

AGEP: BPR: Understanding URM STEM Graduate Students' Identity Integration and Assimilation into a Community of Practice

Western Michigan University

This broadening participation research project is based at Western Michigan University, with research activities at Western Michigan University, the University of Michigan, and Michigan State University. It investigates URM STEM graduate students' negotiation of multiple identities as they encounter the disciplinary norms and practices of STEM communities of practice at PWIs. Persistence and success in STEM relies on graduate students' ability to negotiate and integrate identities as they develop a STEM identity. This research will inform our understanding of the process by which multiple identities are negotiated and integrated when identity conflict emerges during the graduate years for URM graduate students in STEM. Specifically, this research 1) explores identity negotiation as URM graduate students in STEM integrate into a community of practice and 2) documents the social networks URM graduate students in STEM use to support the development of a scientist-identity-centrality. It utilizes a longitudinal, mixed methods design to understand the experiences of students from underrepresented minority groups who are enrolled in STEM/SBE PhD programs at three different universities.

Data collection consists of a pre- and post-survey, a series of semi-structured interviews, and repeated surveys of social networking. The pre- and post-survey measures identity centrality, identity interference, identity compatibility, and perceived social support. The pre-survey was sent to all URM students enrolled in the first or second year of a doctoral or masters to doctoral STEM/SBE program at participating institutions. It was used to identify and recruit interview participants. There are six semi-structured interviews with each participant over three years. Each interview has a unique interview protocol, with questions informed by findings from previous interviews and tailored to their position in their program. Interview data is being analyzed with emergent coding methods and the constant comparative method, guided by the theoretical frameworks and research questions. The social networking surveys are personalized to each interview participants' university and doctoral program, allowing us to track changes in their social networks over the course of their graduate program.

Collectively, these data will inform the development of a model for URM STEM graduate student identity integration and identify specific strategies for institutional support needed to promote successful assimilation into a STEM disciplinary community of practice. To-date, we have developed, validated, and collected data with the identity and social support survey, conducted four interviews, and started data analysis. From the preliminary interview coding exercises, several interesting codes emerged related to the guiding theories and literature for this project. This poster presentation will explore two of the codes: URM Experiences, which is related to Identity theory, and Assimilation, which is part of Community of Practice theory. The URM Experiences code includes data specifically related to the participants' identities as minorities in their program and university. The Assimilation code describes participants' sense of belonging or not belonging to their graduate program and whether they feel like they fit the scientist "mold." These codes focus on specific challenges that URM students at PWIs face with regards to identity and becoming a member of the scientific community.

AGEP-BPR Interpersonal and Intrapersonal Mechanisms in Improving Mentoring Relationships for URM Students in STEM Fields

University of California, Berkeley

In academic and professional contexts, people rely on mentors for psychosocial support, career-related support, and role modeling. However, interracial mentoring relationships may face more challenges than same-race mentoring relationships, as underrepresented minority (URM) individuals in predominantly White institutions often worry that they will face discrimination or confirm negative group stereotypes, and Whites often worry that they will be perceived as prejudiced. Accordingly, our initial goal in this research was to examine whether influencing socio-emotional processes (both at the inter-personal and intra-personal levels) could enhance interracial mentoring interactions. Over the course of this project, we broadened the scope of our goals to investigate interracial dynamics beyond mentorship contexts. Specifically, we sought to gain a deeper understanding of how interracial dynamics at the individual- and community-levels shape attitudes towards race-based social movements and health disparities.

To better understand interracial relations in mentoring and community contexts, we conducted 11 studies. The objective of Studies 1-4 was to examine whether increased mutual self-disclosure among White mentors and URM mentees would improve inter-racial mentoring outcomes by reducing negative affect and increasing feelings of rapport. The objective of Studies 5-6 was to determine whether preparing for interracial mentorship from a self-distanced (i.e., non-first-person), as opposed to a self-immersed (i.e., first-person) perspective, would improve interracial mentoring behavior by reducing neural activity linked to self-referential processes during the provision of criticism. Extending our original aims, the objective of Studies 7-8 was to elucidate whether interracial contact would shape Blacks' and Whites' endorsement of the Black Lives Matter movement. Finally, the objective of Studies 9-11 was to determine whether community-level racial biases would be related to health outcomes for Blacks and Whites.

Our lab-based studies revealed that increased self-disclosure between URM mentees and White mentors decreased negative affect and increased rapport, which in turn predicted positive behavioral outcomes for mentees and mentors (Studies 1-4). Additionally, results revealed that White mentors who prepared for interracial mentorship from a self-distanced perspective showed decreased neural activity in regions linked to self-focus (medial prefrontal cortex; mPFC) when conveying criticism to a Black mentee. This decreased mPFC activity, in turn, predicted more positive and helpful mentorship (Study 5). Self-distancing was also shown to mitigate the link between Whites' self-focus and poor mentorship (Study 6). Our community-based studies found that increased interracial contact predicted increased endorsement of the Black Lives Matter movement for Whites, but decreased endorsement of this movement for Blacks (Studies 7-8). Finally, Blacks showed poorer health outcomes in communities where Whites (Studies 9-10) or Blacks themselves (Study 11) harbored more racial bias. Together, this research elucidates factors that may disrupt and facilitate interracial relationships in both mentoring and non-mentoring contexts.

AGEP-BPR: A Study of the Cultural Factors Affecting Underrepresented Minority STEM Doctoral Students and Academic Pathway and Transition Programs

American Institutes for Research

A Study of the Cultural Factors Affecting Underrepresented Minority STEM Doctoral Students and Academic Pathway and Transition Programs is an exploratory, qualitative study of four higher education institutional programs that provide pathways or “bridges” to PhD programs for underrepresented minorities (URMs) pursuing science, technology, engineering or mathematics (STEM) degrees. The study is being funded through an NSF Alliances for Graduate Education and the Professoriate Broadening Participation Research (AGEP-BPR) grant. The purpose of the study is to explore the key features of these types of bridge programs, including the activities and strategies institutions use to support URMs’ advancement through STEM master’s programs and their subsequent pursuit of STEM doctoral degrees. The study is guided by the following three research questions:

1. What criteria are STEM Ph.D. pathway programs using to recruit and admit students?
2. What interventions or supports do Ph.D. pathway programs use to promote students’ social and academic preparation and integration for success in STEM doctorate programs?
3. What cultural factors of the STEM department and the larger institution affect students’ experiences in the Ph.D. pathway programs?

The four bridge sites were selected purposefully to ensure diversity in program maturity, pathway program focus in terms of specific STEM discipline(s), and program structure. The following criteria were considered when selecting the sites: (1) when program implementation began and maturity of program, (2) number of student participants in the program, and (3) type of program [e.g., Louis Stokes Alliances for Minority Participation (LSAMP) program, AGEP program]. Ensuring variation in site selection allows this study to learn about different types of components used by bridge programs. One program is housed within a Hispanic Serving Institution (HSI), two are located within predominantly white institutions (PWI), and one program is a bridge between a historically black colleges and universities (HBCU) and a PWI. The sites are spread throughout the U.S., and include sites that have been in existence from eight years to a site that is relatively new and is currently in its third year. Cohort size varies from 3 to 18.

The multi-day site visits entail interviews and focus groups with bridge program leadership, faculty, and participating students and will occur in the spring of study Year 1, the fall and spring of study Year 2, and the fall and spring of study Year 3 at each institution. The results of the study will be disseminated through peer-reviewed journal articles at the end of the study. To date, two rounds of data collection have occurred. Formal data analysis will begin when data collection has been completed.

This research is intended to provide information to the STEM community about the cultural factors that most affect underrepresented students’ experiences in STEM graduate programs, the role of STEM PhD bridge programs in affecting those experiences, and the institutional/departmental cultural factors that affect implementation of the bridge programs themselves. The research also is intended to explore differences in cultural factors that affect student experiences and program implementation between specific STEM disciplines.

AGEP-KAT: Adopting Evidence Based Strategies to Improve Academic Climate and the Success of Underrepresented Doctoral Students in Engineering

PITT STRIVE: The University of Pittsburgh's Transition to the Doctorate by Adaptable Engagement (TDAE) Program

University of Pittsburgh

Studies reveal that Black/African Americans (5.3%), Hispanic/Latinos (3.5%), and American Indians (1.4%) are significantly underrepresented in the professoriate. The primary goal of PITT STRIVE, a National Science Foundation (NSF) Alliances for Graduate Education and the Professoriate-Knowledge Adoption and Translation (AGEP-KAT) program, is to improve the transition of Underrepresented Minorities, who are US citizens, into doctoral engineering programs at the University of Pittsburgh and to ensure their successful completion by employing evidence-based strategies for student and faculty engagement and fostering an inclusive academic climate for URM doctoral students.

The University of Pittsburgh PITT STRIVE program is housed and administered under the Swanson School of Engineering (SSOE) Office of Diversity. The PITT STRIVE leadership team aims to develop, coordinate, implement, and assess program activities and outcomes in the following focus areas:

- Improving faculty engagement with URM students.
- Improving faculty awareness of the problems facing URM students.
- Developing a shared vision among vested faculty regarding the success of URM students within our School of Engineering.
- Fostering an inclusive academic culture climate for the success of URM doctoral students.

The PITT STRIVE program is now in its second year. We have successfully recruited 7 scholars into the program and enlisted the participation of our entire underrepresented graduate student population as fellows. Both scholars and fellows benefit from our professional development activities, training sessions, and student focused workshops.

With the goal of adopting/adapting evidence-based strategies for student and faculty engagement, one of the most critical lessons learned from the first year is that the idea of simply adopting/adapting the activities of a successful program (e.g. University of Baltimore County, UMBC, Promise) is likely not the best strategy to employ. Factors such as the University climate and demographics, faculty and student culture, program recognition/maturity, available budget, etc., can cause an activity that is highly successful at one location to fail at another. Thus, a major focus of PITT STRIVE's first year was to acquire data on our climate and culture so the program could more strategically address the specific needs of our scholars and fellows. Cultural and climate focused assessments and one-on-one interviews were performed with our students, faculty, and leadership. During these sessions, some common themes emerged that pointed to specific focus areas.

One of the most critical focus areas was to unify our underrepresented graduate students who are scattered throughout our 6 departments without much ability to interact. Next, we identified that there were very limited opportunities for these students to engage with our faculty. Several social and professional activities were developed to address these areas, the most successful event was our first annual summer 2-night retreat that was held at Oglebay Resort, WV. Under the direction of professional facilitators of race based discussions, the event brought together faculty along with our scholars and fellows. Participants worked through sessions discussing emotional topics, personal challenges, and engaged in fun getting-to-know-you activities. The result was rated by all who attended as highly valuable and seemed to be the first catalyzing event for PITT STRIVE.

AGEP-T Collaborative Research: California Alliance for Graduate Education and the Professoriate

University of California, Berkeley; California Institute of Technology; Stanford University; University of California, Los Angeles

The NSF AGEP California Alliance is an unprecedented partnership among UC Berkeley, UCLA, Stanford and Caltech. Our goal is to significantly increase the number of underrepresented minority (URM) graduate students and postdoctoral scholars in the mathematical, physical, computer sciences and engineering (MPCS&E) fields who go on to competitive research and teaching careers at great universities across the nation. Underrepresentation in these fields and at these institutions has been severe and seemingly intractable. Our approach has been to create a vibrant cross-institutional intellectual community of practice among URM graduate students, postdoctoral fellows, faculty, and key administrators in MPCS&E at the CA Alliance institutions. Four activities support this approach.

Annual Retreats

Each year 120- 150 faculty, postdocs, and advanced doctoral students attend the CA Alliance Annual Retreat. The retreats are designed to generate interactions within and across disciplines, institutions, and cohorts. The retreat focuses on networking, collaboration, professional development, and providing access to new professional opportunities. Formats include small group consultations, inspirational keynote talks, and primers and panels on topics such as preparing for postdoctoral and faculty jobs, developing a research agenda, academic writing, and publishing. Most advanced eligible graduate students at the Alliance universities participate in the retreat. All attendees have rated it effective.

Postdoctoral Fellowship Program

The California Alliance has leveraged AGEP support for 3 postdoctoral fellows with institutional funds controlled both by PIs and administrators to support 18 URM postdoctoral fellows at the CA Alliance institutions. The application and selection process is integrated with the prestigious UC President's Postdoctoral Fellows program.

Research Exchange

The California Alliance has developed a new model for cross-Alliance mentoring and advising of URM students and postdoctoral fellows. Alliance and institutional funds support 25+ AGEP participants for inter-campus visits to network, present research, and initiate collaborations. In several cases, the visits have led to postdoctoral appointments and collaborative publications.

Professional Development Resources

The CA Alliance created a website that serves as a curated hub, aggregator, and repository for national resources on career pathways and professional development advice for graduate students and postdocs in the mathematical and physical sciences, and engineering.

AGEP-T Collaborative Research: California Alliance for Graduate Education and the Professoriate

University of California, Berkeley; California Institute of Technology; Stanford University; University of California, Los Angeles

The focus of the California Alliance is to advance URM scholars into the professoriate. To be successful at winning faculty positions, scholars need to do *more* than complete their Ph.D. programs – they must stand out in terms of their publication record. A candidate's publication record is the most important criterion for potential employment, and an objective predictor of success in the academy, as well as for promotions to tenure and beyond.

In an initial effort to understand publication trends among graduate students in STEM, we turned to a completed data collection effort, the Berkeley Life in the Sciences Study (BLISS), which surveyed all graduate students in the mathematical and physical sciences at Berkeley and which achieved high rates of participation. The survey asked respondents, among other questions, whether they had been an author on a manuscript submitted for publication in the past year, indicating whether the student was involved in research at a sufficient level to warrant authorship. We found an overall pattern such that URM students and women, relative to majority group males, were significantly less likely to be authors on a manuscript. These findings hold when statistically controlling for other factors that might affect publication (e.g., seniority in the program, teaching responsibilities, research assistantships). However, while the disparities were magnified in Mathematical and Physical Sciences at Berkeley, in Berkeley's separate College of Chemistry, *no disparity emerged*.

Given this unexpected result, we sought to replicate the finding in a larger dataset, and thus turned to Berkeley's long-running PhD Exit Survey, which is required and has a 100% response rate. Two questions from this brief survey serve as proxies for students' participation in the research process— whether they had presented their findings at national conferences, and how much they were encouraged by their advisors to publish. These findings are strikingly similar to those found in the BLISS survey, with the disparities most pronounced in math and physical sciences, but insignificant in the College of Chemistry.

Initial ethnography in Berkeley's College of Chemistry suggests that one of the core principles that accounts for all graduates' success is the **structured progression** of students through the program. In a series of interviews, we have learned that Chemistry students, from the time they enter the department, are expected to have regular check-ins with mentors to check on their progress. At regular intervals, both students and mentors fill out forms designed to monitor student progress so that nobody "falls through the cracks." Furthermore, respondents all report that there is a uniform and unwavering expectation for everyone to publish. For example, Chemistry advisors are directly asked, "When would you expect this student to submit a paper for publication?" In short, our initial research suggests that a structured graduate program may blunt the effects of bias that lead to publication disparities, consistent with social science research demonstrating that bias, especially implicit bias, is most likely to be applied under conditions of ambiguity (Dovidio and Gaertner, 2000).

AGEP-T: Collaborative Research: Advancing Interdisciplinary STEM Graduate Education in Energy and Sustainability Disciplines

Texas A&M University; Prairie View A&M University; Texas A&M University – Corpus Christi; Texas A&M University – Kingsville; West Texas A&M University

The Texas A&M University System (TAMUS) AGEP Alliance is composed of five doctoral degree-granting institutions (Texas A&M University – College Station, Prairie View A&M University, Texas A&M University – Corpus Christi, Texas A&M University – Kingsville, and West Texas A&M University). The long-term goal of the Alliance is to increase the number of successful URM STEM faculty by measurably increasing the number of STEM doctoral degrees awarded to URM students each year and increasing the number of URMs transitioning to STEM faculty positions (or to competitive postdocs that lead to faculty positions). The short-term operational goal of the project is to develop, implement, and assess a set of transportable strategies to ultimately increase the number of successful URM STEM faculty by increasing the number of URMs who enter participating doctoral programs, the percentage of URMs completing STEM doctoral degrees, and the number who transition to faculty positions (or to competitive postdoctoral positions), and by reducing their time to doctoral degree.

To meet the goals and objectives of the project, TAMUS AGEP developed activities that connected students and faculty across existing programs. Since the start of the project in September 2013, there has been a 50% increase of TAMUS AGEP participants. There are currently 146 URM STEM graduate students involved in the program. Twenty-nine TAMUS AGEP students have graduated (23 master's; 6 doctoral students). Six master's students transitioned into a STEM Ph.D. program (4 to a TAMUS institution; 2 to Doctoral-highest institutions). Three Ph.D. students transitioned into the professoriate: adjunct professor in biology at a Texas community college, adjunct professor in nuclear engineering at a New Mexico junior college, and a tenure-track assistant professor in Industrial Engineering at a Doctoral-highest institution. One current TAMUS AGEP Ph.D. student will transition into a tenure-track assistant professor position in Community Health at a Doctoral-highest institution starting Fall 2017.

TAMUS AGEP developed a retention bonus program for students who participated in a number of AGEP and campus wide professional development activities. Over 100 students received participation bonuses ranging from \$125-\$2500 per semester. Through 4 annual TAMUS AGEP conferences and social media communications, TAMUS AGEP was able to create community and support for students at individual institutions and across Alliance institutions. The Alliance-wide Fellowship and Research Funding Application Lab activity prepared students for the fellowship application process, with several TAMUS AGEP receiving fellowships such as the NSF GRFP and the Ford Foundation Dissertation Fellowship. TAMUS AGEP students attended the 21st, 22nd, and 23rd Institute on Teaching and Mentoring with the Southern Regional Education Board. The TAMUS AGEP mini-grant competition awarded 7 AGEP students (up to \$7000 each) for seed funding to support the development of new collaborate research and/or teaching efforts.

TAMUS AGEP continues to offer programs, seminars, and workshops that focus on training and professional development as it relates to teaching, research, and networking in academia. The TAMUS AGEP activities helped to increase the participation, reduce barriers, and promote the success of URM doctoral students prepare for careers in the professoriate.

AGEP-T: Collaborative Research: Advancing Interdisciplinary STEM Graduate Education in Energy and Sustainability Disciplines

Texas A&M University; Prairie View A&M University; Texas A&M University – Corpus Christi; Texas A&M University – Kingsville; West Texas A&M University

Inclusive environments provide a feeling of recognition and empowerment for most individuals. While the frequency of social ostracism (being ignored and excluded) is higher for women than for men, this outcome also depends on the salience of ethnicity for the individual. Graduate students of color, who perceive their collegiate experiences to be marginalized, suffer distinct consequences that influence rates of retention and degree completion, compared to general targets of social exclusion (Carter-Sowell, Dickens, Miller, & Zimmerman, 2016). However, with strategic efforts to bolster social support, students of color can thrive, efficiently and effectively, in diverse academic and campus settings (Watkins, Green, Goodson, Guidry & Stanley, 2007). We present evidence of the impact of chronic ostracism experiences on perceptions of campus climate across five doctoral degree-granting institutions (Texas A&M University – College Station, Prairie View A&M University, Texas A&M University – Corpus Christi, Texas A&M University – Kingsville, and West Texas A&M University). Also, we introduce evidence based interventions that can reduce perceptions of exclusion by marginalized, graduate student populations.

For the research studies in the project, graduate students were recruited to participate in data collection sessions during scheduled time slots at the TAMUS AGEP Annual Conferences. The surveys assessed attendees' self-reports of the stressors and the support systems affecting their individual pursuits of academic, interpersonal, and well-being goals. Analyses of Study 1 data (n=44) indicated that marginalized graduate students reported more chronic experiences of social ostracism and/or information exclusion, more negative recurring thoughts about their interactions with others on campus, and less overall satisfaction with their collegiate experiences. Analyses of Study 2 data (n=31) showed that the effects of graduate students' social experiences differed across the TAMUS Alliance of Institutions. Specifically, we found that once a graduate student experienced regular episodes of being ignored and excluded, he/she had more difficulty building a community of belonging in his/her graduate program. Furthermore, we found that graduate students who took less traditional (direct) paths to the professoriate reported more difficulty building a community of belonging in their graduate programs. These differences may be due to the composition of social networks available to them throughout the designated academic programs and campus communities.

Together, these findings extend the existing research on the "chilly" climate in academia that creates an exclusionary environment for diverse populations. For example, interpersonal dynamics affect persistent and recurring thinking. Both positive and negative ruminations may influence well-being and academic outcomes for graduate students at ALL TAMUS Alliance campuses. Implications for engaging contentious topics in order to reduce perceptions of exclusion by marginalized graduate student populations and to better understand issues relating to identity, resilience, and psychological well-being for students are explored and research is ongoing in the TAMUS AGEP program.

AGEP-Transformation: The CIC Professorial Advancement Initiative

AGEP-T Professorial Advancement Initiative (PAI)

University of Illinois; Indiana University; University of Iowa; University of Michigan; Michigan State University; University of Minnesota; University of Nebraska-Lincoln; Northwestern University; Ohio State University; Pennsylvania State University; Purdue University; University of Wisconsin-Madison

The Big Ten Academic Alliance was awarded a National Science Foundation Alliance for Graduate Education and the Professoriate (AGEP) Transformation grant in 2013 to launch the Professorial Advancement Initiative (PAI). The programmatic goal of PAI is to double the rate at which underrepresented minority (URM) faculty are hired in the science, technology, engineering, and mathematics (STEM) fields at participating Big Ten Academic Alliance institutions: Illinois, Indiana, Iowa, Michigan, Michigan State, Minnesota, Nebraska, Northwestern, Ohio State, Penn State, Purdue, and Wisconsin. We used 2010, 2011, 2012 as benchmarking years to set the baseline for measuring improvement. Over this three-year period, the alliance universities hired an average of 24 URM faculty/year. Using this average as the baseline, the alliance set as its numerical goal to more than double this rate, which translates to hiring 50+ URM faculty each year. Now in its third year of funding, the PAI has exceeded its URM faculty hiring goal by more than 30 percent.

The PAI takes a two-pronged approach to achieve its faculty diversity goal by 1) creating a pool of URM postdoctoral fellows who are well prepared and trained to enter the academy as tenure-track faculty members; and 2) educating mentors, faculty, and faculty search committees about unconscious bias and diversity hiring.

To achieve the first objective, we have matched postdocs with mentors. A set of mentoring modules were developed to help facilitate discussion and guide mentors in coaching their postdocs. The postdoc-mentoring experience covers a variety of topics such as

- preparation for a faculty role—grant writing, establishing a research program, promotion and tenure process, difficult discussions, collaboration options, and time management; and
- interview preparation—communication, department interviews, job talks, and CV review.

A professional development series has been initiated that includes monthly webinars for postdocs and campus-based workshops. The PAI research team established the initial topical areas for the webinar series. The webinar series is centrally-driven by the Big Ten Academic Alliance and focuses on job coaching, networking opportunities, and grant writing. The campus-based workshops are campus-driven and focus on personal development and campus networking. PAI postdocs also have the opportunity to participate in regional and national conferences and coaching workshops. Additionally, postdocs are supported to meet face-to-face with cross-institutional mentors.

In support of activities aligned with objective 2, we have developed training materials on unconscious bias, including video case-studies and facilitation guides. These resources are aimed at mitigating negative racial and ethnic biases and perceptions among those involved in the hiring process. The video case-studies were developed to challenge the norms in hiring and bring to the forefront the ways in which bias can dominate the faculty selection process. Additionally, we have created a collaborative resource library for Big Ten Academic Alliance members to share and distribute materials for their faculty training workshops. Another tool that we developed is a searchable directory of URM postdocs (i.e., PAI postdocs) that Big Ten Academic Alliance campuses can use for recruitment.

AGEP-Transformation: The CIC Professorial Advancement Initiative

The Forgotten Scholar: Underrepresented Minority Postdoc Experiences in STEM Fields

University of Illinois; Indiana University; University of Iowa; University of Michigan; Michigan State University; University of Minnesota; University of Nebraska-Lincoln; Northwestern University; Ohio State University; Pennsylvania State University; Purdue University; University of Wisconsin-Madison

It is estimated that by the year 2050, the present majority population will be in the minority (Bernstein & Edwards, 2008), emphasizing the need to address the current underrepresentation of minority faculty members in the STEM fields. In order to maintain the U.S. STEM workforce, underrepresented minorities (URMs) must pursue careers in STEM fields. Much of the research to date has focused on STEM education and STEM interest at the K-12 and undergraduate level and we know little about experiences of URM postdocs in STEM fields. Research on and the development of postdocs is often overlooked as postdocs have reported feeling that they are exploited for low cost labor by institutions (Rohn, 2011). In order to understand challenges URM postdocs face and how to support their transition into professoriate, we conducted qualitative in-depth interviews. Twenty-four underrepresented minority postdocs in STEM fields completed an interview, to examine their self-efficacy, sense of belonging, identity as researchers, and challenges of being a minority.

The rich qualitative data yielded a number of themes related to challenges of being a postdoc, in general as well as challenges specific to being a minority in STEM. Overall, the themes related to challenges for all postdocs mostly focused on their self-efficacy (such as writing grants, getting published, etc.) and the culture of the work environment. For the challenges for minority postdocs, the themes that emerged focused on their identity and sense of belonging within the work environment and community, as well as facing stereotypes and biases as a result of being a minority. While a majority of prior work has focused on undergraduate and postgraduate students, the results from our study are the first to point out that a pervasive sense of isolation exists among URM postdocs, who have accomplished the highest level of education. Clearly, it is imperative that mechanisms are developed that allow URM postdocs to have mentors who might understand these challenges.

References

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California AGEP Model to Increase the Success of Underrepresented Minority Postdoctoral Fellows Becoming Faculty in Mathematics, Engineering and Physical and Computer Sciences

University of California, Berkeley; California Institute of Technology; Stanford University; University of California, Los Angeles

The University of California-Berkeley is leading a regional network with the University of California-Los Angeles, Stanford University, and the California Institute of Technology to refine, implement, study, sustain, disseminate and begin expanding, reproducing, and replicating the current multi-dimensional California AGEP Alliance model at the national level.

The California AGEP Alliance II is advancing a model to improve the representation of URMs in STEM faculty positions, eventually providing URM STEM role models to STEM undergraduate and graduate students at postsecondary academic institutions across the Nation. Replicated nationally, this approach could eliminate the more than factor-of-two difference between the current fractions of URM PhD students (~9%) and URM faculty (~4%). The California Alliance is focused on the least-diverse STEM fields, namely the mathematical, physical, and computer sciences and engineering (MPCS&E).

The California AGEP Alliance II is refining the following components of the model while significantly increasing the dissemination of state-of-the art knowledge about equitable and inclusive educational and mentoring practices to faculty who work with graduate students and postdoctoral fellows.

Key Components of the California Alliance II Model:

- (1) A new approach to postdoctoral recruitment, professional development, and advancement to the professoriate.
- (2) A Research Exchange (RE) that facilitates cross-institutional mentoring for early identification, professional development, and advancement of URM PhD students. The RE is designed for nationalization, replication and expansion.
- (3) An expanded vibrant community of practice, including faculty, administrators, postdocs, alumni, and doctoral students to support URM advancement. The community of practice is developed and supported at annual retreats and through an online community on AAAS' Trellis.
- (4) Integrated survey-based and ethnographic research to enhance URM participation in the STEM professoriate.

The California Alliance II's integrated research systematically explores the intersections of identity, structure, and belonging. Our findings point to an important role for structure in PhD programs, especially in regard to expectations for career advancement into the ranks of the professoriate. Our multi-method research contributes scholarship to social psychology of belonging, identity, and achievement; social anthropology research on learning; and the sociology of professions.

Collaborative AGEP-T: PROMISE AGEP Maryland Transformation

PROMISE: Maryland's AGEP: Transforming STEM Inclusion and Pipeline Development in Maryland

University of Maryland, Baltimore; University of Maryland, Baltimore County; University of Maryland, College Park

PROMISE AGEP: Maryland Transformation has worked to recruit, retain, and train a diverse STEM graduate student body at institutions within the University System of Maryland (USM) for the purpose of preparing a diverse STEM workforce that will include future faculty. PROMISE uses as its conceptual framework ***professional development coupled with a psychological sense of community*** (PSOC: McMillian & Chavis, 1986) to serve graduate students and postdocs. PROMISE hosts a suite of activities, based upon 4 goals: ***1) Cultivating New Students, 2) PhD Completion and Career Preparation, 3) Programs for Postdoctoral Scholars, and 4) Programs for Faculty.*** The PROMISE AGEP has hosted professional development and community building events at UMBC, UMCP, UMB, Towson, Bowie State, UMES, and local hotels. To accomplish the goals, PROMISE hosts “Conferences for Undergraduates” that discuss preparation for graduate school: choosing a program, the application process, statement of purpose, letters of recommendation, and the GRE. More than 100 undergraduate students have attended annually, and participation has come from institutions throughout the USM. Each campus also hosts individual efforts that partner with other organizations and include other campuses, e.g., the McNair partnerships, Summer Horizons. In 2015, PROMISE strengthened its connections with the USM LSAMP for UMBC, UMCP, and UMES, working with the program directors of those schools to provide graduate school mentoring and preparation sessions. Signature programs such as the PROMISE Dissertation House and the Summer Success Institute (Annual August professional development conference) draw national attention, and are heavily sought-after by graduate students within the USM. Workshops and programs include: *How to prepare a TED-style talk, Finding a Dissertation Topic, PROMISE Research Symposium, Writing Accountability Group (W.A.G), Pathways to Leadership, Career Paths for Graduate Students, PROMISE Friends and Family Celebration of Graduates, Career-Life Balance, Financial Literacy/Credit Scores, PROF-it: How to develop a teaching portfolio, PROMISE Fall Harvest Dinner, How to Deal with Stress, Scientific Publishing, Faculty Diversity and You, Faculty X|Y, and IRB seminars.* The postdoctoral fellows for faculty diversity participated in activities such as developing teaching portfolios, developing a syllabus, understanding and acknowledging strengths as a scientist, developing scientific peer groups, and scientific writing, teaching opportunities, and mentoring graduate students. PROMISE has also produced resources for faculty, e.g., a workshop, articles, and resource website. Advisory board member contributions for faculty include slides for academic interventions, an article published by AAAS online based on the PROMISE event titled, *Talking to foreign-born STEM faculty about diversity*, a video presentation that is used to train faculty mentors, and links to other PROMISE Resources. PROMISE is a stakeholder in annual meetings of the USM graduate deans, is responsible for founding the STEM deans Council for the USM, and is now part of the Academic Affairs arm of the University System of Maryland. PROMISE has journal articles, books, book chapters, social media presence, and online and printed news stories that are used by schools in the U.S. and abroad to foster and develop diverse future faculty.

Collaborative AGEP-T:PROMISE AGEP Maryland Transformation

PROMISE AGEP: Maryland Transformation, the Third Space, and Contributions to Social Science Research

University of Maryland, Baltimore; University of Maryland, Baltimore County; University of Maryland, College Park

The social science studies of PROMISE strive to gain a better understanding of how agency in graduate programs and in career advancement is influenced by, micro-affirmations/micro-aggressions, sense of belonging, membership in professional networks such as AGEP, faculty-student mentoring experiences, being a woman or underrepresented minority (URM) student, and being in a critical mass discipline for women and URMs. The three social science research studies are an ethnographic study of high impact practices, a qualitative study of mentoring, and a survey of STEM doctoral students on five PROMISE campuses. The team has completed 16 observations of PROMISE events, 27 interviews about advising, mentoring, and relationships with faculty, and administered a survey that 1,525 students from 5 PROMISE campuses responded to. The mentoring study explored students' definitions of mentoring, their mentoring experiences, and what they were hoping to gain through mentoring. Students' definitions of mentoring emphasized career support and exposure to community practices. Students were hoping to gain a better understanding of their identity as a scientist, develop skills and be prepared for their careers. Good mentoring increased students' confidence, which was perceived as having career implications. Students' developmental networks were intentionally cultivated and included their advisors or Principal Investigators, departmental faculty, peers and friends. Advisor relationships were particularly important for academic integration such as addressing questions and students' development as a researcher and helping student network in the field. Programmatic initiatives such as PROMISE filled in missing areas, allowing students to connect with faculty and peers outside of the laboratory, creating spaces where URM students could be vulnerable and see themselves, fostering social integration and creating a sense of community, and informing cognitive maps of graduate education and careers. Similar results were also found in separate surveys that were administered by PROMISE's formative evaluation and assessment. The ethnographic study found that PROMISE events functioned as third spaces for graduate students, spaces that are neither work nor home, where dialogue can take place to build community and sense of belonging. In these third spaces, students were offered a new set of "ruling relations" (or power relations) that differed from what many graduate students experienced in departments that constrained their sense of agency. Specifically, PROMISE events created community, gave students additional affirmation and support, and strove for a sense of egalitarianism among students, faculty and mentors. Our survey study on micro-aggressions found differences in educational experiences and outcomes by sex and racial/ethnic group, for STEM and non-STEM students, and for PROMISE participants and non-participants. One finding included STEM students being more likely to report stronger mentoring relationships with faculty and advisors than non-STEM students, and less likely to experience a sense of belonging in their graduate programs. There have been presentations at conferences such as AERA and ASHE, and more papers are in the works. Additional studies of the "psychological sense of community" as a conceptual framework for the activities of PROMISE, and studies of STEM identity contribute to the research segments of PROMISE and its publications.

Collaborative Research: AGEP Transformation Alliance: Bridging the PhD to Postdoc to Faculty Transitions for Women of Color in STEM

Vanderbilt University; Fisk University; Wake Forest University

Our nation has been confronted with an ongoing challenge to increase the pool of historically underrepresented minority (URM) undergraduate and graduate students at the PhD level in STEM and some modest gains have been achieved. In parallel, our universities and colleges are now in a better position to recruit, retain and promote URM STEM faculty who serve as role models and academic leaders for URM students to learn from, work with, and emulate. Recent NSF reports indicate that URMs occupy 8% of STEM associate and full professors at all 4 year colleges and universities and about 6% of these positions at the nation's most research intensive institutions. URM women hold even smaller shares of these academic STEM positions; indeed, at many institutions the number of women of color STEM faculty is zero. Vanderbilt University, Fisk University, and Wake Forest University will collaborate to develop, study and refine a model to recruit, retain and advance recent URM STEM PhDs, including especially women of color, through an innovative postdoctoral fellowship and into tenured track positions. The project includes activities to transition postdoctoral fellows into faculty positions--a postdoc to faculty bridge program--to provide junior faculty with mentoring and to assist junior faculty in developing strong scholarly identities. The integrated research will include cross sectional surveys, three year longitudinal surveys and small group interviews to gain a better understanding of the processes facilitating the choices women and URMs make in their STEM careers. Variables to study include differences at the intersections of gender and race, social relationship influences, the academic professional culture and the institutional context. Vanderbilt and Fisk Universities will institutionalize the key model interventions, stage the model components for implementation, and Wake Forest University will disseminate the model to the more than 50 research organizations in the Collaborative to Advance Equity through Research. The National Academy of Science's Ford Foundation Diversity Fellows program will work with the alliance to identify and recruit promising postdoctoral fellows for project participation. The Anna Julia Cooper Center at Wake Forest will conduct scale up and dissemination activities for the alliance. Formative and summative evaluation work is being will be performed by an external evaluation team, via a subaward from Vanderbilt to the Institute for Broadening Participation. In the project's inaugural year, we have so far identified 12 initial candidates from over 75 applications, recruited via the National Academies Ford Fellows program and other national recruitment activities. The candidates along with their potential host laboratories will be participating in a four-day symposium in February to develop research projects and determine fit for the program. The launch of our AGEP project has already resulted in significant institutionalization, with Vanderbilt announcing the creation of the Academic Pathway Fellowship Program, which will sustain the activities piloted during this AGEP project.

Collaborative Research: AGEP Transformation Alliance: CIRTl AGEP - Improved Academic Climate for STEM Dissertators and Postdocs to Increase Interest in Faculty Careers

Boston University; Cornell University; Howard University; Iowa State University; Michigan State University; Northwestern University; University of Buffalo; University of Georgia; University of Maryland, College Park; University of Texas at Arlington

Our goals are to improve the climate in graduate education to increase the number of underrepresented graduate students and postdocs interested in and prepared for faculty careers. The nine universities in our alliance have jointly agreed on project outcomes and the metrics we will use for assessment, while allowing for natural variation in the interventions that each institution will implement locally. Our Networked Improvement Community will use cycles of improvement to evaluate outcomes against common metrics and adapt what works well at other locations within the partnership. We will also disseminate our outcomes and tested practices across the 43 CIRTl universities that produce 30% of the nation's STEM PhDs.

Our interventions are focused on faculty and postdocs who advise STEM graduate students as well as graduate peers who play a role in building and support inclusive communities. Participants in faculty/postdoc workshops will think through their own social identities, understand underrepresented graduate student experiences, as well as implicit bias and the impact things like microaggressions can have on student success within their own research groups. Faculty will also examine metrics of student success and work through systemic reasons for different outcomes that they can feasibly change. We will utilize design thinking workshops so that the faculty have full ownership of the changes implemented in their departments.

For graduate student peers, the workshops will lead students through an understanding of identity, underrepresented student experience, implicit bias, and microaggressions. Graduate students will then work through a few variations of leadership development workshops. Some universities in the network will hold design thinking workshops that have graduate students develop ongoing communities that support their peers, e.g., at the start of their post-candidacy. Other universities will conduct leadership programs that focus on graduate students developing inclusive teams in their careers. By evaluating outcomes against common metrics, these two options can be compared.

We will also form learning communities of underrepresented PhD students after their candidacy to enhance the transition towards the professoriate. The learning community will include career and professional development workshops, cohort building and peer mentoring.

The qualitative research component of this project will be centered upon three research questions:

- How do students describe initial and continuing engagement with the department and the discipline?
- What experiences and relationships are most influential in strengthening students' interest in faculty careers?

- How do peers and external supports influence the sense of community?

After each implementation cycle, the research team will conduct 4-5 focus groups at two institutions with students (3 focus groups with underrepresented students, 2 with majority students) and 3-4 focus groups at the same institutions with administrators, department leaders, and faculty members.

We will also analyze the data that is integrated within each improvement cycle. We will explore the extent to which a multilevel model can account for the data and which of the proposed drivers has the strongest impact on underrepresented student interest in faculty careers.

Collaborative Research: Northern Ohio AGEP-T: A Racially and Ethnically Inclusive Graduate Education Model in Biology, Chemistry and Engineering

Bowling Green State University; Case Western Reserve University; Cleveland State University; Kent State University; University of Akron; University of Toledo; Youngstown State University; Central State University; Tuskegee University

The Northern Ohio AGEP Alliance (NOA-AGEP) is striving to support the participation and success of underrepresented minority (URM) students in the STEM pipeline through to the professoriate with a multifaceted program that includes professional development for students and faculty. Funded in October 2015, NOA-AGEP is developing, implementing, and studying a model to improve URM student participation, preparation, and success in STEM graduate education while preparing them for entry into the professoriate. NOA-AGEP focuses exclusively on U.S. citizen URM graduate and undergraduate students in the fields of biological sciences, chemistry, and engineering. Activities for NOA-AGEP fall into four categories: Institutional Engagement, AGEP Scholar Professional Development, Social Science Research, and Evaluation.

Institutional Engagement applies campus- and Alliance-wide efforts through diversity education workshops for faculty, staff, and students (Diversity 360), a five-session faculty program promoting and recognizing good mentoring practices of URM graduate students (Mentor Fellows), best practices for URM recruitment pathways (AGEP Scholar Recruitment), and a tool and process to examine data and identify equity gaps for URM faculty, staff, and students (Diversity Scorecard).

AGEP Scholar Professional Development activities are cohesive supports designed for newly-matriculated URM PhD students (AGEP Scholars), including a weekend bridge experience for all AGEP Scholars (Summer Bridge Program), individualized guidance, support, and empowerment (Academic Coaching), a deep network of mentors spanning an academic career to increase retention and persistence in academia (Mentor Circles), conference networking and presentation skills training (NOA-AGEP Research Symposia), and opportunities for peer mentoring (Partnerships with HBCUs).

Social Science Research, led by Dr. Diana Bilimoria at Case Western Reserve University, seeks to understand the mechanisms that promote URM students' perceptions of inclusion and the extent to which the proportion of diversity (i.e. majority and minority dynamics) influence URM doctoral students' identity development across both demographic social identity and professional identity.

Evaluation, conducted by H&H Strategies, ensures that the processes and tools disseminated will be calibrated to increase the number of URM students prepared to take the next step in their pathway to the professoriate.

By developing, implementing, and studying the recruitment, retention, and graduation of URM PhD students in biology, chemistry, and engineering, NOA-AGEP will provide a useful model for other regions in the U.S. with historically low URM enrollment and success.

Collaborative Research: The Pacific Northwest Alliance to Develop, Implement and Study a STEM Graduate Education Model for American Indians and Native Alaskans

Washington State University; Montana State University; University of Idaho; University of Montana; Heritage University; Montana Tech; Northwest Indian College; Salish Kootenai College

American Indians and Alaska Natives (AI/AN) are the most underrepresented American demographic group in STEM graduate education and the professoriate, and their participation is not growing as rapidly as other underrepresented groups. The Pacific Northwest Alliance¹ (PNW-COSMOS) is an eight-institution alliance with the goal of increasing the participation of AI/AN students in STEM graduate education through the development, study and implementation of culturally congruent recruitment and mentoring strategies. The Alliance strives to apply the “Four R’s”—respect, relevance, reciprocity, and responsibility¹—in coordination of the grant and its activities. Annual summits provide an opportunity to showcase activities, a platform for student and faculty voices, and face-to-face interactions with the external advisory board and external evaluator. Annual assessment reports and informal feedback from the external evaluator provide guidance and developmental evaluation of the assumptions on which the program model is based; consultation with Salish Kootenai College, Northwest Indian College, and Heritage University assists in grounding Alliance activities on the needs of AI/AN students. Alliance news is disseminated by website, newsletter, and social media. Major Alliance activities highlighted in the poster are the Indigenous Mentoring Program and the Indigenous Knowledge Field Camp. The Alliance’s Social Science Research is presented separately. The Indigenous Mentoring Program (IMP) model was developed for faculty mentoring AI/AN students in recognition that AI/AN students are at different locations along an indigenous identity continuum; indigenous communities are culturally different; and participating institutions have different leadership structures and support services for indigenous STEM graduate students. Hence, the IMP model was developed with institutional, pedagogical, cultural, and disciplinary flexibility. The model consists of nine modules designed to provide information relating to mentoring, student resources, student socialization, cultural humility training, and culturally attuned practices for research conducted by AI/AN students. The IMP was piloted at Montana State University, Montana Tech, University of Montana, and Salish Kootenai College in 2016. Next steps include program refinement and assessment, and rollout to partner institutions in a train-the-trainer model. The Indigenous Knowledge Field Camp (IKFC) developed by the University of Idaho, provides a place-based, cultural-immersion experience for pairs of faculty mentors and student mentees to increase understanding of both Native and Western cultures. Participants collectively and individually reflect on and share their cultural perceptions and beliefs via a place-based, intensive camping and rafting field camp on traditional Nez Perce lands with the assistance of Nez Perce tribal scientists and educators. The underlying concept of the IKFC is that a transcultural understanding of Western science and Traditional Ecological Knowledge can be achieved through an intense immersion in the culture, knowledge, and resources of Native populations on Native land. The poster includes a snapshot of reflections by faculty and students who have participated in the IKFC.

1. Kirkness, V.J., Barnhardt, R. 1991. First Nations and Higher Education: The Four R’s—Respect, Relevance, Reciprocity, Responsibility. *Journal of American Indian Education* 30: 1-15.

Collaborative Research: The Pacific Northwest Alliance to Develop, Implement and Study a STEM Graduate Education Model for American Indians and Native Alaskans [PNW-COSMOS]—Social Science Research Project [SSRP]

Washington State University; Montana State University; University of Idaho; University of Montana; Heritage University; Montana Tech; Northwest Indian College; Salish Kootenai College

The goal of PNW-COSMOS is to increase participation of AI/AN students in STEM graduate education through the development, study and implementation of culturally congruent recruitment and mentoring strategies. The goal of the Social Science Research Project (SSRP) is to advance knowledge about what influences graduate student success in STEM disciplines. SSRP activities examine how culturally congruent approaches facilitate socialization. Cultural congruence is a key construct that recognizes that for learning and mentoring to be successful, they must take place in ways that are compatible with students' cultural backgrounds. Traditional approaches to graduate education can clash with student cultural ways of being, leading to potential dissonance and attrition. The SSRP is designed to explore the concepts and practices taking place in the PNW-COSMOS, not as a form of evaluation, but as a form of co-investigation to determine if and how cultural congruity contributes to effective mentoring, socialization, and student success. SSRP is examining how graduate students from different racial and ethnic groups perceive cultural congruity. Utilizing the Cultural Congruity Scale and the University Environment Scale (Gloria & Kurpius, 1996), an online survey was developed and administered to a sample of STEM graduate students at alliance member campuses with graduate programs and at peer institutions with a focus on diversity and student retention (Northern Arizona University, Oklahoma State University, University of South Dakota, University of California-Riverside, Kansas State University, University of Utah). To date there are 3,193 student responses from all ethnic and cultural backgrounds to determine within and between group differences. Analysis is in process. Descriptive statistics will provide aggregate information about characteristics of students in the study. Differences in cultural congruity experiences of AI/AN STEM graduate students compared to other STEM graduate students in other racial and ethnic groups will be estimated using Analysis of Variance models that hold constant differences based on the age and sex of the students. Another question being addressed is how cultural congruity benefits different aspects of student socialization and mentoring. Based on findings from the survey, we will identify six campuses for case studies to fully understand cultural congruity, socialization, and mentoring in context. Data collected will include individual and focus group interviews with faculty and students as well as document analysis and observation. Data will be analyzed using content analysis. Dissemination to the PNW-COSMOS team takes place throughout all stages of the SSRP. The SSRP outputs include a current literature review related to socialization and cultural congruity for AI/AN students and best practices for mentoring based on the literature; presentations (e.g., Association for the Study of Higher Education, American Educational Research Association); and publications (e.g., *The Department Chair*, book chapter) to national audiences.

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Collaborative Research: The Tuskegee Alliance to Develop, Implement and Study a Virtual Graduate Education Model for Underrepresented Minorities in STEM

Collaborative Research: AGEP-T: The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)

Tuskegee University; Alabama State University; Auburn University; Oakland University

This poster describes goals, programmatic interventions and outcomes of a **virtual** model for STEM doctoral education for URMs, established by the Tuskegee AGEP-T T-PAC Alliance and their preparation for careers in the STEM Professoriate. The Alliance consists of two Historically Black Colleges and Universities (HBCU), Tuskegee University and Alabama State University; and a Traditionally White Institution (TWI), Auburn University, located in Alabama.

T-PAC's virtual interventions provide comprehensive assistance to its 18 participating US Citizen URM STEM doctoral students (Scholars) as they progress through the doctoral pipeline. Interventions include: 1) Virtual tutorials on STEM graduate content; 2) Virtual tutorials to assist with the preparation of qualifying exams; 3) An **institutionalized** virtual graduate course "Literature Search and Technical Writing" to assist Scholars with technical writing needs; 4) An **institutionalized** virtual graduate course "Proposal Development" to assist Scholars with the writing of competitive proposals; and 5) Virtual teaching experiences. The T-PAC's virtual concept was suggested to us by our general graduate student body prior to the development of the T-PAC Alliance proposal. Eligible Scholars are also mentored to submit GRFP applications. Webinars on various topics of interest to Scholars are also given.

In addition to virtual efforts, our poster describes T-PAC professional development workshops that are offered to Scholars to provide resources to assist them in dealing with the rigors of graduate school such as management of stress, which is a common theme among the majority of URM graduate students. The workshops are also focused on creating awareness among Scholars of the Professoriate, including job responsibilities and its rewards.

The poster also highlights T-PAC's active dissemination efforts, including spearheading two refereed symposia at the 2015 and 2016 Understanding Interventions Conferences. T-PAC Alliance outcomes to-date are summarized, including in terms of Scholar progress as a result of immersion in T-PAC activities and its institutionalization efforts.

Collaborative Research: The Tuskegee Alliance to Develop, Implement and Study a Virtual Graduate Education Model for Underrepresented Minorities in STEM

Collaborative Research: AGEP-T: The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)

Tuskegee University; Alabama State University; Auburn University; Oakland University

The Tuskegee Alliance to Forge Pathways to Academic Careers (T-PAC) funded by the National Science Foundation (NSF) Alliances for Graduate Education and the Professoriate (AGEP) is a collaborative effort across three doctoral granting institutions that include, two Historically Black Colleges and Universities (HBCU), Tuskegee University (TU) and Alabama State University (ASU); a Traditionally White Institution (TWI), Auburn University (AU). The T-PAC Alliance is a uniquely designed virtual-based graduate education model designed to provide professional development opportunities and resources that prepare underrepresented minority (URM) or traditionally underrepresented students in STEM graduate programs for STEM faculty careers at institutions of higher education.

This poster provides an overview of the research findings for the T-PAC project. Quantitative data collection included multiple phases of data collection via online surveys. The research phase includes the academic self-concept scale (Reynolds, 1988) administered via Qualtrics to STEM graduate students across all three institutions. The academic self-concept scale consists of seven factors (e.g. grades and effort, study habits and organizational self-perception, peer evaluation, self-confidence in academics, satisfaction with school, self-doubt regarding ability, and self-evaluation with external factors).

Results indicate that all students' self-confidence in academics increased as they began conducting independent research, but URM students' were lower than non-URM students were in both the early and late stages of progress in their graduate studies. Moreover, URM students exhibited less positive self-evaluation based on external factors in the early stage of progress, but this self-evaluation increased in the latter stages. In addition, a second survey identified career choices after graduation as well as undergraduate and graduate experiences. Choice responses were analyzed with parametric statistics, using the whole sample, and then sub-dividing this sample by institution (HBCU vs. TWI), and URM status (URM vs. non-URM).

In general, students were more likely to choose non-academic vs academic careers. Reasons for pursuing academia were also included in the survey questions and regardless of ethnicity, students at the HBCUs were more likely to select academic careers due to a desire to mentor future generations than students at the TWI. In contrast, students at the TWI were more likely to state a desire to teach and conduct research as a reason to pursue academia than students at the HBCUs. URM students at all institutions had a view of academia more closely aligned with teaching responsibilities than non-URMs, whereas non-URMs had a broader view of academia that included teaching and research responsibilities than non-URMs.

Qualitative findings suggest that intrinsic motivation, support systems, advising, and undergraduate research experiences are factors impacting the graduate experience. Findings from this study are consistent with previous studies that identify intrinsic motivation, support systems, advising, relationship

and rapport with advisors, and an overall desire to succeed in STEM as instrumental to persistence. This NSF funded project gives voice to STEM URM graduate students that are U.S. citizens in STEM graduate programs providing perspectives on strategies for broadening their participation in STEM degree programs and encouraging their pursuit of STEM careers.

Completion and Attrition in AGEP and non-AGEP Institutions

Council of Graduate Schools

The goal of the original project is to: (1) estimate completion rates, attrition rates, median time-to-degree, and median time-to-attrition for underrepresented minority (URM) students, particularly those who are Black/African American, American Indian/Alaska Native, or Hispanic/Latino, in doctoral programs in science, technology, engineering, and mathematics (STEM) fields; and (2) elucidate factors that may contribute to the successful completion of the degree among URM STEM doctoral students. The project has also received a supplementary support to convene a forum to examine promising practices and advance the national discourse on facilitating transformative changes that result in a more diverse and inclusive professoriate and doctoral education enterprise in STEM fields.

Through partnership and active participations from the twenty-one institutions, the overarching objective of this project is to examine patterns of completion and attrition among underrepresented minorities in STEM doctoral programs across a diverse set of AGEP and non-AGEP institutions with a view to understanding the factors that promote successful completion and the policies and practices that hold promise in this regard. Also, the project will convene principal investigators and key project personnel of active AGEP grants in order to facilitate a forum to examine promising practices and advance the national discourse on facilitating transformative changes that result in a more diverse and inclusive professoriate and doctoral education enterprise in STEM fields, as well as to develop a network of AGEP grantees and NSF for sharing insights and lessons learned from their respective alliance activities, and for fostering a sense of community.

All twenty-one partnering institutions were responsible for collecting student-level enrollment data; assembling an inventory of policies, practices, and interventions; and implementing a student survey. CGS researchers also conducted focus group interviews with students and university personnel during site visits to sixteen of the twenty-one institutions to gather additional contexts. The resulting dataset, which is the largest of its kind, has been analyzed and studies by CGS researchers, and study results have been broadly shared in the graduate education community. In addition, the CGS project team will convene a meeting of principal investigators and key project personnel of active AGEP grants.

The project has resulted in the largest dataset of its kind that captures completion and attrition of URM students in STEM doctoral programs, and has calculated seven-year completion and attrition rates, ten-year completion and attrition rates, median time-to-degree, and median time-to-attrition. The study found that 44% of URM doctoral students who entered their STEM programs at the participating institutions between May 1992 and April 2005 earned their doctorates within seven years, while 36% of them withdrew from their doctoral programs, and 20% remained in the program. The resulting findings have been disseminated widely in the graduate education community via a CGS publication, webinar, and other means, and CGS researchers continue to advance research studies using the project data, which will result in several education research articles. Also, the project will result in a successful convening of principal investigators and other key project personnel of all active AGEP grantees.

Physics Bridge Program

American Physical Society

The American Physical Society Bridge Program (APS-BP) is an effort to increase the number of physics PhDs awarded to underrepresented minority (URM) students, in particular, African-American, Hispanic American, and Native-American students. APS- BP is creating sustainable transition programs and a national network of doctoral granting institutions to mentor students to successfully complete PhD programs. The objectives of the project are to 1) increase, within a decade, the fraction of physics PhDs awarded to underrepresented minority students to match the fraction of physics Bachelor's degrees granted to these groups, 2) Develop, evaluate, and document sustainable model bridging experiences that improve the access to and culture of graduate education for all students, with emphasis on those underrepresented in doctoral programs in physics, and 3) Promote and disseminate successful program components to the physics community.

Key activities associated with APS-BP include *URM Student Recruitment and Placement at Bridge, Partnership and Member Institutions, Bridge Student Progress Tracking, Designation of new Partnership and Member Institutions, offering the Partnership Institution 10K mini-grant, Research and Project Self-Assessment*, as well as *Organizing Annual Conferences for the Bridge and physics education community*.

The APS-BP currently funds six Bridge sites (The Ohio State University, Indiana University, California State University-Long Beach, Florida State University, University of Central Florida, and University of South Florida). APS-BP has also designated 27 physics departments as Bridge-like Partnership Institutions, which have demonstrated their commitment to improving diversity in physics through a rigorous vetting process.

Finally, APS-BP is developing a coalition of academic institutions that share a commitment to increasing educational opportunities for underrepresented minority physics students. These institutions are termed Member Institutions. This growing network of Partnership and Member Institutions allows for more applicants to be placed at supportive programs, while also establishing lasting relationships with faculty and administrators at these institutions.

Over the duration of the funding period, APS-BP student application numbers have increased, as have the numbers of students who are placed at Bridge affiliated institutions. For the 2016 cohort, 90 applications were submitted to the APS-BP program. Of this pool, 40 students were accepted into Bridge affiliated programs (Bridge, Partnership, and Member Institutions). Twenty-four students were placed at one of our 6 Bridge Sites, 10 were placed at our Partnership Sites, and 6 accepted offers from APS-BP Member Sites.

This number of placements has allowed us to not only meet, but also exceed our program goal of erasing the national achievement gap (In physics, the addition of only about 30 doctoral degrees each year will bring the fraction of URM students receiving the highest degree up to the same fraction of these student who receive Bachelor's degrees in the discipline). By placing an additional 40 students in the 4th year, APS-BP has now contributed a total of 106 students into the physics PhD pipeline.

SREB-AGEP Doctoral Scholars Program

Southern Regional Education Board

National Science Foundation (NSF) funding supports Alliances for Graduate Education and the Professoriate Program (AGEP), Doctoral Scholars Program (DSP) attendance of SREB-AGEP DSP scholars at the annual Compact for Faculty Diversity Institute on Teaching and Mentoring (Institute). The Institute is the largest gathering, with over 1,100 attending, of historically underrepresented minority Ph.D. scholars who are pursuing a career in academia. The Institute provides scholars with the knowledge, skills and support that increase their likelihood of success in graduate school and enhance their preparation for a career as a college or university faculty member. The Institute offers over 60 different workshops and plenary sessions on enhancing teaching skills, developing mentoring skills, building a network of scholars and providing recruiting opportunities. Over half of attending scholars are enrolled in STEM; 16 percent are in social and behavioral sciences; and 4 percent are enrolled in health professions — totaling three-fourths of all attendees. Over 80 percent of scholars attending the Institute are historically underrepresented minority Ph.D. students who represent more than 260 higher education institutions, 48 states, Puerto Rico and the District of Columbia.

The intellectual merit of the Doctoral Scholars Program is demonstrated by inclusion of the AGEP community in the Institute and provides AGEP scholars access to professional development, recruitment opportunities and skills attainment — all of which are not typically provided in most Ph.D. programs of study. The participation of AGEP scholars at the Institute has provided professional development experiences that address many problems that historically underrepresented minority Ph.D. scholars who are pursuing a career in academia encounter. Cultural disconnection, discrimination, lack of identifiable mentors, lack of minority faculty role models, isolation, and a lack of underrepresented peers in their department are some of the problems that underrepresented Ph.D. scholars encounter in graduate study that the Institute addresses.

The AGEP-DSP helps to achieve two broad goals: 1) provide AGEP scholars with the information, knowledge, skill attainment and professional support that enhance the likelihood of success in graduate school and eventually in earning a Ph.D.; and 2) provide professional development for AGEP scholars that enhances their preparation for a successful career as a productive faculty member in academia.

Through participating in the Institute, AGEP scholars are exposed to a larger body of historically underrepresented minority Ph.D. scholars who are pursuing a career in academia and can forge relationships that can result in future professional collaborations for research and academic study.

AGEP student from the following AGEP institutions attended the 2017 Institute that was held in Tampa, Florida: Alabama State University, Northwestern University, Prairie View A&M University, Purdue University, State University of New York at Stony Brook University, Texas A&M University- Corpus Christi, Texas A&M University – Kingsville, Texas A&M University – College Station, Tuskegee University, University of California – Los Angeles, University of Maryland Baltimore County, University of Maryland College Park, University of Maryland Eastern Shore, University of Michigan Ann Arbor, and West Texas A&M University.

The Michigan AGEP Alliance for Transformation (MAA): Mentoring and Community Building to Accelerate Successful Progression into the Professoriate

Transformational programming and student outcomes within the Michigan AGEP Alliance

Michigan Technological University; Wayne State University; University of Michigan; Michigan State University; Western Michigan University

The long-term vision and planned outcome of MAA is to increase the success of U.S. citizens who are underrepresented minority (URM) graduate students and postdoctoral scholars in all fields of STEM through graduate study, postdoctoral training and the professoriate. This vision is actively addressed by adapting to the needs of the five MAA campuses two existing models; one for fostering multidisciplinary learning communities with diverse students and the other for improving faculty mentoring of URM graduate students and postdoctoral fellows, to the needs of the five MAA campuses. The specific objectives pertinent to the transformational component of the project are:

Objective 1: Designing, adapting and implementing evidence-based mentoring initiatives, on all five campuses.

Objective 2: Designing, adapting and implementing evidence-based initiatives to promote interdisciplinary learning communities, on all five campuses.

Activities at each campus include:

- The MAA fosters multidisciplinary learning communities of graduate students and faculty members. Monthly meetings allow AGEP participants to create dialogues across disciplines through informal oral presentations about current research. The learning communities also provide opportunities to share key information regarding graduate school success and experience a social network that extends beyond the academic setting.
- Various alliance institutions have adapted the U of M MORE model to guide the generation of Individual Development Plans for students and postdocs. In doing so, each campus organizes a series of mentoring activities, including mentoring training opportunities for faculty.
- The MAA participants gather each Spring and Fall for MAA Conferences, hosted by one of the campuses, to build student networks and provide supportive activities, workshops, and other sessions for each stage of career planning and development. These meetings also provide a mechanism to disseminate the two models using a train-the-trainer strategy.

Outcomes:

The AGEP Communities represents high percentage of doctoral students within the MAA who are Black, Hispanic or American Indian US citizens. A high percentage of the graduate student participants complete an advanced degree. Many of our MAA alumni have successfully secured post-doctoral and academic-related positions.

The Michigan AGEP Alliance for Transformation (MAA): Mentoring and Community Building to Accelerate Successful Progression into the Professoriate

Race-related contextual experiences as influences on academic identity and STEM persistence among students from the Michigan AGEP Alliance

Michigan Technological University; Wayne State University; University of Michigan; Michigan State University; Western Michigan University

A primary focus of the Michigan AGEP Alliance's (MAA) research component was to learn about contextual experiences that affect underrepresented racial/ethnic minority students' disciplinary identity and persistence in STEM and to use information learned to support and enhance our Alliance programming around interdisciplinary learning communities and mentoring. To test questions from our conceptual model, we used multiple methods (longitudinal survey, semi-structured interviews) in which we gathered student-reported data on their contextual experiences of climate and mentoring, academic identity, cultural identity and supports, campus/programmatic resources and supports, and STEM motivation and persistence outcomes over a 2-year period. Our sample included URM and non-URM students across our Alliance institutions (N=507 and N=589, respectively). This poster presents example preliminary findings from multivariate analyses of students' quantitative survey data and thematic content analysis of their qualitative open-ended survey questions.

Analyses indicate URM students experienced less equity and inclusion within their departments/academic programs, compared to non-URM students in the same departments and programs. URM students reported significantly more micro-aggressions (interpersonal discrimination and incivility), more racial and socioeconomic discrimination, less equitable racial climate, fewer mentors of the same race, and were more likely to have to seek mentors outside of their departments. At the same time, URM students were more likely to report drawing support from their cultural background and from communities on campus outside of their department to help them succeed in their graduate studies, compared to non-URM students. Among URM students, experiences of identity-based stigma (e.g., negative racial climate, interpersonal micro-aggressions, unsupportive mentoring based in low expectations) were negatively associated with their academic identity (e.g., reported disciplinary centrality, self-efficacy, sense of belonging, intellectual engagement in program) and STEM persistence outcomes (e.g., reported academic challenges, intention to persist in STEM, and interest in faculty/university research careers). Some relationships between students' climate and mentoring variables with academic identity and career interest outcomes differed across pre-candidates and candidates, even when accounting for time/year in program, suggesting these experiences can have differential impacts on academic identity and career interests for earlier and later stage students.

Analyses also examined factors that promote academic identity and STEM persistence. Findings indicate that URM students' reported contextual support resources (e.g., quality mentoring relationship, inclusive program racial climate, same race mentors) and their individual/cultural assets (strong racial identity, culturally-based supports) can (a) enhance their academic identity and STEM persistence outcomes and (b) mitigate negative impacts of identity-based stigma experiences on academic identity and STEM persistence outcomes. Further, those research/survey participants reporting participation in AGEP campus programming also highlighted ways that AGEP supported their sense of community and professional skills and development. Taken together, our findings and our further exploration of variation in student experiences – including the ways that they draw support from individual and cultural assets as well as campus and programmatic resources to mitigate challenges in their department/program contexts - can help inform programming to enhance STEM success, degree completion, and faculty/research pipelines.

The Stony Brook-Brookhaven AGEP Frontiers of Research and Academic Models of Excellence (FRAME) Alliance for Transformation

Stony Brook University; Brookhaven National Laboratory

Interdisciplinary Consortium for Research and Educational Access in Science and Engineering (INCREASE) & Brookhaven Science Associates (Stony Brook University; Columbia University; Cornell University; Harvard University; Massachusetts Institute of Technology; Princeton University; Yale University)

The national AGEP program's success in growing the recruitment, enrollment and degree production for underrepresented minority (URM) students in Science, technology, engineering and math (STEM) fields did not translate into comparable growth in the representation of URM STEM PhD's in research faculty and senior leadership positions in higher education. URM STEM scholars continue to face significant barriers to their advancement into such roles, including reduced access to resources and fewer mentoring opportunities critical for such success. To address these issues, AGEP-T FRAME's programmatic efforts support URM-STEM dissertating graduate student and postdoctoral trainee participation in high impact research to improve research productivity, enhance professional preparation, and prepare trainees for careers in the Professoriate at the highest levels of research and teaching. AGEP-T FRAME leveraged the existing research partnership between Stony Brook University (SBU) and Brookhaven National Laboratory (BNL) to build a first of its kind, diversity partnership connecting the URM-STEM scholar communities across institutions to develop essential skills in seven key competency areas: 1) Discipline-specific conceptual knowledge; 2) Research development; 3) Communication; 4) Professionalism; 5) Leadership and management, 6) Responsible conduct of research; and 7) teaching. The outcomes of this alliance project include significant growth in the number of URM STEM postdoctoral trainees at both partner institutions, as well as strong career placement outcomes in research and tenure track positions for dissertating graduate student participants.

The Stony Brook-Brookhaven AGEP Frontiers of Research and Academic Models of Excellence (FRAME) Alliance for Transformation Social Science Research Project

Stony Brook University, Brookhaven National Laboratory

The AGEP-T FRAME social science research project examined two key psychosocial factors and their impact on STEM engagement and success of graduate students and postdocs: (1) the level and stability of **STEM self-efficacy** and (2) **STEM identity**. Specifically, this research explored the factors that contribute to how historically underrepresented minority (URM) graduate students (on the basis of race and gender) and postdocs develop and maintain high and stable levels of STEM self-efficacy (i.e., confidence in their ability to be successful in STEM) and STEM identity (i.e., investment and belonging in STEM). The research project utilized a mixed-methods, longitudinal design (repeated measure surveys over multiple time points) to assess stability and change in psychosocial constructs. The research findings confirm hypotheses that URM graduate students report lower STEM career identity than their non-URM peers. However, also as hypothesized, participation in AGEP-T programmatic activities predicted increased STEM efficacy among URM graduate students compared to their non-URM peers. Further, the findings demonstrate that increases in STEM efficacy predict positive changes in STEM career identity and sense of belonging in STEM among URM participants. The research project also investigated the role of graduate student **perceptions of environmental entity theory (PEET)**, i.e., the perception that their professors, peers, advisors in their STEM department believe that STEM success is achieved through natural ability and genius. Findings indicate that higher perceptions of environmental entity theory (PEET) among graduate students predicted higher perceptions of a sexist atmosphere within the department, feelings of impostorism (particularly among female graduate students), and lower STEM efficacy and sense of belonging. Further, lower levels of domain specific self-efficacy and sense of belonging in STEM field predicted a higher probability of considering dropping out of one's graduate program. Together, the findings from the social science research project demonstrate the importance of STEM identity, efficacy, advisor supportiveness and perceptions of a department culture that values inclusion for the academic and social belonging needs of underrepresented STEM scholars.