, and professional health?

Other issues

Across academic levels and STEM fields (e.g., math-intensive and non-math intensive), there are a lack of comprehensive data sets and therefore of demographic analyses to characterize

the full nature and extent of differentials in academic and professional participation and performance by Hispanic American males (versus Hispanic American females as well as other male populations). This lack of data contributes to doubts in some policy communities that this issue merits the attention of researcher and practitioner communities.

Members of this group expressed their belief that participation and performance of Hispanic Americans is imperiled by systemic inequities that begin in elementary education systems (e.g., lack of minority male role models in elementary and secondary education) and are reinforced by the culture and climate existing at different levels of academic and professional organizations. Educational settings in particular exacerbate differences in gender performance through differential expectations of teachers and faculty in gateway and gatekeeper courses. These inequities are reinforced by differences in peer and parental influences (e.g., cultural expectations that Hispanic males will leave educational pathways at the high school or baccalaureate levels in order to assume gainful employment).

Native American and Asian Pacific Islander

Native Americans and Asian Pacific Islanders (including Native Hawaiians) share a lack of societal awareness and visibility. They also share fluid and ambiguous definitions of themselves. But they are also distinct groups with unique challenges that require research and interventions beyond those developed for African American and Hispanic American populations. Indeed each group has great racial and ethnic diversity within it. The small population sizes of these distinct subgroups may necessitate regional studies and innovative methodologies to supplement national studies. Additionally, data disaggregation by subpopulation in large national studies is critically important to understand what really is going on. Native Americans also have sovereign political identities.

Among both populations, societal and cultural issues underlie a variety of challenges to STEM participation and performance. Large fractions of both populations struggle with low socio-economic status and its associated challenges with community safety, school quality, teacher quality, nutritional quality, and other quality of life issues. Education is frequently associated by males in these populations with emasculation and unwanted assimilation into the dominant culture. A question to consider is whether this is driven by the lack of male role model teachers/mentors/advisors at all levels of education.

At root, researchers are seeking to understand complex questions such as the main drivers of low rates of educational interest/attainment and high rates of incarceration and military service. What role is played by education in traditional-culture versus dominant-culture settings? How can pursuit of education pathways be better facilitated? How can the view be reversed that higher education, particularly for males, is a selfish pursuit that does not contribute to the general welfare of families and communities?

It is possible that unexamined data sets exist. For example, the American Indian Science and Engineering Society (AISES) ran several NSF-funded Young Scholars programs in the 1990s. The populations are small enough that it may be possible to track down previous participants and ascertain their current participation in STEM.

General Discussion on Ethnicity and Educational Level

Following the discussions that focused on specific ethnic groups, there was a broad general discussion by Colloquy attendees in which they identified gaps in current research that

merited exploration in any future research program. The results of this discussion are summarized in section 3.2.

Discussion of Theoretical Frameworks

After identifying research questions, Colloquy attendees turned their attention to identifying theoretical frameworks that might guide developing the answers. Attendees were formed into four randomly assigned groups of six to eight persons and their findings are reported below. Across the four groups attendees cautioned that the application of theories (and methodologies) must be driven by specific research questions.

Group 1

The first group developed the graphic shown in Figure 1. It shows a circle with four quadrants with each quadrant corresponding to one of the major areas of inquiry previously identified. Within each area of inquiry, relevant theoretical frameworks are indicated. For example, in the area of “Challenges,” suggested theoretical frameworks include critical race theory (CRT), organizational change, ecological change, and social/cultural capital.

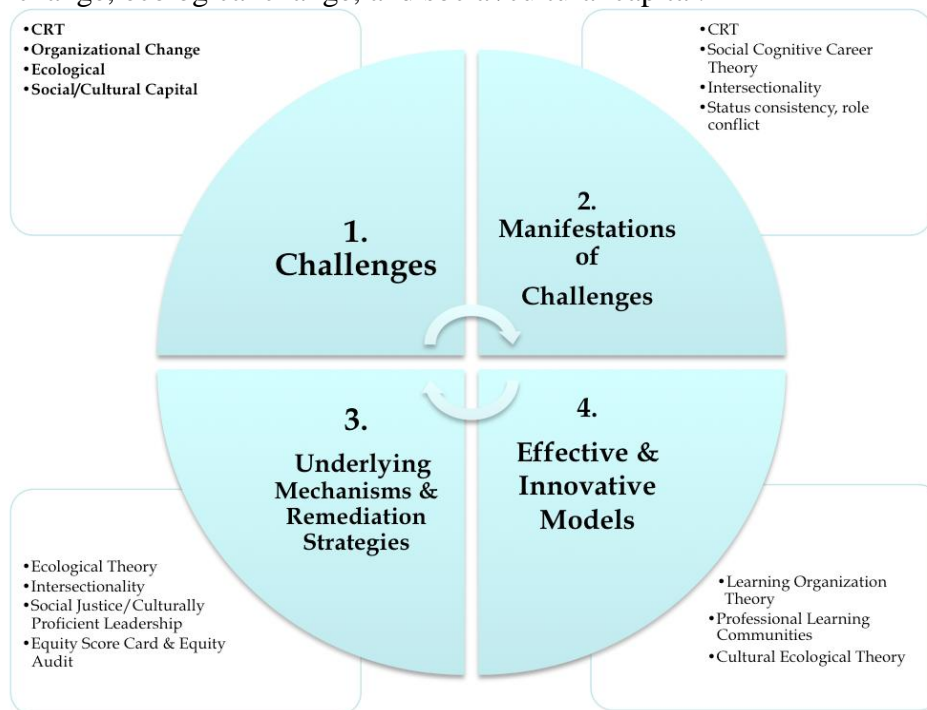


Figure 1. Meta-framework linking each of the major areas of inquiry with theoretical frameworks as suggested by Group 1.

This group also developed an example through which to clarify the application of the framework as shown in Figure 2.

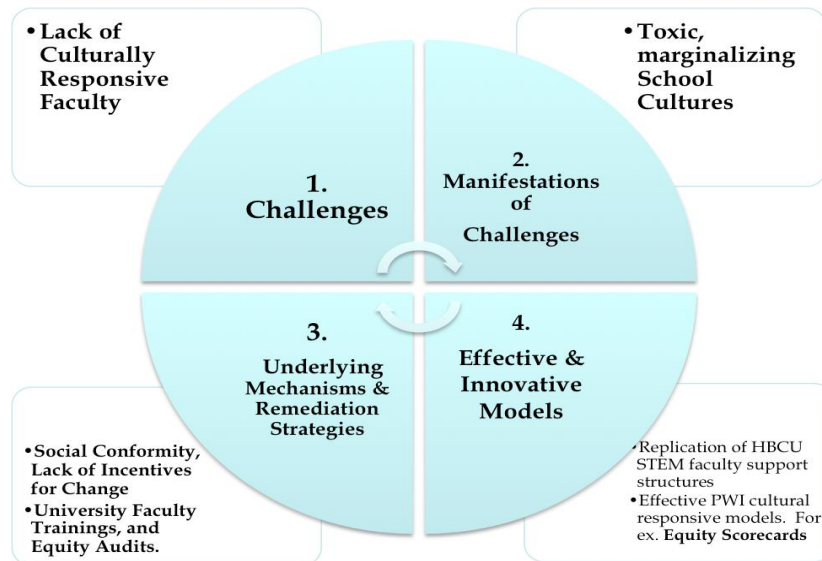


Figure 2. Example of the application of Group 1's theoretical meta-framework.

In the example, a challenge to the academic performance of minority males has been identified, within the construct of critical race theory, as a lack of culturally responsive faculty. The challenge is made manifest by toxic school cultures which marginalize minority males. The underlying mechanisms of the challenge include the privileging of social conformity, lack of incentives for change, inadequate faculty training, and lack of equity audits. Applicable innovative models by which to address the challenge include replication at Predominantly White Institutions (PWI) of support structures found to be effective at Historically Black Colleges and Universities (HBCUs) as well as models for culturally responsive activities (e.g., Equity scorecards).

Group 2

The second group developed the graphic shown in Figure 3. It shows four quadrants with each quadrant corresponding to one of the major areas of inquiry previously identified. Within each area of inquiry, relevant theoretical frameworks are indicated. For example, in the area of "Challenges," the suggested theoretical frameworks are all within the broad category of Human Ecology including attributional work (including the work of Claude Steele), Margaret Beale-Spencer's PVEST theory, Uri Brofenbrenner's theory, and Kurt Lewin's approach to social psychology.

<p>Challenges - Human Ecology</p> <ul style="list-style-type: none"> • Attributional (encompasses Claude Steele’s work) • Margaret Beale-Spencer’s PVEST Theory (1997) • Uri Bronfenbrenner’s Theory (1972) • Kurt Lewin (social psychology) 	<p>Manifestations</p> <ul style="list-style-type: none"> • Identity Theories <ul style="list-style-type: none"> - Race-based Identity Development theories including social construction of masculinity - Gender-based - Identity Development (Wortham) <ul style="list-style-type: none"> * Adolescent Identity Development Theories * Respectability • Agency/Self-Efficacy/Self-Concept <ul style="list-style-type: none"> - Bandura, Mendosa, Steele/Aaronson
<p>Underlying Mechanisms (models of intervention)</p> <ul style="list-style-type: none"> • Discipline-Based Intervention <ul style="list-style-type: none"> - Subject Matter Learning • Organizational Theory <ul style="list-style-type: none"> - Organizational Psychology/Organizational Behavior • Distributed Intelligence with pooled knowledge • Social Supportive 	<p>Success</p> <ul style="list-style-type: none"> • Macro <ul style="list-style-type: none"> - The Algebra Project (Bob Moses) <ul style="list-style-type: none"> * Organizational Psychology/Behavior Theories - The Meyerhoff Program (Hrabrowski) <ul style="list-style-type: none"> * Social Supportive Theories - DNIMAS (Norfolk State) - McNair Scholars/SROP - Others (e.g, program models for women in S&E) • Micro (as concepts considered) <ul style="list-style-type: none"> - Models of Effort (Lauren Resnick) - Models of Aspiration

Figure 3. Meta-framework linking each of the major areas of inquiry with theoretical frameworks as suggested by Group 2.

Group 3

The third group offered questions tied to each of the major areas of inquiry as shown in Table 1.

Table 1. Key framework questions for each major area of inquiry as offered by Group 3.

<p><i>Challenge</i></p> <ul style="list-style-type: none"> • What role do masculinity and gender knowledge in the field play into the role of science (e.g., feminization of science and characterization of disciplines as “soft” vs. “hard”)? • What can be learned from a review of the data on students being “pushed out” or transferring from one science to the next? What role does micro-aggression play? • Do male views of masculinity play into their decisions to pursue (or not) specific fields in STEM? • How might deficit cognitive frame theory, specifically with regards to faculty attitudes, improve our understanding? <p><i>Manifestations</i> – How might a review of Cumulative Advantage (essentially the rich get richer) inform our efforts? What are some best practices for creating a system of cumulative advantage in STEM for minority males? Are there different models at different educational levels?</p> <p><i>Mechanisms</i> - What are the layers of context that should be taken into consideration in developing multi-complex comprehensive models of research interventions include attention to individuals and families? How might such a model be informed by a review of the social, racial, policy, ecological frameworks?</p>
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Success Models

How might the following models (in whole or in part) contribute to our understanding of what works to enhance the academic and career prospects of minority males?

- Resiliency, coping models
- Critical race theory (CRT), specifically with respect to interest convergence.
- “Academic Identification” – There are models that are based on how well male students perform academically including “stereotype threat” vs. “self help”
- Self support systems
- “Self theory” – a concept of encouraging students to see themselves in STEM
- Elaine Seymour’s work “Talking About Leaving”

Group 4

The fourth group developed the graphic shown in Figure 4. Unlike the others it is not tied to the four major research areas. Rather, it starts with the individual and looks at their interactions and contexts. This framework places particular emphasis on context as created by interactions among various meta-theoretical frameworks (e.g., identity, racial, social, teaching/learning, and organizational).

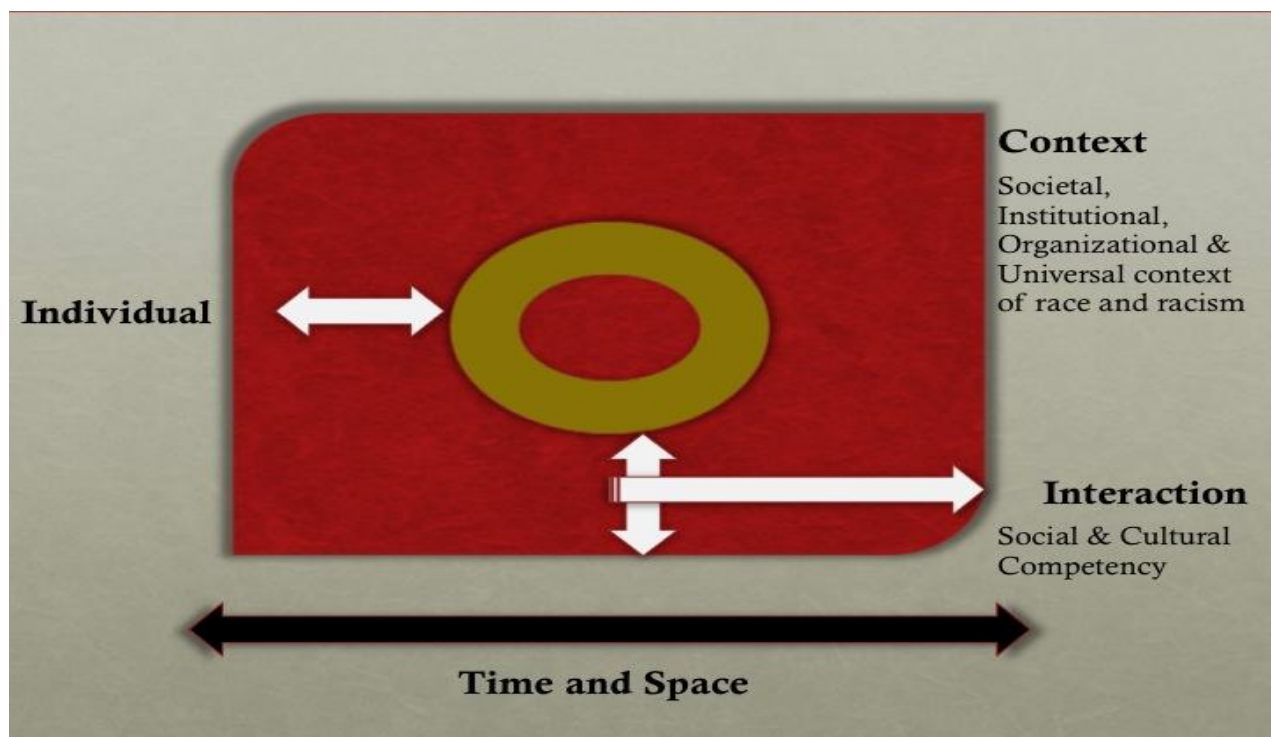


Figure 4. Theoretical framework connecting individuals, their interactions, and contexts. As shown in Table 2, within this meta -framework a variety of theoretical frameworks may be applicable.

Table 2. Theoretical frameworks applicable to the meta-framework shown in Figure 4.

- Critical Race Theory
- Sociological and Cultural Theoretical Frameworks
 - Racial Formation
 - Stratification
 - Social and Cultural Capital
 - Affirmative Development
 - Cultural Responsive/ Empowering Theories
- Meta-theoretical Paradigms
 - Pedagogy
- Ecological/ Phenomenology
 - Race, human development, context, risk protective factors, individual agency
- Social Closure Theory
 - Organizational dynamics and ownership
 - Protecting existing structure
- Language Socialization Theory
 - Scientific Discourse
 - Family Interaction
- Resiliency Theory
 - Adaption and adjustment
 - Organizational, group, and individual
 - Defiance leading to agency [can teach defiance, but not resilience]
 - Resistance (transformational: political w/ academic trajectory)
- Racial Identity
 - TRIOS – [*TRIOS is comprised of attitudes, beliefs and values about time, rhythm, improvisation, orality and spirituality.*]
 - Multidimensional Model of Racial Identity
 - Race Self Complexity
 - Triple Quandary (after Boykin's)
- New Big Five (personality)
- Socio-cultural framework
- Mentoring Theory
- Learning Theory
- Stereotype Threat
- Multiple Worlds
- Identity and Development (gender, race, professional, and socio-class)

General Discussion of Theoretical Frameworks

In considering the presentations of groups 1, 2 and 3, some wondered whether race had been privileged over gender. Each may be individually salient as well as salient in combination. The view was expressed that looking at either individually was no longer sufficient.

The general discussion acknowledged that there are various levels of examination and a lot of complexity to be managed. The groups considered 10 to 15 theoretical frameworks, but could just as easily have looked at 10 to 15 others. Those present agreed that different theoretical frameworks may be appropriate at different educational levels (K-5, middle school, high school, college, etc.) and that the frameworks offered are simply examples and not “the best” frameworks for application in any given instance. It was noted that this view provided greater freedom to researchers to propose innovative approaches.

Discussion of Research Methodologies

After identifying theoretical frameworks, Colloquy attendees turned their attention to identifying research methodologies by which to pursue the research questions. Attendees were formed into four randomly assigned groups of six to eight persons and their findings are reported below. Across the four groups attendees cautioned that the application of methodologies (and theories) must be driven by specific research questions and the overall research design.

Group 1

The first group admonished that research designs are needed that are more tailored to work that is currently being left undone. Alternate ways of generating knowledge beyond the traditional empirical research focus are needed. Quantitative and qualitative works should speak to and amplify one another in their approach to generating knowledge about the nuances of being men of color in STEM fields.

They noted that a structural concern may arise regarding the validity and reliability of the research because of the samples sizes of the populations being studied and an inability to extrapolate data in a manner consistent with the post-modern paradigm and approach to research design.

The specific research methodologies identified by Group 1 are shown in Table 3.

Table 3. Candidate research methodologies identified by Group 1.

<ul style="list-style-type: none"> • Quantitative Methods <ul style="list-style-type: none"> - Structural Equation Modeling • Qualitative Methods [very important if we are to dig deep into men’s experiences] <ul style="list-style-type: none"> - Oral Histories - Life Histories – important for role models of current young men (and to see newer stories) - Critical-Ethnography - Case Studies - Grounded Theory - Hermeneutical (Meta-analysis, biographies, fiction, narrative, historical) • Mixed Methods <ul style="list-style-type: none"> - Program Evaluations to inform future practice in communities - Longitudinal Studies • Action-Based Research – practitioner based research with more immediate results and may have emancipatory effects on the practitioner
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Group 2

The second group also surfaced the issue of determining the sample sizes required to obtain defensible empirical data as well as anticipating that the topic area may prompt increased skepticism among researchers outside of the area. They also cautioned against conflating methodology and method. This group suggested a variety of methodologies organized as fairly standard research methodologies, grassroots methodologies that may allow researchers to examine the complexities of males of color and their trajectories into STEM in an environment of mutual suspicion, and a new conceptual grounded methodology as shown in Table 4.

Table 4. Candidate research methodologies identified by Group 2.

<p>Research Methodologies</p> <ul style="list-style-type: none"> • Structural Equation Modeling (SEM) • Hierarchical Linear Modeling (HLM) • Classroom Research <ul style="list-style-type: none"> - Studying the ecologies of effective classrooms - Classroom observations/interventions (if pedagogy is so important for minority males, then we need to understand it) • GIS and GPS Strategies <ul style="list-style-type: none"> - Looking at counties & regions with high numbers of people of color - Study students who have achieved success - Asset mapping

Table 4 (continued). Candidate research methodologies identified by Group 2.

<p>Grassroots Methodologies</p> <ul style="list-style-type: none"> • Critical Race Methodologies <ul style="list-style-type: none"> - Permanence of racism - Intersectionality of race, class, gender, geography, history - Histories of scientific racism - Honors the complexity of lived experiences of males of color - Importance of place, geography - Honor or privilege the voice of men of color (need to talk with them and not just about them) - Longitudinal work - Comes from a critical perspective <p>A Grounded Methodology</p> <ul style="list-style-type: none"> • A new synergistic framework has to be critical; it has to be transformative and tied to action. • Needs to be collaborative, interdisciplinary, transdisciplinary, inclusive, innovative • Needs to be reflexive (admit what we do not know): bold, willing to take risks, challenge itself, challenges scientific hegemonies, iconoclastic • Creates new data source • Creates a culture of inquiry that recognizes that that data are not center stage, but that practitioners, using data, become agents of change. How you use the data is more important than what it says, particularly with respect to the data generated by institutional research offices at individual institutions. <p>Diffusion of Research-based innovation (need support to move good ideas into practice)</p>

This group expressed the view that the research program should aim to humanize males of color by focusing on human agency, the validation of voice and honoring the complexity of human experiences and communities.

Group 3

This group emphasized that research designs must support examination of the individual, communal, organizational, and societal factors embedded within “the challenge” major research area. They suggested such methodologies as life event storytelling and surveying (including discourse analysis), longitudinal data collection, quasi-experimental research design, ethnographies, and portraiture (as pioneered by Harvard’s Sara Lawrence-Lightfoot). They observed that it is important to consider the lens through which methodologies are applied and cautioned against becoming trapped in a post-positivist construct. They were concerned about how specific methodologies might harm vulnerable populations (e.g., attempting to conduct large-scale national data investigations on populations that are fundamentally small and regional). Ultimately, they urged caution as there are strengths and limitations to any methodological approach.

Group 4

The final group emphasized the need for new methodologies, with appropriate theoretical grounding, that are validated by pilot study use. They also emphasized the importance of broad diversity in the reviewer pool for any grant program—including attention to ethnicity, discipline, background, as well as research theories and methodologies used. They suggested that experienced researchers should nominate other experienced researchers for service on review panels. Finally, they emphasized that any research program solicitation should communicate that all research methodologies are equally valued and possibly provide examples (e.g., photo voice, observational, experimental, focus groups, interviews, etc.).

General Discussion of Research Methodologies

Colloquy attendees expressed concern about the adequacy of reviewer pool for proposals submitted to an NSF grant program addressing this area and emphasized how critical it will be to both properly prepare reviewers and to sensitize NSF to be receptive to new approaches. In particular, the small sample size of the many of the (sub) populations under consideration will necessitate unconventional methodologies. Irrespective of the methods used, it is essential that the researchers hear and reflect the minority male populations under study.

Community Building Activities

Although the agenda called for attendees to consider organizational models and change processes and the types of projects that might be supported. The Colloquy planning team, in consultation with on-site NSF representatives, decided that it would be more productive to reallocate the time for allotted for such discussions to informal discussions within self-selected groups. The idea was to foster cross-disciplinary and cross-institutional research collaborations which might further inform and initiate the nascent research agenda that had evolved thus far. In support of the individual and group discussions, Dr. Robert Teranishi, who serves as a consultant for the Ford Foundation's Advancing Higher Education Access and Success Initiative, made an impromptu presentation on grant opportunities available at the Ford Foundation. The foundation has an education division which has separate program officers for pre-college and higher education. He indicated that the foundation is concerned about the need to be responsive to needs of the most vulnerable populations. Its agenda includes attention to college access and completion. He indicated that Ford's goals include removing barriers, changing attitudes, and achieving social justice. It seeks to increase institutional capacity for implementing and sustaining reform, as well as building political will among would-be change agents. Although the Ford Foundation is interested in supporting large-scale systemic efforts as well as demonstrations of scalability and replicability, Teranishi urged resistance to attitudes such as "If you work at the margins, you'll get marginal change" which imply a need to ignore small minority communities.

Teranishi emphasized the importance of talking with program officers at private foundations because they often do not have external reviewers, and seek to achieve a consensus discussion among program officers. Therefore the more your program officer knows about your research, the better s/he can advocate on your behalf. Teranishi noted that, compared to past years, fewer program officers have discretionary funds.

With regard to budgeting, Teranishi noted that for Ford Foundation, a moderate grant is one in the range of \$150,000 to \$250,000 over a duration of 2 to 3 years, but he has seen grant amounts of up to \$1M over 2 years. He noted that many private foundations strictly limit indirect costs, so it is important to carefully account for actual direct costs that you may be used to treating as indirect costs.

Advocacy

On their own initiative and without NSF staff present, Colloquy attendees devoted a few moments to a discussion of how to be effective advocates for the proposed research program. There was a discussion of the various audiences to be considered (e.g., a university office of public or governmental affairs, city/state/federal legislator, city/state/federal agencies, various executive branch offices such as the White House Domestic Policy Council, professional societies, think tanks, and advocacy organizations): For each of these audiences the message is basically the same – keep them informed of what you are doing (individually and collectively) and its implications for existing or pending policy initiatives. For interactions with individuals, the point is to show them how your work advances their agendas. Although the big picture message is the same, it necessarily needs to be tailored to the needs and “ear” of each distinct audience. Essential points to keep in mind are that academics can provide data that help to tell a story, a key part of messaging is desired actions, and effective messages have specific characteristics⁴ (e.g., see for example *Now Hear This* by Fenton Communications).

OTHER AREAS OF CONCERN

During the course of the Colloquy several issues were raised that attendees recognized merited separate meetings to discuss them adequately in their full complexity. Such issues included:

- Data Collection and Reporting – With some minority populations the participation in STEM is sufficiently small that privacy concerns have prompted the practice of suppressing available data on academic and professional progress. Yet such actions can significantly impede the ability to learn from promising and proven practices to increase participation in STEM. Similarly, at the level of individuals, there are practical programmatic concerns about balancing activities that might tend to (a) spotlight individuals in such a way as to make them subject to stereotype threat, or (b) ignore individuals in such a way as contribute to feelings of invisibility. Serious attention needs to be devoted to discerning a means by which to balance privacy concerns and researchers’ need for access to valuable information to inform future improved educational and professional practices.

Another data issue is one of properly reflecting the contributions of liberal arts minority serving institutions as sources of minority STEM baccalaureate recipients. For example, Georgia Tech is frequently cited as a top producer of African Americans baccalaureates in STEM, but little acknowledgement is given of the role of its 3-2 program with Morehouse College that provide many of the African Americans who go on to attain baccalaureate degrees. Data on community college contributions to STEM baccalaureate

⁴ See for example, *Now Hear This*, by Fenton Communications. Available at http://www.fenton.com/FENTON_IndustryGuide_NowHearThis.pdf.

degree attainment is similarly lacking even though some reports indicated that up to a third of community college students are students of color and up to 50% of community college students aspire to transfer to a baccalaureate program.

Another issue which is particularly salient in community colleges is how inclusively STEM is defined. It clearly includes the physical and life sciences and engineering disciplines as well as technology fields associated with these disciplines (e.g., chemical technology). But given the complexity of on-board computer systems, does it include automotive technology? STEM includes computer science and computer technology, but what about management information systems, or knowledge management systems? Fundamentally, the question concerns the areas of overlap between STEM and career and technical fields. Many of those concerned about economic development and employment would include many career and technical fields, while many traditional academics would not. Given the evident interest of many in minority communities in career and technical fields, should researchers view these fields as distinct, as pathways to STEM, or as full parts of STEM? A full discussion of the implications of such choices is merited.

- For-profit colleges have a prominent role in the higher education of minorities. For example, data presented by Lorelle Espinosa showed that the University of Phoenix (online) and Strayer University were the fourth and fifth most productive producer of STEM degrees for African American males in 2007. Yet as highlighted in recent Congressional hearings <NEED REF>, some for profit educational institutions have engaged in practices that might be characterized as predatory. Therefore, discussion is warranted on the relative merits of for-profit educational institutions in engaging and enrolling minority males, the graduation rates of minority males from such institutions, and the financial impact on minority males of choosing for-profit institutions as their educational pathway.
- Have the colloquy attendees placed too much emphasis on identity manifestation rather than its function in any given context? Might specific identities matter less than the concept of identity and how it evolves? Consider the work of Princeton's Anthony Appiah. Might individuals forced to assume a given identity within STEM face a conflict with their other identities and therefore choose to avoid or leave STEM? Role conflict and Role confusion may both exist.

Closing Comments

Colloquy attendees had two overriding concerns. First, they thought it imperative to continually emphasize that any research program must not exist in isolation, but must be tied to energetic action to achieve positive outcomes for minority males. Second, much of the discussion at the Colloquy implicitly was framed in terms of boys who were within formal or informal educational systems. But there are too many young men who have left or are in danger of leaving these systems.

There may be models of successful efforts to re-engage them in education in general, but particularly in STEM education. We may need an emotional mental health approach to encourage students to enter STEM. This may require attention to surrounding issues that affect student enrollment, engagement, and completion. Viewed a different way, even those aspiring to be novelists have to take math in high school; so math becomes a gateway to college education in all fields.

One attendee noted that we often assume that we need people who are “passionate” about STEM, but if we are to reach the populations discussed at the Colloquy and even more broadly into the US population, we need to be more welcoming of people who are “okay” with STEM, but not necessarily passionate. They may not all will want to be Ph.D. scientists and engineers, but they can be informed citizens, consumers, business owners, service providers, employees, and policy makers able to operate in a society that is increasingly complex and driven by scientific and technological underpinnings.

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