Integrating STEM Research and Teaching: Mentoring Students

Establishing and Maintaining a Research Agenda

Developing Effective Mentoring Relationships

Achieving Career–Life Balance

Planning for Career Success

Societal Role

FACULTY MEMBER

QEM MENTORING GUIDE

FOR

EARLY CAREER STEM FACULTY

AT HBCUS

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INTRODUCTION:

The Need for Effective Research Mentoring
of Early Career STEM Faculty at HBCUs

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Nearly 25 years ago, I embarked on my career as a Chemistry faculty member and researcher. Having graduated as one of only a handful of African American women in the United States to earn a doctorate in chemistry in the late 1980's, I knew that one of my life's goals would be to work to increase the number of underrepresented minorities and women in the Science, Technology, Engineering, and Mathematics (STEM) disciplines. As a graduate of two Historically Black Colleges and Universities (HBCUs), I realized that these institutions play a critical role in training underrepresented minorities in STEM and that I could make the greatest impact by joining the faculty of an HBCU. I also knew that there would be challenges in establishing a thriving research program at an HBCU, where the predominant mission is teaching. In developing my successful research and teaching career, I found that having mentors was critical. This was especially true at my HBCU, where there was an absence of a critical mass of colleagues for collaboration, and challenges in getting the time and resources needed to establish a thriving research agenda.

In my journey through the ranks of faculty to administrative positions as dean, provost, and now president of an HBCU, I can attest to the need for formal and informal mentoring to build a successful and fulfilling career. Also, serving as a mentor has been critical for me in achieving my goal of helping to advance the minority pipeline in STEM. The increasing demand for greater diversity among university faculty has placed the spotlight on the dearth of underrepresented minorities among the ranks of tenured faculty. Nowhere is this shortage more severe than in the STEM disciplines. If we are to increase the numbers of underrepresented minorities choosing STEM careers, we must develop guidelines that help early career faculty to be successful, while fulfilling their career and personal goals.

Five years ago, the Quality Education for Minorities (QEM) Network obtained a grant from the National Science Foundation (NSF) to conduct an educational research project aimed at determining what factors are critical in supporting early career STEM faculty at HBCUs in developing successful research and teaching careers. This *Research Mentoring Guide* is the culmination of the work emanating from the QEM Professional Development and Mentoring project and represents the experiences and expertise of those involved in this project as mentors and advisors. Their articles explore various best practices and provide valuable advice to beginning faculty, mentors and coaches, and university leadership on proven ways to advance and support early career STEM faculty. Topics cover commonly encountered issues that often present barriers to establishing successful research programs and,

consequently, to achieving promotion and tenure. The purpose of this *Research Mentoring Guide* is to enhance knowledge of the mentoring process and its importance to early career faculty at HBCUs, and to provide advice to senior faculty and administrators, as well as other stakeholders, including funding agencies, on their role in supporting career development for STEM faculty.

In his article, *HBCUs and the Societal Benefits of STEM*, Louis discusses the important role that HBCUs must play in diversifying the STEM workforce. His article cites NSF data showing that African Americans make up 12.2% of the population but only 5% of the STEM workforce. The essential role of diversity in STEM is reflected in the NSF 2014-2018 strategic plan, which states, "Diversity is a critical driver of excellence in research and innovation in STEM in the 21st century, as the future of science depends upon diversity of thought that will strengthen the scientific infrastructure." If HBCUs are to fulfill their critical role, they must find ways to support the development of early career faculty, who serve as role models for students seeking to follow in their footsteps to pursue careers in STEM.

"Mentoring and supporting early career faculty in STEM at HBCUs is critical to developing the pipeline and encouraging underrepresented minorities and women in STEM careers."

HBCUs often face challenges that make it difficult to provide the needed support for beginning STEM faculty. In his article, Kofi Bota discusses why it is important that early-career, tenure-track faculty understand the political climate of the university, including the governance structure and the different roles of the board, president, and faculty. It also is especially important to understand policies and procedures for processes including management of grants and contracts, tenure and promotion, accreditation, budget allocation, and a variety of other issues. "An early-career faculty member has a high stake in good governance and effective institutional policies, structures, and processes because his or her productive career at that institution will depend upon a stable, well-managed institution."

Brown's article focuses on the importance of planning for a successful academic career, defined as achieving tenured, full-professor status. Developing a knowledge-based, flexible career plan that includes a research plan, a teaching plan, a service plan, research funding and collaborations, and time management is critical. He says, "Even when you know your destination, you may still need … a PLAN that will help you get there". To be effective, a career plan "must evolve into an interactive dynamic, self-reflecting and self-evaluative document that is continually updated". Developing a successful approach to work-life balance is also necessary for a successful career in STEM. In her article, Johnson provides excellent advice to early career faculty, based on her personal experiences, on best practices in prioritizing work life and personal life.

A critical component of a successful career plan is developing an effective mentoring relationship early in one's career. The steps involved in developing that relationship are not always well defined, and there is no "one-size fits all" approach. In their article, Johnson and Grider lay out simple, straightforward advice to the early career faculty (mentee) as the primary driver in establishing and cultivating a mentoring network that builds on several types

of mentoring relationships spanning a variety of professional and personal needs. The authors suggest that the best way to get the most out of a mentoring relationship is to establish a formal general partnership agreement with defined parameters.

Hill, et al. further elaborate on the benefits, models, and functions of career and psychosocial mentoring as an "antidote to differential academic and professional outcomes" for underrepresented minorities (URMs) in STEM. They cite research to support the conclusion that not only do URM faculty have unequal access to mentoring, but that the efficacy of the mentoring experience for URM faculty may also be limited. Thus, for URMs, the model of multiple mentors or mentoring networks, including developmental networks and relationship constellations (i.e., social networks that encompass multiple relationships) may be most effective. The authors point to the need for more evidence-based studies of mentoring among URMs to establish best practices and inform programmatic interventions.

Establishing and maintaining a research agenda is a vital component of a successful career plan for early career faculty in STEM. Compared with STEM faculty at major research institutions, STEM faculty at HBCUs may find establishing a research agenda challenging. Factors contributing to this situation may include heavy teaching loads (often 12 credits per semester); excessive service obligations (including advising and committee service); inadequate research laboratories or lack of access to core facilities; absence of start-up packages; lack of peer/collaborating researchers; lack of access to postdocs, graduate research assistants, and/or technicians; inexperience or lack of support in grant proposal development; absence of mentors; and minimal financial support for conference travel, professional development, and publication. These factors are especially critical for early career faculty who need to establish a research plan early in order to position themselves for success in the tenure and promotion process.

> *"Establishing and maintaining a research agenda is a **vital component of a successful career plan** for early career faculty in STEM."*

Grider and Johnson discuss practical aspects of establishing a research program within the context of an HBCU. Steps such as acquiring research equipment, establishing collaborations, and writing research proposals can be facilitated through research mentoring relationships. In his article, Bililign addresses the challenge of integrating research and teaching, as one also focuses on training undergraduate students. At most HBCUs, teaching is the primary role of faculty. In order to effectively establish a research agenda, the research and teaching must be complementary and integrated. "Linkage of research and teaching makes university education distinctive; the most effective teachers are those engaged in research and scholarship that are able to transmit the excitement of science in the classroom." Balancing research, teaching, and service, while also developing students who have critical thinking and problem-solving skills requires an integrated approach and several models are explored.

This *Research Mentoring Guide* concludes with a case study demonstrating how the QEM approach to faculty productivity, as developed and implemented over the past five years, has been adapted to a small, comprehensive, HBCU with undergraduate and master's level

programs. McKayle and Engerman describe how the targeted interventions – faculty release time, provision of mentors, professional development workshops, access to experts, and access to scientific resources- have contributed to increased productivity in publications and funded grants. Advice for other HBCUs interested in adopting these interventions is also provided.

Mentoring and supporting early career faculty in STEM at HBCUs is critical to developing the pipeline and encouraging underrepresented minorities and women in STEM careers. By implementing targeted interventions and strategies for supporting research mentoring networks as presented in this *Research Mentoring Guide,* we can begin to address the dearth of minorities in STEM and develop the diversity so critical to our country's future.

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Juliette B. Bell is President of the University of Maryland Eastern Shore (UMES). Prior to joining UMES in 2012, Dr. Bell served as Provost and Vice President for Academic Affairs at Central State University in Ohio and as Provost and Vice Chancellor for Academic Affairs at Fayetteville State University in North Carolina. In these positions, Dr. Bell provided transformational leadership resulting in development, enhancement, and restructuring of academic colleges; new cutting-edge academic programs, on-line degree programs, international partnerships; and improved student success.

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Dr. Bell is a strong advocate for increasing the number of minority scientists and has dedicated much of her career to providing motivation and opportunities for students to participate in scientific research. At UMES, she continues to provide leadership to public, private, and governmental agencies, including the National Science Foundation, the American Association of Colleges and Universities, and currently serves as Chair of the Council of 1890 Universities.

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HBCUs and the Societal Benefits of STEM

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1.0   INTRODUCTION

The author of this article was not a mentor in the National Science Foundation (NSF)-supported Quality Education for Minorities (QEM) Network Professional Development and Mentoring (PDM) project, however, he has interacted with many junior faculty members from Historically Black Colleges and Universities (HBCUs), including as a consultant at various QEM faculty development workshops. The mentoring section of this article addresses four characteristics of the junior faculty (**JF**) that the author has observed; i) The majority of the JF wish to engage in STEM research. ii) Many have very heavy teaching loads relative to faculty at research one universities. iii) Many lack access to graduate students or postdocs with whom to conduct research at their home institutions. iv) Many lack the infrastructure to conduct the desired research at their home institutions. The major charge to the author was to discuss the role that HBCUs can play in realizing the societal benefits of Science, Technology, Engineering, and Mathematics (STEM). Thus, professional development and mentoring of junior faculty are addressed in this larger context, reflected in the title of this article.

2.0   GOAL AND OBJECTIVES OF THIS ARTICLE

The goal of this article is to discuss the PDM of JF at HBCUs in the context of the role that HBCUs[i] can play in providing the benefits of STEM to society. This will be achieved through five objectives, namely; i) To provide general guidelines and references for the PDM of JF, ii) To describe the HBCUs role in STEM research, iii) To describe the HBCUs role in STEM education, iv) To describe the HBCUs role in STEM outreach and engagement, and v) To relate these roles to ongoing initiatives in the various STEM fields and major organizations. Objective v) will be integrated into the discussion of objectives i) through iv).

3.0   GENERAL GUIDELINES FOR MENTORING OF JUNIOR FACULTY

There are many commendable references on advice for JF, Robert Boice's is among the most highly rated [ii]. Fewer references address the needs of JF from groups underrepresented in STEM[iii], and even fewer address the needs of STEM JF at HBCUs[iv]. This section summarizes the mentoring guidelines for STEM JF, with special notes for STEM JF at HBCUs where necessary. Since the National Science Foundation (NSF) is the premier source of funding for STEM research, the guidelines are presented in terms of the NSF Intellectual Merit and Broader Impacts criteria.

Merriam-Webster defines a mentor as *someone who teaches or gives help and advice to a less experienced and often younger person*. This is a close description of what a JF seeks in a mentor. However, before searching for a mentor, the JF should define his/her own career

goals and objectives. In general terms, the goal of a junior faculty (JF) may be stated as, "*to have a successful career.*" Success can entail reaching the highest levels in their field, either in research/teaching, administration, or a combination of both. This can be done in steps: i) Getting tenure and promotion to associate professor, ii) Getting promoted to full professor, and iii) Becoming a leader.

Tenure decisions are generally made on three criteria; **research, teaching, and service**. The JF should begin with a written copy of their school's promotion and tenure **(P&T) guidelines** that spell out how they will be evaluated on each of these criteria. Next the JF should find a mentor to help them interpret the P&T guidelines and navigate the path to tenure. The mentor should be someone the JF feels comfortable relating to as an **advisor, advocate, and senior associate**. The person should have the seniority to **influence** the factors that might affect the JF's progress, be someone who can keep the JF's personal information in **confidence**, and have the **competence** to evaluate the quality of the JF's work as it relates to the P&T criteria.

> *"Tenure decisions are generally made on three criteria; **research, teaching, and service.**"*

One person may not possess all of these attributes for the JF's research, teaching, and service. In that case, the JF may choose multiple mentors to meet these needs, as well as for guidance on managing the JF's work-life balance. In addition to the senior mentor, the JF may find support from peer mentors at their institution and/or across other institutions. This group can provide support and share insights into resolving challenges that arise on the road to tenure and promotion.

The major components of research productivity are external grants (funding), and publication. For STEM the premier source of funding is the NSF, which has several programs that address the needs of HBCU junior faculty who may lack the infrastructure, equipment, or personnel to conduct research at their home institution. These include the **HBCU-UP/Research Initiation Award** program[v], **EPSCoR**[vi] and others. Publication includes peer reviewed journal papers and conference proceedings, as well as book chapters and transaction papers. The P&T guidelines and the mentor will provide a clear explanation of the number, impact factor, and citation count requirements for evaluating publications. End-of-semester student evaluations are generally a large part of the JF's teaching assessment. The JF should get help from their Teaching Resources Center to assess and evaluate the JF's teaching. Additionally, the JF may ask an experienced and popular teacher for help.

Service includes work on department, school, and university committees, as well as professional service. The latter includes officer positions in professional societies as well as membership on the editorial board of journals and on professional conference organizing committees. Service on proposal review panels at NSF, the National Institutes of Health (NIH), the Office of Naval Research (ONR) and others federal agencies are another valuable form of service that also gives the JF access to program officers.

JF women and underrepresented STEM faculty at predominantly white institutions should beware of excessive invitations to serve on committees as the token minority. This can add up to an unfair overburden that distracts from the other activities necessary to advance

their careers. The mentor can help shield the JF from these requests.[vii] More details on strategies for successful research, teaching, and service are provided in references on advice to junior faculty[viii]. These include guidelines for promotion to full professor and selection of a path to academic leadership.

Like any relationship it takes dedication to make mentoring work. The key requirements are: **preparation, consistency, responsiveness, and appreciation**. The JF and advisor should prepare for each meeting. This includes making an agenda of items to be discussed and submitting the necessary materials to be reviewed before the meeting occurs. Consistency refers to setting a regular schedule and location for meetings with the mentor. Responsiveness refers to timely response to mentor requests, including drafts of proposals or papers or copies of lesson plans for review. Appreciation refers to the JF's acknowledgment of help provided by the mentor. The JF should also be aware of his/her responsibility to mentor others, including their peers and students under their supervision. Ultimately the JF's career is their responsibility. The mentor can help, but success depends on the work of the JF.

4.0   STEM BENEFITS TO SOCIETY

STEM has made major contributions to every aspect of human and economic development. The Brookings Advanced Industries Project reports, "*As of 2013, the nation's 50 advanced industries employed 12.3 million U.S. workers. U.S. advanced industries produce $2.7 trillion in value added annually—17 percent of all U.S. gross domestic product (GDP).*"[ix] For much of the 20th century the US was the world's leader in STEM, but by the end of the century US global leadership in STEM began to slide[x]. NSF reports, "*since 2001, the share of the world's R&D performed in the U.S. has decreased, from 37% to 30%, while in this same time period, the share of worldwide R&D performed by Asian countries grew from 25% to 34%.*" In recent international rankings American students scored 17th in Science achievement and 25th in Math ability out of 65 countries[xi].

Furthermore, the U.S. fails to capitalize on the relative advantage that its broad racial and ethnic diversity affords in the global STEM enterprise. Table 1 summarizes the distribution of groups in the general US population and their respective representation in the STEM workforce in 2010. Additionally, 35% of STEM professionals with a disability are either unemployed or out of the workforce [xii].

Table 1. Representation by Gender and Race in STEM in the U.S. (2010)[12]

	Female %		Male %	
	U.S. Population	In STEM	U.S. Population	In STEM
White	32.3	18	31.3	51
Asian	2.5	5	2.2	13
Black	6.4	2	5.8	3
Hispanic	8.1	2	8.3	4
Other	1.6	1	1.5	1
TOTAL	**50.9**	**28**	**49.1**	**72**

> *"Full representation of all of America's STEM talent is a competitive advantage to enrich this diversity of thoughts and approaches, and thus advance science and engineering knowledge and the wellbeing of the Nation."*

The National Science Foundation highlights the importance of diversity in STEM in its 2014-2018 strategic plan for the NSF INCLUDES program by stating, "*Diversity is a critical driver of excellence in research and innovation in STEM in the 21st century, as the future of science depends upon diversity of thought that will strengthen the scientific infrastructure. Full representation of all of America's STEM talent is a competitive advantage to enrich this diversity of thoughts and approaches, and thus advance science and engineering knowledge and the wellbeing of the Nation.*"[xiii] Thus HBCUs are in a uniquely advantageous position to contribute to the advancement of knowledge and the training of the next generation of STEM practitioners.

5.0   STEM RESEARCH

STEM research can be classified as basic and applied. Basic research is largely supported by government funds from agencies like the National Science Foundation,[xiv] and its **intellectual merit** may also include significant benefits to society. HBCUs have a direct role to play in STEM research through the work of their faculty and students at their own facilities, and in the cases where they do not have the necessary facilities, in partnership with other universities and government research labs where the resources exist. In addition, they can achieve a **broader impact** by training the next generation of STEM researchers from their institutions. The **Department of Energy** is a good example of opportunities for HBCUs collaboration with federally sponsored research labs[xv].

6.0   STEM EDUCATION

STEM education may also be broken into two categories. The first is STEM education research, which includes curriculum, pedagogy, evaluation and assessment of teaching effectiveness, and methods to facilitate diversity in STEM. Research contributes to the intellectual merit of STEM education. The second category of STEM education is the actual teaching of STEM. This encompasses the broader impacts of STEM education as it involves training the next generation of STEM practitioners, including public and private sector scientists and engineers, K-12 teachers and university faculty, and research professionals. HBCUs can pursue STEM education research into innovative curricula and pedagogies that attract, retain, and excite underrepresented minority (URM) students for STEM careers. Furthermore, HBCUs can help to foster integrated diversity [1] by partnering with predominantly white serving institutions (PWSIs) in research, faculty and student exchanges, and in shared courses and projects across universities. **NSF's LSAMP**[xvi] and **ADVANCE**

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[1] Integrated diversity occurs when a diverse group of members work together in direct contact with each other. Segregated diversity occurs when different racial, ethic, gender, physical ability, and/or socio-economic groups work as separate clusters without direct interaction with each other. In this case, STEM may appear diverse by the numbers, but truly collaborative diversity in STEM, that is the aim of NSF and the larger STEM community, would not be occurring.

programs in particular foster such collaborations. Additionally, HBCUs can partner with the private sector, government agencies, and civil society organizations for research and education opportunities. These include formal research partnerships, such as **NSF's Industry-University Cooperative Research Centers Program**[xvii] (IUCRC), **NASA's** summer faculty and student research programs[xviii], **The Science Policy Internship Programs for Students at the OSTP** in the White House[xix], and corporate or NGO internships.

7.0   STEM OUTREACH AND ENGAGEMENT

STEM outreach and engagement broadens the impact of STEM's benefits to society. Outreach can be thought of as; "**priming the pipeline**," which involves outreach to K-12 education; "**maintaining the flow**," which involves the recruitment and retention of STEM students, and "**continued connection**," which involves keeping graduates connected to STEM careers. Engagement refers to involving the general public in the understanding, support for, and participation in all phases of the STEM enterprise.

7.1   Priming the pipeline: Consists of outreach to K-12 to instill a love for STEM in the students' formative years. It can include Fairs such as the **White House Science Fair,**[xx] STEM Summer Camps at the University, and focused engagement for K-12 teachers on campus, e.g., through the NSF **Research Experiences for Teachers** program.[xxi]

7.2   Maintaining the flow: Involves recruiting students to STEM from K-12 schools and community colleges and retaining them in STEM through graduation. This is a natural continuation of K-12 outreach mentioned above. It can include community colleges through shared activities in student groups like **Engineers Without Borders**. NSF's **Empowering All Youth for STEM** program encourages universities to engage in K-12 outreach and the **President and First Lady's Call to Action on College Opportunity** stresses the need for K-16 partnerships to increase the number of college graduates in STEM fields[xxii]. It also includes effective pre-college preparation, and mentoring programs from post-admission through graduation to assure students' successes[xxiii].

7.3   Continued connection: Entails working with students *before they graduate* to support their pursuit of graduate education or careers in STEM fields. **NSF's Alliances for Graduate Education and the Professoriate** (AGEP)[xxiv], and the **Graduate Research Fellowship** programs are two examples that provide funding for graduate study.

7.4   Engagement: Engages the public to communicate the activities and benefits of STEM in a manner that stimulates their interest, encourages related discourse, and ultimately leads to better understanding of, support for, and greater participation in the STEM enterprise. The OSTP memorandum to Agencies of the Federal Government calls for **Citizen Science and Crowdsourcing** to help address societal and scientific challenges[xxv].

Junior Faculty **(JF)** at HBCUs can engage their institutions in all of these activities. They can do this with support from NSF, particularly through its new **NSF INCLUDES** initiative, with Corporations, other Government Agencies, as well as with Private Foundations and Civil Society Organizations.

8.0   STEM INTERNATIONAL

International engagements also provide avenues for HBCUs to contribute to the societal benefits of STEM. However, minority students participate at much lower rates than white students in study abroad programs[xxvi]. JF at HBCUs can partner with faculty at foreign universities on research through programs like **NSF's Partnerships for International Research and Education** (PIRE) [xxvii] and **USAID's Partnerships for Enhanced Engagement in Research** (PEER), administered by the National Academi of Science[xxviii]. HBCUs may also offer opportunities for students to study abroad in courses that carry credit toward their major, and to participate in research and service abroad**. NSF's Research Experience for Undergraduates** (REU)[xxix] program supports several of these activities through supplements to existing grants.

9.0   WOMEN IN STEM

Women are underrepresented in most STEM fields, and most significantly in Engineering and Computer Science. The research, education, and outreach initiatives described above all have direct relevance to women. However, the underrepresentation and different needs of women in STEM, and STEM diversity initiatives, may be masked by the lumping of men and women into aggregate URM racial and ethnic groups as well as groups with disabilities. STEM fields with greater impact on society and social well-being, such as Psychology, Chemical and Biological Engineering attract a greater percentage of women[xxx]. Other factors apply to both men and women from URMs, but must be tailored to the needs of women. These include **STEM organizational structures** - physical, psychological, and interpersonal - that require women to fit a male-oriented organizational structure rather than changing the structure to be equally inclusive of women.

Implicit bias is another factor by which girls and women are viewed as less capable or competent in STEM fields by teachers, professors, and supervisors who have the power to influence their educational and career choices. The importance of peer mentoring, role models, and accommodations for women to **balance motherhood and careers** are also important concerns to consider for true inclusion of women and girls in STEM integrated diversity initiatives[xxxi]. HBCUs must make these gendered differentiations in their role as leading contributors to diversity in the intellectual merit and broader impacts of STEM.

10.0   CONCLUSION

STEM is vital for our continued economic and social development. However only 16% of students are pursuing STEM education in the U.S. The US' racial and ethnic diversity is an advantage in the global STEM enterprise, but it is severely underutilized, as racial and ethnic minorities, women, and people with disabilities remain underrepresented in STEM. HBCUs can help to diversify the STEM enterprise and its benefits to society. This will be driven by HBCUs JF who successfully rise through the ranks of academy to become leaders in their fields**. Mentorship is key to the success of junior faculty (JF) in general**, and crucial for faculty at HBCUs, whom may face higher teaching loads and less institutional resources than their peers at non-HBCU institutions — crucial as they strive to advance in their respective fields, and extend the benefits of STEM to society in the process.

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Understanding Institutional Structures, Policies, and Processes

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ABSTRACT

*This article reviews the principles and processes related to the three-legged stool of governance in higher education institutions: roles and responsibilities of boards of trustees, the president, and the faculty. It urges an early career faculty member to be conversant not only with those governance principles but also with the institutional structures, policies, and processes articulated in the **Faculty** and **Student Handbooks**. It is equally important for the early career faculty member to know about the **Principles** of institutional accreditation and compliance with the **Comprehensive Standards** of the regional accrediting body, and implementation of the institutional continuous improvement **Quality Enhancement Plan** or similar plans that address institutional effectiveness in achieving its mission, goals and objectives, and student learning outcomes. Early career, tenure-track faculty members in engineering should also be familiar with the **Accreditation Board for Engineering and Technology (ABET)** Engineering Accreditation Commission criteria for bachelor's and master's degree programs in engineering. The early career, tenure-track faculty member should pay particular attention to areas such as policies and procedures for the management of external grants and contracts, strategies for meritorious student teaching and learning outcomes and career-life balance, and institutional policies on sexual assault and harassment.*

An early career, tenure-track faculty member has a high stake in good governance and effective institutional policies, structures, and processes because his or her productive career at a given institution will depend upon a stable, well-managed institution. In a 2013 article, *Leading the University: the Roles of Trustees, Presidents, and Faculty*, Legon, Lombardi, and Rhoades describe how those roles can be effectively played and how they can go wrong [1]. Many countries in Europe, Asia, and South America want to emulate the American higher education model and have great interest in the governance structure and processes in U.S. colleges and universities.

In his lectures abroad as President of the Association of Governing Boards (AGB) of Universities and Colleges, Legon touts the virtues of the American higher education model; however, while still excellent in many ways, Legon *et al* acknowledge that there are new challenges facing American colleges and universities. Among these challenges, which all the institutional stakeholders should be aware of, are: (1) increased government regulatory

oversight [2-4]; (2) shrinking financial resources [5]; (3) concerns about the value of higher education [6]; (4) the viability of the American higher education teaching and learning model [7, 8]; and (5) demands by students for higher education at a reasonable price [9-11]. Christensen, Horn, and Johnson in their best-selling book, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* [12], Arum and Roksa in their book, *Academically Adrift: Limited Learning on College Campuses* [13] and others [14-17] have described similar challenges.

To exercise their fiduciary authority to meet the new challenges in higher education, Legon *et al* recommend that **boards of trustees** operate with transparency and cultivate a culture of inquiry, while not intruding into institutional management and faculty prerogatives. They urge boards of trustees not to be satisfied by reports solely driven by the president and the central administration; and not to limit their interactions with their institutions only through regularly scheduled meetings with the president but also to participate in events with faculty and students. Early career, tenure-track faculty who appreciate the appropriate role of the board of trustees can participate meaningfully in discussions about expectations and roles of faculty members. Unlike faculty members of yesteryear, an early career, tenure-track faculty member of today cannot be oblivious to the currents shaping the landscape of higher education that are likely to inform how he or she is evaluated during the tenure review process.

Historically, the most authoritative source on **shared governance** in higher education institutions has been the *Policy Documents and Reports of the American Association of University Professors (AAUP)* [18]. In 1966, the AAUP, the American Council on Education, and the AGB jointly issued the *Statement on Government of Colleges and Universities* [19]. From its inception in 1915, shared governance has been a central theme that has informed the deliberations of the AAUP regarding higher education policies and procedures in areas such as academic freedom, tenure, and due process; faculty status and evaluation; faculty workload; intellectual property; and collective bargaining. The AAUP's occasional sanctions of some colleges and universities have emanated often from what it believes are serious or egregious violations of the principles inherent in the *Statement on Government of Colleges and Universities* and the associated policies and procedures.

The overview by Legon *et al* describes contemporary challenges that a board of trustees—as the final institutional authority—should address. The AAUP principles also recognize that the board of trustees:

> *Plays a central role in relating the likely needs of the future to predictable resources; it has the responsibility for husbanding the endowment; it is responsible for obtaining needed capital and operating funds; and in the broadest sense of the term it should pay attention to personnel policy. In order to fulfill these duties, the board should be aided by, and may insist upon, the development of long-range planning by the administration and faculty* [19].

The second leg in the **three-legged stool of higher education governance** is the president, who, as the chief executive and planning officer, should be evaluated primarily for his or her overall institutional leadership. The president must have the vision and ability to see

new horizons and to persuade the stakeholders of the institution, including the alumni, to work toward achieving his or her vision. Such attributes will determine the effectiveness and influence of the institution in the larger community. Recognizing **the president's role** and responsibilities for planning, organizing, directing, and representing the institution, the AAUP further states, *inter alia*, that:

> *The president must at times, with or without support, infuse new life into a department; relatedly, the president may at times be required, working within the concept of tenure, to solve problems of obsolescence. The president will necessarily utilize the judgments of the faculty but may also, in the interest of academic standards, seek outside evaluations by scholars of acknowledged competence. It is the duty of the president to see to it that the standards and procedures in operational use within the college or university conform to the policy established by the governing board and to the standards of sound academic practice. It is also incumbent on the president to ensure that faculty views, including dissenting views, are presented to the board in those areas and on those issues where responsibilities are shared. The president is largely responsible for the maintenance of institutional resources and the creation of new resources.*

The **role of the faculty** obviously is central in the teaching of and learning by students, as well as research and service. That role imbues the faculty with primary responsibilities in curriculum, subject matter, methods of instruction, and areas of student life related to instruction. The AAUP governance principles, *inter alia*, state that:

> *The faculty sets the requirements for the degrees offered, determines when the requirements have been met, and authorizes the president and board to grant the degrees thus achieved. Faculty status and related matters are primarily a faculty responsibility; this area includes appointments, reappointments, decisions not to reappoint, promotions, the granting of tenure, and dismissal. The primary responsibility of the faculty for such matters is based upon the fact that its judgment is central to general educational policy.*

> *Furthermore, scholars in a particular field or activity have the chief competence for judging the work of their colleagues; in such competence it is implicit that responsibility exists for both adverse and favorable judgments. Likewise, there is the more general competence of experienced faculty personnel committees having a broader charge. Determinations in these matters should first be by faculty action through established procedures, reviewed by the chief academic officers with the concurrence of the board* [19].

A literature review of **faculty involvement in institutional governance** was conducted by Jones [20]. It showed that 80% of faculty at doctoral, master's, and baccalaureate institutions believe that shared governance is an important part of their institution's values and identity. In a study of over 2,000 faculty, faculty senate chairs, and academic vice presidents, Minor found that 77% of them believed that shared governance was an important part of their institution's identity [21]. However, in another study by Minor, focused on Historically Black Colleges and Universities (HBCUs), over 75% of their faculty

did not see faculty governance as an important issue [22], which has been ascribed to their "*deep commitment to teaching and students that negatively affect the ability and desire to participate effectively in governance.*" However, only 43% of faculty senates and 50% of faculty at 4-year public institutions agree that faculty members are sufficiently involved in campus decision making [23-24]. Insufficient rewards and incentives exist for faculty to participate in governance.

While the AAUP principles on governance are a good framework for early career, tenure-track faculty to understand the role of the faculty in college and university governance, the best source of understanding the internal workings of one's institution is the ***Faculty Handbook.*** Many early career faculty members tend to focus primarily on the provisions of the Handbook pertaining to promotion and tenure. However, it behooves them to thoroughly review all aspects of the Handbook, such as the central administrative structure, especially:

> *"... to understand the role of the faculty in college and university governance, the best source of understanding the internal workings of one's institution is the **Faculty Handbook**."*
>
> *…*
>
> *"An early career faculty member should also be conversant with the sections of his or her institution's **Student Handbook** … "*

- The role and responsibilities of the provost and vice president for academic affairs and the deans;

- The role and responsibilities of the vice president for research (if there is one);

- The internal governance structure regarding the faculty senate or assembly and its various committees;

- Annual faculty evaluations;

- Employment policies and procedures and types and terms of faculty appointments and working conditions;

- Faculty obligations, especially regarding students' rights, academic freedom, and code of ethics;

- Opportunities for professional development, career advancement, and mentoring initiatives;

- Grievance procedures involving faculty, staff, or students;

- Institutional policies on career-life balance; and

- Promotion policies and procedures, and third year reviews.

An early career faculty member should also be conversant with the sections of his or her institution's ***Student Handbook*** that are relevant to interacting with students in the research, teaching, and outreach activities such as:

- Administrative Termination of Students

- Compliance with the *American with Disabilities Act (ADA)*

- Constitution of the Student Government Association

- Disorderly Conduct Policy and Procedures

- Drug-Free Policy

- Financial Aid Policy and Processes

- Fraternities, Sororities, Professional and Social Fellowship Organizations Policies
- Health Services
- Institutional Sexual Assault and Harassment Policies and Procedures
- Intercollegiate Athletics Policies on Classroom Attendance and Grading
- International Student Services
- Official Absence Excuses for Students
- Policy on Peaceful Assembly
- Smoking Policy
- Student Code of Conduct
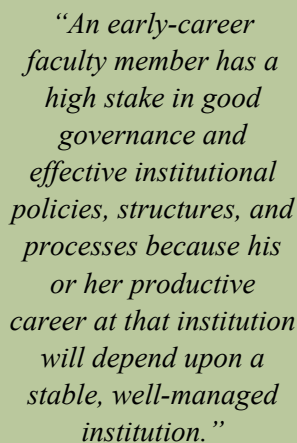- The *Family Educational Rights and Privacy Act*

Externally-funded research and development grants and contracts are obviously important for science, engineering, and mathematics faculty members' professional productivity requisite to attaining promotion and tenure. Thus, an early-career faculty member should frequently interact with the staff of the offices of sponsored programs and grants management regarding proposal submission and post-grant award procedures. Many faculty members tend to wait until the proposal preparation crunch time before contacting the office of sponsored programs and understanding the internal proposal review processes and procedures, often resulting in inadequately prepared proposals, or worse, late submission of proposals, which are then rejected by the cognizant funding agency.

Collegial relationships with the departmental chairs of science, engineering, and mathematics are essential. In engineering schools, good interactions with the dean are highly advisable. The natural sciences and mathematics departments tend to be more decentralized than schools or colleges of engineering and cordial interactions with the chair may be more paramount. However, it is good for the dean of science (or arts and sciences) to be aware of the early career faculty member's meritorious performance in scholastic, teaching, and outreach activities way before the tenure and promotion review. Early career tenure-track faculty members may be so engrossed in their research activities that they tend to ignore meetings called by the dean. Such behavior is not only professionally discourteous but may unnecessarily offend the dean.

An early career, tenure-track faculty member should also be familiar with the *Principles of Accreditation* of the regional body—approved by the U.S. Department of Education—for the accreditation of degree-granting higher education institutions in his or her region. For institutions in the Southern states, the accrediting body is the *Southern Association of Colleges and Schools (SACS) Commission on Colleges* [25]. The mission of all such regional accreditors is "*the enhancement of educational quality throughout its region and the improvement of the effectiveness of institutions by ensuring that they meet standards established by the higher education community that address the needs of society and students.*"

Every ten years, each regional accreditor conducts a reaffirmation review of a member institution for compliance with a set of *Principles*: the Principle of Integrity; the Core Requirements; the Comprehensive Standards; additional Federal Government Requirements; and specific policies of the Commission on Colleges. The heart of this review, in most cases conducted over two years, is a collective analysis by the institution's internal constituencies involving administrative officers, staff, faculty, students, and trustees. Most faculty members think that reaccreditation is driven primarily by the institution's financial health or deficits since the latter are often reported by the news media, especially for HBCUs and other financially struggling institutions. However, governance issues and poor quality of academic programs have also resulted in an institution being put on probation or having its accreditation revoked by the regional accrediting body. Revocation of institutional accreditation will cause students to lose their federal financial aid such as Pell Grants, as well as their eligibility for federal student loans.

The institutional internal accreditation review process tends to be dominated by experienced and senior faculty and staff, who are often selected by the president and his or her senior administrators, with little involvement by junior faculty. However, in addition to compliance with the *Principles*, an increasingly important component of the reaccreditation review is the institution's continuous improvement *Quality Enhancement Plan* (QEP), in the case of SACS. A new, tenure-track faculty member should review in-depth the QEP—or similar plans required by other regional accrediting bodies—because of their relevance as a framework for teaching of and learning by students.

"An early-career faculty member has a high stake in good governance and effective institutional policies, structures, and processes because his or her productive career at that institution will depend upon a stable, well-managed institution."

The QEP encompasses key issues emerging from institutional assessment; learning outcomes as well as the environment supporting student learning; accomplishing the mission of the institution; institutional capability for the initiation, implementation, and completion of the QEP; broad-based involvement of institutional constituencies in the development and proposed implementation of the QEP; and goals and plans to assess achievement of those plans. Early career, tenure-track faculty members should be committed to achieving the student learning outcomes of the QEP. Such a commitment will enhance their teaching effectiveness, which is an important consideration in the promotion and tenure review.

Another external accrediting body that conducts periodic review of programs in engineering and computing are the *Accreditation Board for Engineering and Technology (ABET)* Engineering and Computing Accreditation Commissions [26]. The criteria for accrediting engineering and computing programs cover baccalaureate and master's degrees, and specific degree program areas. An institution that wants ABET accreditation for its bachelor's degree programs in engineering and computing must satisfy general criteria in student performance and outcomes, educational objectives, continuous improvement, curriculum, faculty, facilities, and institutional support.

In addition to satisfying the bachelor's criteria, ABET-accredited master's level programs must satisfy criteria appropriate to the specialization area and one academic year beyond the bachelor's degree level. Graduates in master's specialization areas must also have an ability to apply their knowledge in specialized areas of engineering and computing. Many industrial companies will not recruit graduates of engineering bachelor's and master's degree programs that are not ABET-accredited.

Degree programs in the natural sciences and mathematics (excluding computer science by ABET) do not undergo an accreditation process similar to that by ABET. However, the American Chemical Society (ACS) has an ACS-certified bachelor's undergraduate professional education in chemistry. The requirements for this ACS certification significantly exceed those of the normal bachelor's degree in chemistry [27].

SUMMARY/RECOMMENDATIONS

An early career, tenure-track faculty member should not be oblivious to the currents shaping the landscape of higher education that will inform how he or she is evaluated during the tenure review. At a minimum, attention should be paid to the following:

- The early career, tenure-track faculty member should understand the internal organizational policies, governance structures and procedures at his or her institution, especially those pertaining to the management of external grants and contracts and strategies for meritorious student teaching and learning outcomes and career-life balance.

- Effective teaching and research productivity will likely have equal weight in promotion and tenure reviews.

- An early career, tenure-track faculty member should not get too involved in committee activities that will take too much time from research. However, participating in judiciously selected departmental or school QEP review committees pertaining to the institutional accreditation or ABET accreditation will augur well for his or her standing with the dean, provost and vice president for academic affairs, and president who will make his or her tenure decisions. It will also inculcate leadership skills for future professional endeavors.

- Administrative Termination of Students Policy

- Family Educational Rights and Privacy Act

- Policies on Sexual Assault and Harassment of Faculty, Staff, and Students

- Student Code of Conduct Policy and Procedures

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Figure 1.   QEM HBCU-UP Education Research Project's Professional Development and Mentoring (PDM) Program

CAREER ADVANCEMENT PLAN (CAP) TEMPLATE

GOALS *What do I want/plan to achieve?*	OBJECTIVE(S) *What do I need to do to realize this goal?* *(Must be specific/ attainable/measurable)*	ACTIVITIES *Methodology – What specific activities will I undertake to achieve each objective listed?*	SKILLS/ RESOURCES NEEDED	TIMELINE *When will I start/complete each of the activities listed?*
GOAL I: **Promotion to Associate Professor**				
GOAL II: **Achievement of Tenure at Associate/Full Professor Level**				
Goal III: **Scholarly Productivity** **(e.g., proposals; research papers; presentations)**				
Goal IV: **Mentoring/ Professional Development of Students**				

CAREER PLANNING FOR ACADEMIC SUCCESS

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You arrive on campus and get settled in your office for your first semester as a newly hired tenure track assistant professor. You had previously agreed to your teaching assignments for the semester and have had the opportunity to see your assigned laboratory space for your research. You learn that you inherited this lab space from a senior professor in the department who recently retired. The thrill, excitement and, yes, even dreams associated with your new position are tempered by anxiety over challenges associated with the realities of what it will take to achieve those dreams.

As you reflect on the start of your new career, you know that, in simple terms, academic success for you will be defined by obtaining tenure and promotion to associate professor, and then to full professor. To achieve this success will mean that you will have to excel as a teacher and as a researcher, while providing excellent service to your university, your profession, your community and to society. The retired professor whose laboratory you inherited worked 40 years in a rewarding, productive, and highly successful career. Your dreams and aspirations are to do the same. As Douglas H. Everett said *"There are some people who live in a dream world, and there are some who face reality; and then there are those who turn one into the other."*[1] Your goal is to turn your dreams into reality. However, the big question that you must consider is how will this be achieved? Developing a plan should be your first step.

Why Plan?

Your initial goal is to obtain tenure and promotion to associate professor. Proceeding without a strategic plan to reach your goal is tantamount to driving your car to a specific destination where you have never been before without using a roadmap/GPS. The importance of developing a plan cannot be overstated! Yogi Berra perhaps best articulates the importance of developing a plan with this quote *"If you don't know where you are going, you'll end up someplace else."*[2] Here are several additional quotations expounding the virtues of planning and having a plan:

- *"A goal without a plan is just a wish."* [3]

- *"By failing to prepare, you are preparing to fail."* [4]

- *"Always plan ahead. It wasn't raining when Noah built the ark."* [5]

As you begin the planning process, there are several basic questions you will need to consider:

1. How does one strategically plan to enhance their professional development with respect to both teaching and research?

2. How does one plan to obtain the fiscal resources to achieve both teaching and research?

Answers to these two questions will be explored in this document.

Career Plan

When you accepted the position of assistant professor, you indicated both a general and specific area of research that you intended to pursue. Whether the intended topics and research questions are an extension of your thesis work or something quite different, it is an absolute necessity that you are passionate about the topic/area. Dr. Percy Julian, a renowned African American chemist who was on the faculty at Howard University, advised his mentees "to make sure to do research on <u>important topics</u> or in an important area." *This is crucial since it is difficult to have the requisite passion for research that you yourself do not envision as important.*

"Discover a purpose that gives you passion. Develop a plan that makes you persistent. Design a preparation and motivates you to optimize your potentials. Do it because you love it!" [6]

" Your research plan is a map for your career as a research science professional. "One of the functions of a research plan is to demonstrate your intellectual vision and aspirations. It's also an opportunity to begin to demonstrate the creative and independent thinking required of a successful scientist". [7]

In developing a Career Plan, there are several factors you may wish to consider:

1. Flexibility and Alternatives: It is important that your career planning document evolves continuously. It is a realistic document that should be updated and modified, based on feedback from internal and external mentors. Specific activities should be described in the plan that will enable continued progress toward the achievement of both your short and long-term career goals and objectives. A timeframe that includes projected completion dates for each activity should be an integral component of the Career Plan.

In developing career plans, especially with respect to both teaching and research, you should consider a "Plan A, Plan B, and Plan C." Remember, a GPS often includes several different routes, i.e., no toll roads, no freeways, shortest distance or shortest time, all of which may be important factors in reaching your destination successfully. Flexibility and the ability to make changes in direction are admirable traits that will serve you well in the pursuit of your goal. *"It is not the strongest of the species that survive, not the most intelligent, but the one most responsive to change."* [8]

Being flexible and open to new pedagogy will serve you well in improving your teaching skills. Therefore, your career plans must include professional development activities that will enable you to ultimately become a great teacher, not because of what and how the pedagogy is delivered; but rather *because of how students learn*. It is important to be open to new evidence-based strategies and best practices that increase student engagement, interest, and learning and continued professional development with respect to becoming a better faculty member. Also, you should continue learning new skills and techniques to enhance their research efforts.

2. Knowledge-Based Planning: To do proper planning, you must seek out and gather all the information that is related to the departmental environment, junior and senior members of the department as well as faculty outside of the department. You must know the policies and procedures for tenure and promotion. Don't assume that all that is needed is a similar publication record as others in the department, because the rules sometime change with time. It is important to read all available departmental and university policies and procedures related to tenure and promotion, shared governance, and sabbaticals.

3. Conferences and Collaborations: Career planning should not be confined to your present institution. Junior faculty should develop career-planning strategies that will enable them to gain both a regional and national reputation. This can be done by presenting papers at regional, national, and international research conferences whenever feasible. Planning efforts should be made to include both undergraduate and graduate students as co-authors and participants in these research conferences. In addition, you should plan strategically to network and develop mutually beneficial collaborations with other professors and scientists in your research area who are external to the university.

4. Time and Time Management: The ticking clock associated with pre-tenure creates a sense of urgency that will require a Research Plan that includes a detailed timetable with expected dates for completion of specific activities as you progress toward tenure. This also suggests that you should have both *short- and long-term projects* or long-term projects that can be separated into several short-term projects. For example, it would not be in your best interest to pursue a specific research project that will only yield publishable research beyond the date when you expect to be considered for tenure.
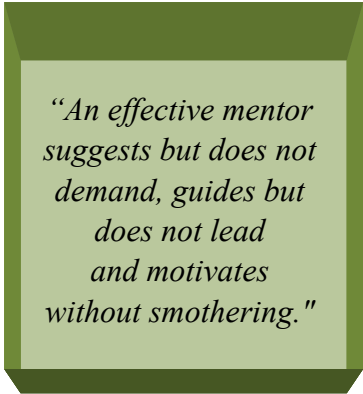
This sense of urgency often dissipates and brings on a sigh of relief and relaxation after earning tenure. The loss of the sense of urgency at this time in your career can sometimes be problematic and slow your progress toward the next promotion to full professor.

5. Plans for Funding Your Research: As an integral component of the Career Plan, early career faculty in STEM must develop strategies and activities to obtain external grants and contracts from both federal and private agencies. While there may be some preliminary funding available from the department, you are expected to write proposals and obtain funding to support the research efforts of you and your students. Successfully obtaining external grant support often is a significant factor in consideration for tenure and promotion, since this provides an external validation of your research and abilities to make a compelling case for grant support for your research. Successful planning and implementation of activities

for this effort, if done effectively, will take a considerable amount of valuable time but nevertheless must be done if you wants to reach your goal. Peter Drucker perhaps said it best - " *Plans are only good intentions unless they immediately degenerate into hard work.*"[9]

   6. Service Planning: So far, this article has focused on research and teaching and has not discussed "service," the third criterion used in promotion and tenure reviews. Service should include; service to the departmental and university wide communities; participation in recruiting and outreach activities, service to the profession and other related activities. However, "too much service", or participating in too many committees can have a negative impact, with respect to your time devoted to teaching and research. Time should be a major consideration with respect to service, especially in the pre-tenure years. Closely aligned with the service component are factors for success not found in a career plan; No amount of career planning will replace or reduce the importance for you to be "collegial", supportive, and ethical and to get along with students, staff and other faculty both in and outside of the department.

Lessons Learned from the Quality Education for Minorities (QEM) Professional Development and Mentoring Program (PDM)

"An effective mentor suggests but does not demand, guides but does not lead and motivates without smothering."

   In the final analysis, **career plans** are little more than words on a piece of paper unless those words can evolve into an interactive dynamic, self-reflecting, and self-evaluative document that is continually updated and that will serve to help you reach your ultimate goal. Simply put, very little of the above discussion will have an impact unless you somehow find the time to sit down and develop a career advancement plan, with highly specific objectives and timelines. In other words, you should do as Napoleon Hill suggests *"Reduce your plan to writing. The moment you complete this, you will have definitely given concrete form to the intangible desire."*[10]

   Time Management: QEM's PDM strategy clearly revealed that the assistant professors participating in the program often found that they were so busy with ongoing daily operations of department meetings, teaching several classes, advising students, writing proposals, training undergraduate and graduate students in laboratory techniques, that they tended to put off planning. In other words, it showed that **time management** is a significant factor in almost every aspect of an assistant professor's professional and academic life. In fact, time management had an impact on their research productivity, on their scholarly activity, as well as their personal life. It was quite evident that the PDM assistant professors were unaware of the importance of effective time management to their academic success. You will need to continually develop effective time management skills and learn to say "no" to extensive committee assignments. Be sure to include time management factors in developing your career plans.

The Career Advancement Plan (CAP) template, shown earlier in Figure 1, was provided to all PDM participants by QEM and was *required* to be completed and turned in to QEM by a specified target date. Accountability was a strong component of the PDM Program and everyone knew that not completing the deliverables within the specified time frame could result in their dismissal from the Program.

Goldilocks Planning: You should not be overly ambitious nor be too conservative with the objectives in your plan ("not too much, not too little –just right"). Another lesson learned from the PDM, with respect to the CAP, was that usually the objectives that participants listed in the CAP (Figure 1.) were too ambitious, overly optimistic, and unrealistic. For example: " I will submit two proposal to NSF and submit two manuscripts already in preparation for publication to peer-reviewed journals by the end of the fall semester." For many of the participants, some of their research objectives took longer than expected because they had underestimated the amount of time needed to recruit and train undergraduate research assistants to work in their laboratories.

In summary, the achievement of your goals of achieving tenure and promotion, leading to a successful and rewarding academic career, will be greatly enhanced with the effective development of a strategic, flexible, and dynamic career plan.

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Work-Life Balance for Women in STEM: A Personal Perspective

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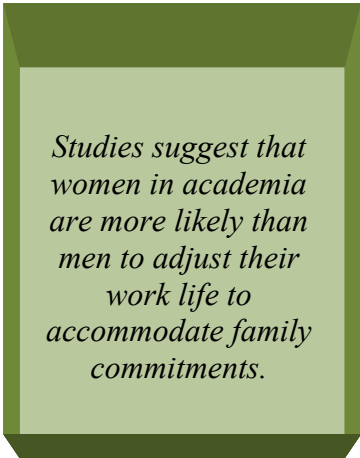Georgia State University, Atlanta GA

ABSTRACT

A 2012 survey by the Association for Women in Science indicated that most scientists had conflicts between work schedules and their personal life and that 48% of the women polled were unhappy with their work-life balance. Studies suggest that these issues significantly contribute to the lack of retention of and advancement by women faculty in STEM fields. As a result, a number of initiatives have been implemented by the National Science Foundation (NSF) and other agencies to identify factors that affect work-life balance of faculty in STEM fields. The Quality Education for Minorities (QEM) Network has addressed issues related to work-life balance at workshops for women and junior faculty, and at Professional Development and Mentoring (PDM) workshops. This article is a personal perspective that reflects suggestions the author has presented at these workshops or to junior faculty at her home institution on how to navigate a STEM career while balancing the demands of life.

INTRODUCTION

In 2012, the Association for Women in Science published the results of an international survey. The survey polled approximately 4,000 scientists and researchers world-wide, and showed that most scientists, both men and women, had conflicts between work schedules and their personal lives at least three times a week [1]. Of the women who completed the survey, 48% were unhappy with their work-life balance and 40% said that they delayed having children because of their careers. Similar studies in the United States have had similar results. In fact, the National Science Foundation recently announced an initiative to help stabilize the work-life balance of women in STEM. This initiative was based in part on studies indicating that failure of the workplace to provide family friendly considerations has impeded the progression of women in academic and research careers [2] and in part on the American Recovery and Reinvestment Act from President Barack Obama's administration, which was passed to create jobs and maintain America's scientific competitiveness. Two critical factors in maintaining America's scientific competitiveness are the ability to generate a pipeline of highly trained scientists and the ability to conduct unbiased, imaginative research that results in cutting-edge discovery.

Academic research is largely considered the driving force behind cutting-edge discovery, and as would be expected, academic research plays a major role in generating pools of diverse and skillful scientists. Interestingly, in undergraduate institutions, women are making up an increasing percentage of the academic work force, yet when looking at the career paths and career trajectories, many women are not on the "fast track" to tenure and promotion. Likewise, female faculty at research intensive institutions are perceived to have less impressive careers than their male counterparts, perhaps because of choices that require them to choose between sacrificing family obligations or work commitments. Studies suggest that women in academics are more likely than men to adjust their work life to accommodate family commitments [3]. In STEM fields in particular, a study of women in physics and chemistry suggests that women were twice as likely as men to have made choices that compromised their careers in order to meet family needs [4].

Studies suggest that women in academia are more likely than men to adjust their work life to accommodate family commitments.

Interestingly, both male and female undergraduate students believe that STEM careers present greater challenges to establishing work-life balance than other careers [5]. Female undergraduates have gone so far as to indicate that if they were to attend graduate school and then have a successful research career, they would have to first give up on having a family [5]. These perceptions appear to be based on facts, as women faculty are less likely to have children than women in professions such as law and medicine, and only 31% of current women faculty have children [6]. Collectively, these studies suggest that in order to build and sustain a highly trained, diverse workforce in STEM research fields, we must first address the real and perceived threats to family life and social status.

Many majority institutions have directly addressed issues of work-life balance by adopting faculty mentoring programs and family friendly policies that are available to both men and women. The mentoring programs are meant to provide peer support to new faculty as they learn to navigate academic life. The family friendly policies often include modified sick leave, parental leave, and health benefits, or mechanisms for delaying or pausing the tenure clock because of family- or health-related issues [7]. A positive outcome of such policies is that they typically are not gender restricted, and are open to men and women. This is especially important since men are also faced with the family related challenges when pursuing research careers. However, AAC&U data suggest that these policies do not benefit men and women equally [7], underscoring the need to carefully examine gender-based differences in the home and in the workplace. The effectiveness of workplace policies has been difficult to assess, mostly because the policies vary widely, and because assessment largely depends on subjective measures.

Another concern is that workplace policies, overall, appear to have a limited effect on improving the career trajectories of women as a whole, perhaps because little attention has been devoted to adapting policies that are beneficial to women of color. While women faculty in STEM face a common set of challenges, women faculty of color in STEM also face many of challenges that broadly affect women of color in our society, as a whole. These challenges include social challenges, health disparities, and familial responsibilities that make it difficult

for women of color to balance the demands of their career with the demands of their family [8]. Women in STEM also face gender bias, and while studies on gender bias against women of color in STEM are rare, there is evidence that different biases are faced with different frequencies that depend on ethnicity or race [10]. These biases, and dealing with them, can further impede the career trajectory of women of color, while simultaneously decreasing their job satisfaction and overall work-life balance. To address some of these challenges, the National Science Foundation (NSF) through the Career-Life Balance (CLB) initiative has developed policies and practices to ensure scientists' balance their work with conflicting demands of family life.

CLB's goal is to attract, retain, and advance graduate students, postdoctoral fellows, and early-career researchers in STEM fields, especially women, by embracing practices such as: deferring award start date for child birth/adoption; providing resources to accommodate CLB opportunities; supporting research and evaluation of women in STEM issues, etc. [12]. As part of its overarching goal to provide support for STEM faculty at minority serving institutions, QEM has addressed issues related to work-life balance at workshops for women and junior faculty by showcasing more senior faculty members who have developed "best practices" and who have made significant advances in their science careers. QEM also organized sessions during Professional Development and Mentoring (PDM) workshops that included discussion regarding work-life balance for male and female faculty in STEM at HBCUs. This article is a personal perspective that reflects the suggestions I have made at QEM workshops over the last 10 years, to mentees in the PDM program, or to junior faculty at my home institution on how to navigate a STEM career while balancing the demands of life.

Be Aware of the Work-Life balance.

Usually during the informal events at the QEM or PDM workshops, I have been asked how I managed to finally balance my career with the demands of being a wife and mother. My answer has always been a long-winded version of, "I have not." The word balance implies that I have found a way to meet all of the demands of work life and of family life designating an equal amount of attention to each. It implies that the two activities are each safely tucked away into separate corners, without any overlap or infringement. I think it is safe to say, this definition of balance never exists for a STEM faculty member, with a family, who is actively engaged in research while also handling the demands of teaching and university service. What does happen is that the most successful STEM faculty members learn to identify and prioritize their obligations. Often they have a clear picture of their long-term goals, with a clear understanding of the path normally taken to achieve those goals. Most importantly, they are often adaptable enough to find alternate paths toward the same end goal.

For me, becoming aware of ways in which work life infringed upon my home life, and vice versa, forced me to make a self-assessment to precisely define my career objectives. I spent the first few years as a faculty member with narrow short-term goals that did not allow me to easily adapt to unexpected challenges. This approach had a major impact on my level of self-satisfaction, and on my perceived effectiveness at work and at home. And so, in conversations with PDM mentees or junior colleagues, I often ask them to first define their career objective, asking a broad question like, "When you imagine yourself as a successful

scientist or STEM faculty member, what is it that you see?" I ask a similarly phrased question about their life objectives as well: "What will make you a successful mother? Do you think your parents will eventually live closer to you?" My main goal in these conversations is to help my mentees to identify: (1) the major milestones, with standard timelines, by which they measure their career success; (2) similar milestones in their lives; and (3) instances where the two "separate" sets of milestones might impinge upon each other. At the end of my own assessment, I had a clear picture of my long-term priorities and a clear definition of what I considered a successful career and a fulfilling life. It also helped me to recognize the impact of overextending myself, either at home or at work, on my long term goals.

Be cognizant of family-friendly policies (formal and informal) that are in place at your institution.

Recently, many institutions have implemented family friendly policies to help address issues related to work-life balance. Often these policies are overlooked at smaller institutions like the HBCUs, not because the institution is unwilling to implement them, but because there is an underlying assumption that the policies do not exist. The university and the department will publish a faculty handbook that outlines all formal policies, which may or may not include mechanisms for delaying the tenure clock or provisions for extended leave. I have found that many of my mentees overlook these policies, or assume that the policies do not apply to their specific situation. It is important to realize that the formal policies are often generic descriptions that apply to a wide range of situations. Tenure clock delay, for example, may not necessarily be limited to new parents. It is important to discuss options with the department chair or with the Office of Human Resources, and having a clear understanding of the written policy before hand will be beneficial to the process.

Determine your priorities.

One of the mantra's of the QEM PDM workshop, presented in many different ways by many different QEM mentors was, "Learn to say no politely." One thing I learned is that sometimes I have to say no to myself. It was *somewhat* easier to say no when my department chair suggested that I head a faculty search committee even though I had not completed my research manuscript. But it was *really* hard not to volunteer to be the coordinator of an undergraduate research program when these types of programs were what attracted me to science. I had to learn to focus on activities that would progress my career in the direction of my long-term goals. Now, any activity that does not move me forward is critically examined for how much that activity will delay me in reaching my long-term goal, or how much time it will take away from my family life. If the outcomes from that activity are not personally worth the expense, then I say no. I think it is important to note that, I had to take this approach in my home life as well.
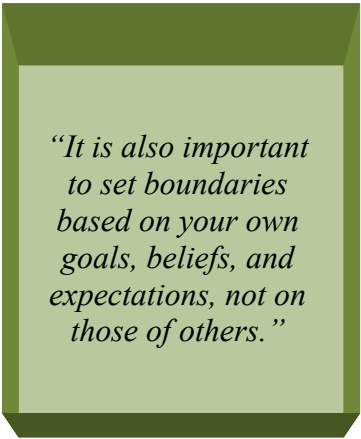
I had to examine how much time being the coach for the little league track team would take away from my ability to write research proposals, or weigh the impact of the week long girlfriend's getaway on the ability to collect experimental data for a manuscript. I am much more rigid in establishing my work priorities. Using Eisenhower's principle [11], anything that is neither urgent nor important for my career success, and that is not personally satisfying to

me, is not included on my list of things to do. At home, I am more flexible about priorities, weighing items that offer immediate results or satisfaction against those that offer a larger degree of satisfaction over a longer time.

Set boundaries and enforce them.

As STEM faculty, it is impossible not to take your work home with you. For me, the ability to take my work home gave me the flexibility to go to the "mother-son lunches" or to extend a visit with my parents by one or two days. I could outline the project summary for my research proposal at homework time, or, spend hours after bedtime revising a manuscript draft. At the same time, however, the tendency to bring work home can severely challenge the work-life balance. To minimize the extent to which work interferes with other aspects of your life, it is important to establish clear boundaries, and to limit the flexibility of those boundaries. For example, you might decide that you will spend three hours on Saturday morning, working on a research proposal, or that two hours every Thursday evening will be your private and protected time at the gym or in the bar. At work, you might decide that between 9 AM and 12 NOON, you will devote 100% of your attention to laboratory research.

Often, when I describe setting boundaries this way to my mentees, they say, "Oh, you mean set a *schedule*." In actuality, I do mean boundaries, because the boundaries (at least mentally, to me) are inflexible and non-negotiable. My designated research boundary, for example, cannot be interrupted or challenged by my students, administrators, or colleagues. It means that I skip the "emergency" faculty meeting, I do not answer the phone or check email, and I do not hang around for casual conversation when I pass my colleagues in the hallway. Likewise, at the end of my three hours on Saturday morning (I actually use a timer!), I save my files and completely switch off "work mode."

> *"It is also important to set boundaries based on your own goals, beliefs, and expectations, not on those of others."*

It is also important to set boundaries based on your own goals, beliefs, and expectations, not on those of others. I have a relative who used to constantly announce to me how it is beneath her to work on weekends. I had colleagues who thought I should attend every departmental social hour. I had students who thought it was extremely inconsiderate of me not to set aside my research time to accommodate their needs. In my discussion with mentees, particularly those who are women, there appears to be a general feeling of unease with prioritizing personal career needs above the needs of others in the workplace. This unease subconsciously extends somewhat into family and society as well, making it harder for many women to set these types of boundaries. However, I found that setting these types of boundaries helped me to mentally switch between work-life and family-life, which had the long term effect of increasing my productivity at work and my sense of fulfillment at home. It allows me to devote my complete attention to a given task and to set mini-milestones. I also find a greater sense of accomplishment for having completed those milestones within the allotted period.

SUMMARY

Establishing practices to achieve work-life balance is one of the major challenges to women, and men, in STEM fields, and the data suggest that this is one of the factors contributing to the small number of women in STEM fields. From a personal perspective as a woman in STEM, the author outlines a strategy for achieving this balance, which includes being aware of how family and social obligations can influence career development, identifying institutional and departmental policies that address issues related to work-life balance, prioritizing long-term and short term goals, and establishing clear boundaries that will limit the overlap of work activities and personal activities.

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"A mentor who is unwilling to offer an honest and frank opinion is of little worth to the mentee. As a mentee, it is important to identify a mentor who will be cognizant of his/her duty to support and advance the mentee without pampering and without abusing the relationship."
(C. Johnson)

"Developing your research agenda is essential for your career. Establish the parameters and a timeline for publishing the results from your studies. These publications will be key to your promotion, tenure, and merit pay raises."
(A. Grider)

A Mentee's Guide to Establishing, Maintaining, and Evaluating a Mentee/Mentor Relationship

by

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ABSTRACT

Effective mentoring can lead to faculty who are more productive and who are more likely to remain at their academic institutions. Many institutions have created mandatory mentoring programs in which junior and senior faculty members within the same institution are paired. In these cases, and also in cases where the mentor/mentee relationship is established through informal means, the mentee often enters the relationship without a clear set of guidelines on how to ensure that it is beneficial and effective, and that it addresses aspects that are specific to him or her. This article provides an overview of steps that can be taken by the mentee to facilitate an effective mentor mentee relationship.

In an effort to improve faculty retention, universities across the nation have adopted formal mentorship programs that are dedicated to the professional development of new and junior faculty. Overall, assessment of the outcomes of these programs suggest that effective mentorship can lead to faculty who are more productive and who are more likely to stay at their academic institutions [1]. More importantly, as departments of science, technology, and engineering have become increasingly more diverse, universities are starting to understand that effective mentorship is not a "one-size-fit-all" commodity, and a unifying theme after evaluation of these programs is that universities need to tailor mentorship programs to meet the unique needs of their women and minority faculty [2,3].

Despite the demonstrated benefits of mentorship programs [4, 5], and the extensive guidelines on the responsibility of universities to establish such programs [6, 7, 8], the role of the mentee in establishing, maintaining, and evaluating the actual mentoring relationship is less clear. This problem is exacerbated at smaller institutions that lack the resources to implement policies and programs that are already in place at larger institutions. For the most part, even the smallest institutions have a basic mentoring plan in place that involves pairing the junior faculty member with more senior faculty in the same department. However, studies suggest that this approach is overly simplistic, as it fails to consider cultural, socio-economic, or gender differences between individuals [4, 9]. Importantly, this general model is unlikely to address the components beyond career development that are considered essential for an effective mentoring program: psychosocial issues, work/life balance, and real-life examples [8, 10].

Regardless of the university's policy or approach to formalized mentoring, it is critical for junior faculty members to be proactive in establishing and cultivating mentoring relationships. However, for junior faculty members facing a new environment and unfamiliar colleagues, it is often difficult and overwhelming to implement effective strategies that will allow them to benefit fully from the mentoring relationship.

The goal of this article is to establish guidelines for getting the best out of mentoring relationships at every phase of the process, from the perspective of the mentee. These guidelines were developed as part of an effort by the Quality Education for Minorities (QEM) Network, to establish best practices for enhancing the professional development of junior faculty members in STEM fields at minority serving institutions. The approaches described in this article are guided by the literature and also stem from the authors' experiences as mentors in QEM's Professional Development and Mentoring (PDM) Program.

ESTABLISHING A MENTORING RELATIONSHIP

Formalized approaches to mentoring can differ. In addition to the traditional approach that pairs a senior faculty member with a junior, less experienced faculty member, other models include a mutual mentoring approach, a team mentoring approach, and strategic collaborations approach [7]. A forward thinking STEM faculty member will build a long term mentoring plan that involves each of these different approaches to some degree. In today's era of collaborative, interdisciplinary research, for example, it is important to build a mentoring network that spans across departments and colleges, and that reaches beyond the home institution. Likewise, it may be necessary to identify mentors who can help to address cultural differences, departmental politics, and social dynamics, even if they are not STEM faculty or members of the same department. The following are guidelines for the mentee that can be applied to any mentoring approach.

Identify the responsibilities and needs of the mentee. A textbook definition of a mentor is a person who takes an interest in, and helps to advance, another person's career and professional development through both an interpersonal and professional relationship with that person [10]. While the mentor is accepting a huge responsibility in agreeing to serve in that role, the mentee needs to acknowledge his/her own responsibility in the relationship. In fact, if the mentee fails to take an active role, the effectiveness of the relationship will be limited.

Self-assessment is a critical step in establishing a mentoring relationship. First, the mentee must be clear about short-term and long-term goals. These goals can be broad, such as "attain tenure within 5 years," or they can be more focused, such as "submit two primary research manuscripts for peer review within the next 18 months."

Second, the mentee should be realistic about their strengths and weaknesses, with the overall goal of understanding how those strengths and weaknesses might affect the ability to attain their goals. For example, if the mentee is not sure of how to prioritize his/her work effort, a heavy teaching load might impede research progress and prevent the mentee from

submitting manuscripts on schedule. Because most HBCUs have a primary mission of teaching, faculty at HBCUs will likely face this particular challenge more often than faculty at majority serving institutions. At the same time, many HBCUs have smaller lecture and laboratory class sizes that might provide the opportunity to implement the mentee's research activities into the classroom laboratory. In making the assessment, the mentee should be very careful to identify possible approaches for working around their perceived weaknesses.

Third, the mentee should be aware of personality traits that may affect the relationship by considering the following questions. Are you able to accept constructive criticism? Are you comfortable with asking for advice and providing details on factors that drive your decision? Are you aware of cultural nuances that might influence your interactions with your mentor? Are you able to identify commonalities between yourself and others, even if your cultural identity is different from theirs? The mentee will want to find a mentor whose personality traits do not clash with his/her own traits. The mentee/mentor relationships in the PDM program were assigned; however, the mentees were eager for constructive criticism on their research proposals, research agendas, and research manuscripts. Occasionally, there were topics that were difficult to discuss. In the example that comes to mind, the difficulty was likely due to differences in the genders of the mentor and mentee. The unease during discussion was probably a surprise to the mentee, but the relationship was one where the mentor was able to move the discussion forward through a series of focused, un-intrusive questions.

"Self-assessment is a critical step in establishing a mentoring relationship.

....

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....

Be aware of personality traits that may affect the relationship

...

identify and rank the issues that he/she wants to discuss with a mentor."

Fourth, the mentee should identify and rank the issues that he/she wants to discuss with a mentor, while keeping in mind that one mentor probably will not be able to address every issue, and that every new faculty member should have several mentors. These issues can be anything from "how to balance family obligations with a career" to "how to teach better" to "what are realistic pre-tenure goals to set and "how soon should one start preparing the tenure packet?" The mentee also might find it helpful to identify the kind of activities that he/she would like to engage in with the mentor. Would the mentee be more comfortable with formal office settings, or would he/she prefer to meet over coffee? Would he/she like to engage in non-academic activities or to attend workshops together? One of the strengths of the PDM program was that it provided the opportunity for mentees and mentors to interact in both formal and informal settings at multi-day workshops. This helped the mentors and mentees to get acquainted with each other early in the relationship, so that the later interactions could be productive and mutually rewarding. It also was through the less

formal interactions that the PDM mentee and mentor were able to establish the confidentiality of their relationship. Although confidentiality was implied, and was also explicitly stated in the formal agreement, the informal casual interactions helped to build a rapport and trust in the relationship that helped to cement the confidentiality.

Awareness of mentee responsibilities is critical for establishing a mutually rewarding relationship. Online surveys and interviews with mentors and mentees strongly indicate that the best relationships are built on mutual respect [1]. Many mentors feel that the work required to be effective is worth the effort when the mentee is respectful of the relationship and of other factors that may compete for the mentor's time. This means that the mentee meets agreed upon deadlines and shows up for all scheduled activities, on time and prepared. Mentors also feel that the best mentees are those that are receptive to feedback, and willing to follow through on that feedback in a timely manner. Importantly, many mentors expect the mentee to take responsibility for driving the relationship [1], in part by showing up for meetings with lists of topics for discussion and timelines for projects. The best mentees are also frank and honest about their needs, are willing to ask for help, and to evaluate thoroughly the pros and cons of any advice they received.

In addition to being respectful of the relationship, it is the junior faculty member's responsibility to be prepared for the mentoring relationship. Since professional development is a unifying theme of most mentor/mentee relationships, a junior faculty member should: (a) share his/her CV with the mentor on day one, with a request for feedback on areas of strength and weakness; (b) formulate a five-year plan for his/her career trajectory to share with the mentor; (c) become familiar with the resources that are available at his/her institution, particularly those that spell out the guidelines for tenure and promotion; and (d) identify and take advantage of opportunities for learning about the university. As the mentee assembles this packet to share with the mentor, he/she should write down questions as they occur, and then separate them later according to the ones that can be answered alone through research and the ones that will need to be addressed with the mentor's help.

Identify potential mentors. Characteristics of effective mentors include those who provide frank and honest feedback, who are engaged during each session and able to focus on the issues identified, and who make the mentor/mentee relationship a priority [1]. Effective mentors typically demonstrate competence, confidence, and commitment [11]. These characteristics are often evident in the potential mentor's personality, and can be discerned through a few casual interactions. A junior faculty member should also ensure that the potential mentor has a wealth of experience to draw from and an established and extensive professional network.

A mentee should identify areas of mutual interest, and then find out as much as possible about the potential mentor. The goal is to identify potential mentors that can help in specific areas as the mentee progresses through his/her career. If, for example, the mentee seeks help with navigating the tenure and promotion process, he/she should not choose a person that achieved promotion and tenure many years before current policies were put into place. Likewise, if the mentee seeks a mentor to help with making informed decisions about where to publish and from which federal agencies to secure research funding, he/she should

not select a person with markedly different research interests. If the mentee, one of only two women in the department, seeks a mentor who will help her to better communicate with male faculty, then she should not select a female mentor who has always been associated with a female-dominated department.

The mentee should keep in mind that mentors do not ALL have to come from within his/her department, and, in fact, it is preferable to include mentors from other departments. A mentor within the department might help with working towards promotion and tenure, and may help with prioritizing service obligations. A mentor outside of the department, but still at the same university, may help with navigating the political environment inside the department or may help with addressing cultural differences. A mentor outside of the university might provide advice on how to interact with academic deans and other administrators, or might provide alternative views on interdepartmental relationships. A peer mentor, one of the same rank and status, will offer an alternative perspective on daily issues, or on issues pertaining to work/life balance. It is important to remember that an effective mentor/mentee relationship is constantly evolving so that it is mutually beneficial to all parties involved.

Define the parameters of the relationship. Prior to identifying potential mentors, the mentee needs to have a realistic view of what is expected out of the relationship. In the first meeting, the mentee should work with the mentor to define the parameters of the relationship. This is often the most challenging part of establishing the relationship, particularly in cases where the mentor and mentee are not familiar with each other. The mentee may worry about being perceived as "pushy" or "domineering," when requesting a pre-scheduled meeting times, while the mentor may worry about being perceived as "resentful" or "disinterested" by setting guidelines for ending the relationship. Survey findings indicate that while these concerns are common and sometimes valid, most mentors/mentees feel that formal relationships were more beneficial to both parties when parameters were established early on [1, 10].

A general partnership agreement is one of the best ways to establish and define the parameters in a formal relationship. Once the parameters have been defined and agreed upon, the mentor and mentee should sign, date, and file the partnership agreement. It should contain a title, a general one-sentence description of the overall mentoring goal or mutual interest, and a list of the specific parameters. Here is an example of the overall mentoring statement, slightly modified from the UCSF mentoring program [11]: "As a mentor and mentee at *Insert Name Here* University, we agree to abide by the following set of guidelines with the overall goal of supporting the professional development of *Mentee's Name* on her/his path to promotion and tenure." This statement should immediately be followed by a list of the agreed upon parameters. At a minimum, the parameters should include the following:

(a) A statement of a commitment to the relationship for a set duration.

(b) A schedule for the frequency of meetings and the meeting type. The language does not have to be exact. For example, an agreement to meet "at least twice per year over the next three years" is sufficient; however, an agreement to meet "in person at least twice per year over the next three years" is better. Remember, the goal is to foster communication between the mentor and mentee, so communications by electronic

mail, telephone or some form of videoconference can be used to increase contact when in person interactions are not possible.

(c) A statement of confidentiality. Though confidentiality is often assumed, the act of promising, in writing, to keep all discussions confidential reminds both the mentor and the mentee of the sensitivity of the relationship and the opportunity for open and honest discussions.

(d) An agreement to "no-fault" ending of the relationship if certain situations occur. List those possible conditions in the agreement.
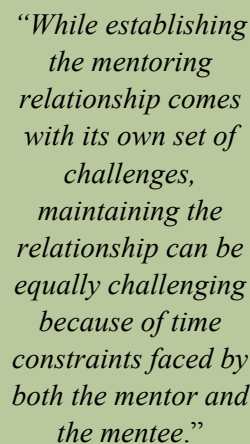
MAINTAINING THE MENTORING RELATIONSHIP

While establishing the mentoring relationship comes with its own set of challenges, maintaining the relationship can be equally challenging because of time constraints faced by both the mentor and the mentee. When the relationship is initially based on a concrete goal, both parties are typically committed to achieving that goal. Once the goal is accomplished, however, the mentor relationship might unintentionally become less of a priority. To prevent this, the mentee should take steps to cultivate the relationship, perhaps by taking ownership of the process. It is important to note that mentor/mentee relationships change with time, and with the growth and professional development of the mentee. An effective mentor will constantly: consider ways in which he/she might foster the mentee's career; reexamine how well he/she has supported the mentee in achieving their goals; and be flexible enough to adapt to the changing needs of the mentee. At the same time, the mentor will recognize when the mentee has needs that are outside the mentor's realm of expertise, and will push the mentee toward others who are more qualified. On the other hand, the mentee's role is to recognize the importance of mentoring and the contribution of the mentors to his/her success. The following are steps the mentee can take to maintain and continue the mentoring relationship.

Perform a needs assessment. Maintaining the mentor/mentee relationship requires constant reevaluation. The mentee should constantly evaluate the effectiveness of relationship, with the goal of increasing communication with the mentor. After the relationship has been firmly established, the mentee should reexamine his/her reasons for seeking out this particular mentor and determine if those needs have changed. If the mentee have recently been awarded tenure, for example, how can the mentor help with the post-tenure career? If the mentee has submitted that first research proposal, how can the mentor help to identify additional funding sources? The mentee should determine how to work effectively with the mentor by examine the relationship for strengths and weaknesses as they relate to the ability to communicate with each other and to achieving personal goals. Are there personality traits that hinder communication? Does the mentor have the required experience or perspective to advise the mentee on issues related to work/life balance? Once the evaluation has been completed, the mentee should consider ways in which he/should would like the relationship to change or to remain the same.

Make it clear to your mentor that you value the relationship. In many mentor/mentee relationships, once the initial goal has been achieved it is not necessary to formally re-establish mutual expectations and goals. Nevertheless, with constant reevaluation and with time, the expectations are likely to change. In taking responsibility for maintaining the relationship, the mentee should express his/her needs directly. He should continue to express the value in the relationship by taking responsibility for setting up and sticking to a goal schedule. She should articulate the need to communicate with the mentor, while being flexible and sensitive to the mentor's scheduling needs. Because the mentor is heavily invested in the mentee's career and professional development, the mentee should also remember to celebrate successes, big and small, with the mentor.

Be responsible for the information flow. Mentees should take responsibility for scheduling meetings, keeping in mind the mentor's preferred method for communication. They should be prepared to manage meetings, setting the communication method in a way that is appropriate for the type of information to be exchanged. If the meeting is to reestablish goals or to provide an update on recent activities, electronic mail or teleconferencing might be sufficient. If the meeting is to discuss multiple items, it might be better to arrange an in person meeting. In these instances, the mentee should provide the mentor with an agenda. This serves to organize the meeting, streamline the discussion, and maximize the outcomes.

In all interactions, it is critical that the mentee listen actively. This means that, while the mentee should put forth his or her own ideas, he or she should not become argumentative or defensive while receiving constructive feedback. He or she should not dominate the conversation or overtake the dialogue when the mentor is offering suggestions. At the same time, active listening involves both listening and responding in a way that improves mutual understanding. The textbook definition often applies to the technique when used in counseling activities, and suggests that the listener feeds back what they hear to the speaker by paraphrasing what they have heard. In the mentor/mentee relationship, this technique should be modified so that it extends beyond a confirmation of repeating what was heard. It should also include a mental assessment of the conversation, followed by a verbal exchange that will allow clarification of questions and that will allow the mentee to understand the basis for the mentor's suggestion.

"While establishing the mentoring relationship comes with its own set of challenges, maintaining the relationship can be equally challenging because of time constraints faced by both the mentor and the mentee."

The mentee should follow-up on all meetings with a written communication. The follow-up can be immediate, providing a restatement of what was discussed during the meeting, or it can be after a few weeks, providing an informal report of the mentee's progress and restatement of how that progress fits into the overall plan. QEM's PDM program required written follow-ups after formalized meetings, but made no such stipulations for the informal meetings. Interestingly, mentees fell into the pattern of the written follow-up, even when not

required. From the mentor's perspective, the unsolicited follow-ups communicated the mentee's appreciation for the mentor's efforts and provided solid evidence that the mentee understood the mentor's suggestions and intent.

Recognize the evolution of the relationship. Mentoring relationships have a natural tendency to evolve. It is important for the mentee to consider how far the relationship has evolved during the stages of assessment and reevaluation. There may be a point in which there is a planned separation in the relationship as the mentee's career advances or as the mentee attains his/her goals. It is important to directly address the transition of the relationship in order to promote future interactions. The mentee can do this simply by expressing an appreciation for the mentor's guidance and help in achieving his/her goals, and by expressing a desire to maintain contact in the future. At the same time, the mentee should provide the mentor with a summative evaluation of the experience and occasional updates even after the formal relationship has ended.

QEM's PDM program included a planned separation. Nevertheless, the mentors and mentees have continued to exchange periodic emails and to personally visit each other's campus during the academic year. From the mentors' perspectives, the relationships have evolved such that the mentees are considered to be peers, rather than junior faculty, but the overall long term goal is the same: to help the mentee achieve his/her career objectives and to maintain a work/life balance that is conducive to a healthy lifestyle. The continued interactions help the mentors reflect on the effectiveness of their mentoring style, while, presumably, it provides the mentees a continued source of support.

EVALUATING THE MENTORING RELATIONSHIP

The evaluation process entails an assessment of the growth and success of the mentee and the mentor. For the mentee, this evaluation can be both quantitative (i.e., how many research proposals were submitted as a direct result of the mentor/mentee relationship?) and qualitative (i.e., how much influence did the mentor/mentee relationship have on your writing style and written communication skills?). Evaluations should be periodic and used to adjust the relationship as needed. This means that although reflective evaluations are critical, the mentor and mentee should also do formal evaluations together.

Periodic Evaluations. Periodic evaluations are performed with the goal of making adjustments in an ongoing relationship. It should be done in a way that allows the mentor/mentee to identify the weaknesses and strengths of the relationship while recognizing their responsibility for promoting and enhancing it. Questions that might be useful in periodic evaluations include:

How well is the partnership working?
What aspects of the partnership are not working and why?
How much progress has the mentee made on accomplishing the early goals?
What additional support can the mentor provide?
What role can the mentee play in strengthening the relationship?
How many of the early goals are still valid?
What external constraints affect the relationship?

Outcomes Evaluation. The outcome evaluation can be used to evaluate: (a) the effectiveness of the mentoring program at the institution; and (b) the growth and success of the mentor and mentee. Often evaluations of the effectiveness of the program involve surveys across multiple mentor/mentee partnerships that are handled by the institution. At a minimum, these evaluations should assess the perceived levels of satisfaction with and effectiveness of the relationship, ease and difficulty in establishing the relationships, method for assigning mentor/mentee pairs, and the degree to which the relationship influenced mentee regarding issues with work/life balance and cultural identity at the institution. Evaluations of the growth and success of the mentor and mentee include an assessment of outcomes that are specific to the career and professional development goals of the mentor/mentee. Still, the following additional considerations can enhance and broaden the evaluation.

Review the original purpose for establishing the relationship. Typically, the original goals were established based on the mentee's needs, so it should be easy to determine whether the mentee has accomplished his/her goals. The goals of the mentor, however, likely were not established early on, and in fact, the purpose was probably to foster the career of the mentee. In this case, the mentee's success is used as a measure of the mentor's support. A more thorough evaluation, however, would specifically ask which actions of the mentor were instrumental in helping the mentee achieve his/her goals, and which actions were inconsequential. This in depth analysis should help the mentor to determine how he/she influenced the mentee's progress.

Examine how the lines of communication changed. It is likely that early communications between the mentor and mentee were limited, caused in part by their unfamiliarity with one another. For this assessment, it is useful to identify events that led to better, more effective communications between the pair. It is also useful to reflect upon instances in which nonverbal communication may have negatively influenced interactions, or to reflect on specific instances in which conflicts and misunderstandings were resolved over the course of the relationship. The outcome of this assessment should allow both individuals to better communicate with other mentors and mentees in the future.

Examine the procedure. Consider whether the meeting times and structures were conducive to both parties involved. Did the mentee feel that there were enough face to face meetings? Were the meetings structured enough, or were they too structured to allow for personable interactions to occur? In what ways did the mentor push the mentee towards sustaining progress and building independence? In what ways could the mentee have been better prepared for meetings or have streamlined interactions with the mentor?

Provide negative and positive feedback. It is likely that the mentee and mentor have provided continuous feedback throughout the relationship. The formal evaluation period is the time to honestly reflect on the expectations and outcomes of the relationship. In providing such feedback to the mentor, the mentee should reflect on his/her own strengths and weaknesses, and on those of the mentor. He or she should provide feedback from both perspectives to the mentor, and it is expected that the mentor will do the same. Ensure that the feedback is honest and tactful, that it addresses all items of concerns, and that it reflects an appreciation for the relationship.

SUMMARY

Here, we have provided a general guideline for junior faculty members and new mentees in establishing, maintaining, and evaluating mentoring relationships. At the start, the mentee should assess his/her own personality traits and the overarching purpose in establishing the relationship, and then he/she should identify mentors with the appropriate experiences and professional networks to foster the mentee's career objectives. To maintain the relationship, the mentee should work diligently to maintain lines of communication with the mentor, with the expectation that the relationship will be mutually respectful and mutually beneficial to the parties involved. Finally, there should be periodic assessments of the relationship and its effectiveness in helping the mentee achieve his/her goals.

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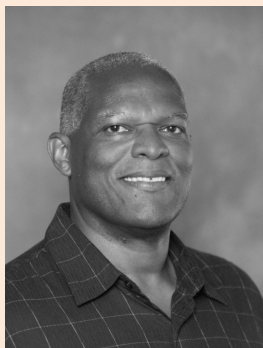
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(Mentoring diagram -- Royalty-free Stock Digital Media retrieved from the Internet)

Mentoring as a Strategy for
Addressing Differential Career Outcomes

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ABSTRACT

Mentoring, with its embeddedness within the career context is distinguishable from other personal relationships. Workplace mentoring, specifically, is characterized by a personal relationship between a less and a more experienced individual for the purposes of professional growth of the less experienced person. While mentoring is ubiquitous, there is evidence to suggest that qualitative and quantitative differences and inequities exist in establishing effective mentoring relationships, and particularly for underrepresented minorities (URMs). To more fully understand the mentoring landscape in which URM mentoring relationships, such as the mentoring component of the QEM PDM program, can be situated and to assemble robust evidence fromwhich best practices can emerge, this paper provides an overview of the benefits, models, and functions of mentoring. The need for mentoring of URM is asserted and the status of evidence is noted. Suggestions for furthering this evidence to advance URM faculty-to-faculty mentoring are offered.

Mentoring as a form of personal, guided, and transformative relationship harkens back to Greek mythology, symbolized by the archetype Mentor and Telemachus in Homer's Odyssey. Even as society has undergone transcendental changes, mentoring has remained a ubiquitous, if not homogenous phenomena that has garnered sustained attention across context—disciplines, sectors, and professions. While arriving at a consensus definition of mentoring across these contexts has been challenging, what however, distinguishes mentoring from all other personal relationships is that it is embedded within the career context and as such, its primary focus is on guided career development and growth (Ragins & Kram, 2007).

In the academic workplace, progression through academic rank and/or advancement to leadership positions are the hallmark of the career success of junior faculty who must balance research, teaching, and service in an ever changing and complex academic environment. Workplace mentoring is characterized by a personal relationship between a less experienced individual (the protégé) and a more experienced person (the mentor) for the protégé's professional growth (Kram, 1985). For historically URM faculty—including individuals from

Black, Hispanic, Native American, and Asian racial-ethnic groups—in science, technology, engineering, and mathematics (STEM), the challenge of progression and advancement looms larger as evidenced by continued proportionately small numbers in STEM areas in the academy. The QEM PDM program, with its strong emphasis on career mentoring is designed to address these challenges and to optimize the success of faculty participants.

Research shows that developmental relationships, such as mentoring, can play a critical role in professional growth and development including career decision/support, and research productivity as well as academic success (Schrubbe, 2004; Sambunjak, Straus, & Marusic, 2010). Thus mentoring, with its demonstrated benefits, offers a potential strategy to address the differential outcomes among faculty that reinforce inequities, as seen in career outcomes, within the academy. Yet mentoring benefits accrue differently across racial and ethnic groups producing differential impact on scholarly productivity for URMs in STEM.

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For example, studies report that URM faculty have limited access to mentoring relationships and professional networks that support and enhance faculty success (Aguirre, Martinez, & Hernandez, 1993; Diggs, Garrison-Wade, Estrada, & Galindo, 2009). Quantitative differences and inequities have been identified via studies revealing that minority faculty receive less mentoring than their non-minority counterpart (Thomas, 2001; Turner & González, 2011; Patitu & Hinton, 2003; Gregory, 2001).

In addition, there are some indications of qualitative differences and inequities where according to Girves, Zepeda and Gwathmey (2005) "for women and minority mentees and/or mentors, the empirical research regarding access to mentors and the benefits derived from being in a mentoring relationship is limited and the results are mixed." This suggests that different race-groups may not just have unequal access to mentoring, but also do not have similar mentoring efficacy and outcomes**.**

Further, Girves et al. (2005) observed that "women in science and engineering fields and minorities in all fields stand at a disadvantage with their peers when forming relationships that are key to their academic integration." Thus, in the mentoring arena, minorities face a double jeopardy, that is seen in the relative absence of mentoring but greater challenges in establishing effective mentoring relationships (Tillman, 2001; Patton & Harper 2003; Patton, 2009).

Such a reality for URM faculty is contrary to Merton's ethos of science that scientific careers should be "open to talent" unaffected and uninfluenced by such personal characteristics as gender and race (Merton, 1942). Further, theorists have argued that STEM fields are powerful institutions in our culture, and therefore reflect and ultimately reinforce the levels of societal (in)equity (Fox, 1999). Above all, the perpetuation of such inequities

are contrary to the democratic ideals and values of liberty, equality, and justice, an inconsistency that leads us on a seemingly never-ending quest to reconcile and harmonize values and actions.

How to leverage the potential benefits and contributions of diversity and create more inclusive environments has garnered significant attention among researchers across organizational settings. Over time, what has emerged is an increasingly nuanced understanding of the conditions under which diversity yields positive results on performance and productivity and greater insights into how culturally diverse teams work. (Cox & Blake, 1991; Page, 2007; Stahl, Maznevski, Voigt & Jonsen, 2010). To the extent that there is evidence showing positive results from culturally diverse teams, efforts such as the QEM PDM program represent critical strategic interventions that optimize the career outcomes of URM faculty, their capacity to meaningfully contribute to and be included in the scientific enterprise.

This paper provides a **broad overview of benefits, models and functions of workplace mentoring, and the mentoring circumstances of URM faculty in STEM**, both in terms of participation in mentoring relationships and assembling the evidence base. Specific examples from the QEM PDM program are included. It is anticipated that this paper will contribute to increased understanding of how mentoring relationships and models might serve as a mechanism/strategy to promote increased equity and greater participation of URM faculty in STEM through the design of interventions and the conduct of rigorous and robust research that documents the efficacy and effectiveness of these interventions.

MENTORING BENEFITS

An ever-increasing body of literature shows that workplace mentoring yields positive benefits. This evolving evidence serves to distill the complexities of mentoring as becomes a basis from which programmatic interventions can be developed. Thus, in positioning mentoring as an antidote to differential academic and professional outcomes, it is important to understand the range of benefits that are derived from these relationships and how they shape career outcomes for those engaged in mentoring relationships.

Although mentoring has a long dyadic tradition, i.e., protégés have a single mentor, a model of multiple mentors or mentoring networks are becoming much more common in the academe. Bozeman and Feeney (2008) offer a perspective on reconciling the single and multiple mentor model by underscoring the essence of the mentoring relationship. They point to the informal, person-to-person communication, and the individual tailoring, which makes mentoring dyadic irrespective of whether mentor and /or mentee are engaged in single or multiple mentoring relationships— mentoring is fundamentally dyadic.

Irrespective of the modality, there are generalizable benefits associated with mentoring. Both objective and subjective career benefits are linked with mentoring. Allen, Eby, Poteet, Lentz and Lima (2004) found that mentored individuals had higher objective career outcomes, which included compensation, and number of promotions than did non-mentored individuals. Mentoring also resulted in higher rated subjective career outcomes— increased career

satisfaction, more likely to believe in career advancement and more likely to be committed to their career (Allen et al., 2004). Mentored individuals were less likely to experience work alienation and lower turnover intentions when compared to non-mentored individuals (Noe, Greenberger, & Wang, 2002).

FACULTY MENTORSHIP MODELS

In the academic workplace, the level and scope of mentoring relationships varies significantly in structure, content, and associated career-related outcomes. The forms of mentoring relationships represent the context-specific choices and options that are available within a faculty's workplace and can be used singly or in combination.

Mentoring relationships can be structured as formal or informal, which signify the way the relationship is initiated, its structure and processes (Ragins & Cotton, 1999). Formal mentorships typically involve assignments by a program coordinator via an application process. The QEM PDM program recruited and assigned six (6) research mentors based on disciplines of participants and QEM's prior knowledge of their experiences in STEM. A study of the effects of formal and informal mentoring relationships in various gender-dominated occupations: engineering (male-dominated), social work (female-dominated), and journalism (gender-integrated), showed that informal mentors were viewed as more effective than formal mentors (Ragins & Cotton, 1999). Formal mentoring elicits concern for both mentor and mentee relative to the assignment process, which ignores interpersonal aspect of the relationship. The programs also face the added challenge of managing a third party, the direct supervisor along with mentor and mentee relationship (Blake-Beard, 2001). Greater importance is placed on mentoring traits than mentoring behaviors or functions. Demographic traits (i.e., gender, race, rank, age) as well as personality, experience, power and caring have been found to be important (Smith, Howard, & Harrington, 2005).

Issues of diversified mentoring (Ragin, 1997) that involves same and cross race and gender mentoring are likely salient for URM academic faculty. The question about whether women and minorities experience mentoring differently is a recurring one that has produced contradictory findings. W. Smith, J. Smith, and Markham (2000) reported "no differences in the levels of career and psychosocial behaviors exhibited in diversified mentorships when compared to homogeneous mentor relationships." These more recent findings contradict the earlier ones of (Thomas, 1990; Ragins & McFarlin, 1990), which showed differences across heterogeneous vs. homogeneous mentoring relationships.

Informal mentoring relationships develop based on mutual identification and the fulfillment of career needs. Perceived competence and interpersonal comfort have shown to be an important part of the selection process in mentoring relationships. Mentees report that mentors provide more psychosocial support in informal mentoring relationships compared to mentoring in formal programs. Those receiving informal mentoring, also report greater satisfaction with their mentors than formal mentoring pairs (Ragins & Cotton, 1999). Given that mentoring relationship initiation in informal mentoring is determined by the individuals involved, mentors tend to be selective in regards to whom they agree to mentor. Typical review criteria include competency levels, motivation, potential, and learning style (Ragins & Cotton, 1999).

In the past, a traditional mentoring pair involved a mentor and mentee that agreed to work within a mentorship relationship. The mentor tended to be older than the mentee, and the pair was most often within the same department (Boice, 1992). While the traditional mentoring relationship continues to work for some, the nontraditional mentoring seems to work for others. For example, technology helps people who normally would have a hard time finding a mentor.

E-mentoring is a way to increase access to mentors (Packard, 2003). Headlam-Wells, Gosland, and Craig (2005) found E-mentoring to be a helpful career development tool for professional women in the UK. Peer mentoring has positive effects for both the mentor and the mentee in various aspects including, interpersonal skill development, increased patience, and better time management (Budge, 2006). A new approach for mentoring minorities (Peer-Onsite-Distance), involves peer and faculty mentors who help provide guidance related to career goals, resources, and interactional skills the URM medical school faculty need (Lewellen-Williams, et al., 2006).

Hanover Research (2014) examined effective faculty mentorship models and identified the successful elements. The classification schema includes seven models, several of those mentioned above. These span the gamut from traditional one-to-one mentoring to less traditional group and team mentoring, involving multiple mentees or mentors as well as peer mentoring and nontraditional/emerging forms such as e-mentoring, informal mentoring, and reverse mentoring (where the junior faculty member has more content-specific experience or knowledge than the senior faculty member).

Across all models seven factors related to success were identified, which can be instructive in the design of mentoring interventions and programs. These included "support from top-level administrators, integration within a more comprehensive strategy for faculty development, a voluntary participation policy, participant involvement in the pairing process, the availability of resources to assist mentorship relationships (i.e., an orientation session), and the establishment of clear mentorship goals and a framework of expectations for the relationship." The QEM PDM program featured all but one of these factors: research mentors were assigned to participants without their involvement.

Among the varied approaches and models to creating mentoring relationships, what is missing from this categorization is developmental networks or relationship constellations

*"... examined **effective faculty mentorship models** and identified the successful elements. ..."*

*"Across all models **seven factors related to success were identified,** which can be instructive in the design of mentoring interventions and programs. ..."*

***"The QEM PDM program featured all but one of these factors** ..."*

*"For minorities, having **a social network that encompasses multiple relationships** is important for professional and personal development, particularly in challenging environments."*

(Higgins & Kram, 2001), which are viewed as advantageous for the career advancement of URMs. For minorities, having a social network that encompasses multiple relationships is important for professional and personal development, particularly in challenging environments (Thomas & Higgins, 2001).

MENTORING FUNCTIONS

Kram's mentor role theory (1985) identifies two broad categories of mentor functions. These include career development and psychosocial functions. The former helps mentees' advancement in the organization through a mentor's sponsorship, coaching, protection, challenging assignments, and exposure. The latter relates to the interpersonal components and focuses on mentee's sense of competence, self-efficacy, and professional and personal development through acceptance and confirmation, counseling, friendship, and role modeling.

Allen et al. (2004) suggested that career mentoring is just as important for positive job and career attitudes as is psychosocial mentoring. Career functioning mentorship depends on the mentor's position and influence in the organization. Psychosocial mentoring relies on the quality of the bond and the psychological attachment. A mentor could have many different functions depending on the mentee's needs and comfort level. A predominantly psychosocial functioning mentor relationship has been shown to increase a mentee's personal growth, identity, self-worth, and self-efficacy (Ragins & Kram, 2007).

MENTORING AS ESSENTIAL TO ACADEMIC/CAREER SUCCESS FOR URM

Turner, González, and Wood (2008) conducted a comprehensive review of the literature of faculty of color in academe and established the transcendental importance of mentoring across time frame and all contexts—national, institutional, and departmental on the persistence of these faculty. They noted the presence of mentors along faculty's career path as a leading factor that contributes to the growth and development of faculty of color, specifically and all faculty in general. Recognizing mentorship's importance, they indicated that mentorship opportunities should be widely available at the departmental, institutional, and national levels. Jackson (2002) calls for the development of mentorship programs at HBCUs for African Americans where senior faculty take junior faculty under their wings. Moody (2004) has emphasized the importance of departmental policies and programs on creating environments of support for URM faculty.

While the importance of mentoring for African American faculty has long been recognized (Holland, 1998), there remains a paucity of information and empirical studies related to faculty-to-faculty mentoring for this group. Tillman (2001) observed that "current discussions of faculty-to-faculty mentoring do not fully address complexities that may contribute to the dynamics of the mentoring relationship for African American faculty." Zambrana, Ray, Espino, Castro, Cohen and Eliason (2015) commented that "despite the crucial role of URMs in the academic workforce, most efforts to explore the academic lives of URM faculty are captured mostly in anthologies of small case studies and auto-ethnographic narratives."

A VITAL RESOURCE: QEM PDM PROGRAM

The QEM PDM program has been a responsive contributor to both the knowledge and practice of mentoring in the following ways.

- Production of an Anthology in which 10 of the 12 participants each wrote an article sharing their experiences and insights about their involvement in the program, thus adding to "small case studies."

- Development of a Career Advancement Plan, a tool that both QEM staff and research mentors used to assist participants to set career advancement goals and to track progress on objectives to meet goals. To date, all but three participants have achieved promotion and tenure.

- Produced a Research Mentoring Guide for replication and adaptation at HBCUs.

CONCLUSIONS AND IMPLICATIONS

Workplace mentoring has been established as a long-standing and widely recognized system that supports faculty progression and advancement, albeit seemingly unequally distributed across racial and ethnic groups. Thus remaining on the table is the question about how to more fully and robustly advance the evidence base from which programmatic interventions can be developed and ultimately to identify best practices for the mentorship of URM faculty in general, and STEM in particular. Pertinent questions that can enhance our understanding of mentorship for URMs includes, but are not limited to why mentoring is effective, which strategies work best, what are the components that need consideration when designing mentoring interventions, what evidence do we have to support unique mentoring interventions for URM junior faculty members?

On the research side, the lack of studies focused on URM faculty-to-faculty mentoring forces us to rely or make inference from studies on other populations and contexts. To advance evidenced-based mentoring for URM faculty it is important to continue to use qualitative methods especially where program interventions are small – e.g. case study design, conduct cross-institutional or national studies to increase sample size of URM faculty in order to conduct meaningful statistics (single organizational studies using quantitative designs can only make a meaningful contribution if the number of URM faculty are sufficiently large).

Additionally, funded mentoring program interventions should be accompanied by (mandated) structured research intervention designs, not just evaluations, to expand the evidence knowledge base of mentoring and to establish best practices and mentoring models for URM faculty. Finally, concerted efforts should be made to increase the visibility and accessibility of the scholarly work related to URM mentoring so that it can inform programmatic interventions and research studies.

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Establishing and Maintaining a STEM Research Agenda

by

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ABSTRACT

Establishing and maintaining a research agenda is critical to the success of early career faculty members in STEM at all institutions and particularly vital for early career faculty members at Historically Black Colleges and Universities (HBCUs) and other small minority-serving institutions (MSIs). The purpose of this article is to present insights into this process from mentors to STEM faculty participating in the Quality Education for Minorities (QEM) Network Professional Development and Mentoring (PDM) Program. There are several steps involved in establishing and maintaining a STEM research agenda. One must identify the type of research to be pursued and the funding resources that are available. Included in this article is discussion concerning the acquisition of research equipment and the identification and consideration of colleagues, collaborators, and mentors as valuable resources in the process of establishing and maintaining a STEM research program. Steps for grant submissions are considered, including utilizing mentors to review proposals, attending grant writing workshops, and serving on grant review panels.

One of the major challenges STEM faculty members face is setting up a research program. Productivity, as shown through a faculty members' publication record, is the outcome of the research program, and is the primary consideration in decisions concerning promotion and merit pay [1, 2]. When interviewed, faculty overwhelmingly deemed research as the most important criteria in tenure decisions [1], although specific criteria concerning the quantity of publications may vary [3]. Consequently, establishing and maintaining a STEM research agenda is essential for career development [4].

The purpose of this article is to present the authors' insights into this process as research mentors to early career STEM faculty members participating in the Quality Education for Minorities (QEM) Network's National Science Foundation-supported Professional Development and Mentoring Program (PDM), and as consultants for QEM's Major Research Instrumentation (MRI) Proposal Development Workshops. The significance of mentors to early career STEM faculty members cannot be overstated. Mentors within and outside one's institution can be chosen to provide support for faculty members as they develop their research, write grants, and confront other issues as they arise [5]. Support for career training and research practices has been shown to significantly increase the research productivity of mentees [6].

PLANNING AND PURSUING A RESEARCH AGENDA

As early career faculty plan their research agenda, the following questions should be considered: Is the research applied or basic? Is there a clinical component? The answers to these questions will determine the laboratory space and equipment that will be needed and the certifications that must be obtained from the institution. If these questions are answered prior to accepting a faculty position, then the faculty member is ahead of the game, since the answers were likely major factors in their decision to accept the current position.

Faculty participants in the PDM program attended seven PDM workshops over the project's five-year period, including a QEM Major Research Instrumentation (MRI) Proposal Development Workshop. The Workshop focused on many of the initial questions involved in initiating a STEM research agenda. For example, consider the major pieces of equipment needed to pursue a research agenda. One helpful hint is to make a list of the equipment needed, and to prioritize the items according to importance. Also, one should consider the amount of space that will be needed to accommodate equipment. Does the department or college have shared-use facilities? If so, this will save money, potentially allowing you to purchase more on your list. Are there colleagues in other departments within the college or university who have the equipment needed? Consider asking them to collaborate. Also consider the proximity of your institution to other institutions that may have the resources that you need. Determine whether the needed equipment is a part of a fee-for-service center, or whether the investigator who controls the equipment is open to collaborative arrangements in exchange for equipment usage.

Identifying funding sources for your research

The early career faculty's research interests will determine where they begin to look for extramural funding. QEM consultants reviewing single-page National Science Foundation (NSF) MRI project summaries from early career STEM faculty members in workshops, often encountered excellent proposals that were more appropriate for submission to other federal agencies. Federal grant-making agencies are listed at www.grants.gov [7]; 26 agencies are listed, along with the number of current grant opportunities. Also you will find that most of the agencies are subdivided into several offices or institutes. For example, the Department of Health and Human Services is divided into 17 subunits, including the National Institutes of Health (NIH) and the Centers for Disease Control. It will be important to identify departments whose mission and goals align with the early career faculty research interests and focus. The missions and goals for each of the agencies can be found on their websites; be sure to read them carefully.

The NIH and NSF have programs for the purchase of major instrumentation. The NIH program is the S10 Biomedical Research Support Shared Instrumentation under the Funding Opportunity Announcement PA-15-088 [8]. As stated in the announcement, "The Shared Instrument Grant (SIG) program encourages applications from groups of NIH-supported investigators to purchase or upgrade a single item of expensive, specialized, commercially available instruments or integrated systems that cost at least $50,000. The maximum award is

$600,000. Types of instruments supported include, but are not limited to: X-ray diffraction systems, nuclear magnetic resonance (NMR) and mass spectrometers, DNA and protein sequencers, biosensors, electron and confocal microscopes, cell-sorters, and biomedical imagers." [8]
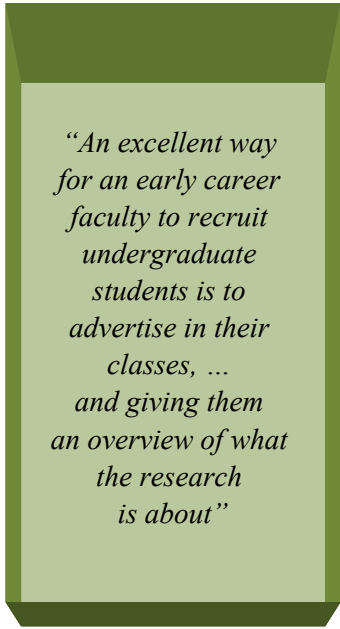
The Major Research Instrumentation (MRI) Program is funded by NSF and has provided technical assistance to faculty at minority-serving institutions through awards to QEM. "The MRI program assists with the acquisition or development of a shared research instrument that is, in general, too costly and/or not appropriate for support through other NSF programs. The program does not fund research projects or provide ongoing support for operating or maintaining facilities or centers." [9] Awards are available for the purchase of equipment costing from $100,000 to $4 million but MSIs are eligible for MRI awards less than $100,000 as well.

Although these federal agencies may be the primary sources for extramural funding of research, other funding sources are available. Many times these non-federal funding sources allow you to obtain the preliminary data necessary to apply for larger, federal grants [10]. There also may be institutional intramural research funds available for beginning faculty members. These awards generally will not fund large equipment purchases. Contact the institution's Office of Sponsored Programs for more extensive lists of funding sources.

Recruiting laboratory personnel

Identifying personnel who can effectively work on research projects will enhance early career faculty's productivity. Many of the following suggestions arose from presentations at the QEM MRI Proposal Development Workshops as well as the PDM's program's multi-year workshops for participants. When starting out, it is likely that personnel from undergraduates in your class, or who are otherwise interested in scientific research will be available.

"An excellent way for an early career faculty to recruit undergraduate students is to advertise in their classes, ... and giving them an overview of what the research is about"

An excellent way for an early career faculty to recruit undergraduate students is to advertise in their classes, letting the students know that they are interested in their help and giving them an overview of what the research is about. Interested undergraduate students could begin their laboratory experience with a semester of an independent study. It is important that they undergo chemical, radiation, and laboratory safety training, and how to safely handle hazardous waste. The institution should provide this training through their Environmental Safety Division (or a similar unit). Once the students complete this training, they are ready to begin working in a laboratory and learning specific research methods.

The QEM PDM program identified early in the project that early career faculty needed guidance regarding the training of undergraduate research assistants. A summary of advice provided during these sessions follows. Start with basic laboratory skills; this includes basic skills that many lower level undergraduate students have not acquired, including the use of micropipettes, the use of a UV/VIS spectrophotometer, and the generation of a protein standard curve. If the students show that they are proficient in these tasks, then they can be progressively introduced to the more complex research methods. Teach them to properly record their laboratory work in their notebook and teach them to use routine software for data analysis. If they successfully complete these assigned tasks during the semester, then they can be invited to continue working in the laboratory the next semester.

One consideration for the undergraduate student researcher is the amount of time that they are able to commit to research. If the department will allow it, it is helpful to have specific course listings for undergraduate research. In this way, students who are registered for a clearly designated research course gain the benefit of accumulating credit hours toward their graduation while having their research experience documented in their transcript. Likewise, the researcher has the benefit of being able to establish a minimum number of hours that they expect the students to work in the laboratory. If the department does not have a mechanism in place to allow research for credit, it is very important to establish clear guidelines with the undergraduate students at the onset of the research experience. Give them a minimum number of hours per week that they must be physically in the laboratory, and also give them a minimum number of days that they must be present. If the research is not for credit, establish a mechanism for monitoring the student's progress and for providing them with feedback in a timely manner.

MAINTAINING A STEM RESEARCH AGENDA

Maintaining a research agenda will be important in early career faculty's success as a STEM faculty member. There are several key elements that will help in this process, including becoming an active member in scientific societies; identifying, establishing, and maintaining collaborative arrangements with colleagues nationally and internationally; serving on grant review panels; and obtaining funding for research. This section will discuss components in the pathway to funding research.

The institution is committed to helping their faculty obtain grant funding. Consequently, get to know the people that constitute the grant submission pipeline and are present in your institution's Office of Sponsored Projects. During the submission process, establish clear lines of communication so that issues that may arise can be identified and corrected. Make sure to read the newsletters and any other correspondence from the Office of Sponsored Projects. These communications often detail significant changes to grant submission processes or provide information about new funding sources.

It is also important to participate in grant writing workshops; these may be provided by your institution through the Office of Sponsored Projects. If your institution has no workshops scheduled, then look for them at nearby institutions. NIH and NSF both sponsor
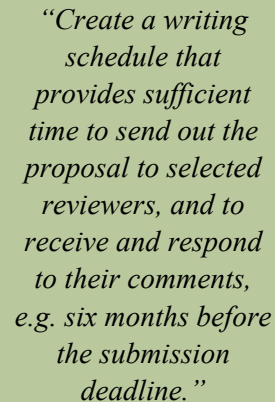
workshops at universities across the United States that are free and open to the public. These workshops are very helpful in discussing the most effective ways to communicate research ideas to fellow scientists. Often they are taught from the perspective of scientists that sit on peer review panels; others provide clear examples of poorly written and well written research proposals. The workshops also provide insight into the process of grant review. At the workshops for PDM early career faculty and QEM's MRI Proposal Development Workshops, and reiterated here, participants were strongly advised to volunteer to serve on grant review panels to which they will submit proposals in the future. The experience associated with the responsibility for reviewing and scoring the proposals and participating in the review panel discussions will be invaluable to composing research proposals.

Developing your grant proposal

Read the announcements for funding opportunities carefully as they provide detailed instructions on how proposals must be formatted, and they clearly state the eligibility requirements for the specific mechanism. The announcements will typically describe the targeted areas of research, and will provide the dates for the submission deadline and scientific review. The announcement will also provide the duration and maximum dollar amount of the award. Use the announcement to identify the common research interests with the participating organizations.

Identify colleagues that will review the grant proposal. Use your QEM consultants and research mentors, contacting them about the possibility of reviewing a proposal draft. Many institutions may have a formal process for reviewing grant proposals prior to submission. In this case, be sure to allot enough time for the institutional review panel to review your proposal. Follow their suggestions after you receive feedback, since this will likely increase the chance of success.

"Create a writing schedule that provides sufficient time to send out the proposal to selected reviewers, and to receive and respond to their comments, e.g. six months before the submission deadline."

To begin the writing process, follow the suggestions received from the grant-writing workshops. Start with the Specific Aims page for NIH, or one-page Project Summary for NSF. Careful attention to the composition of this page is important because it will help to distill the proposal into a clear, concise presentation. Create a writing schedule that provides sufficient time to send out the proposal to selected reviewers, and to receive and respond to their comments, e.g. six months before the submission deadline. Contact the Program Officer associated with the grant award that will receive the proposal. Start with an email requesting a time to speak with him/her. An example of an appropriate email follows:

"Dear Dr. _____,

I am preparing a grant proposal for submission to (*the specific program*) in response to (*the program announcement*). I wish to speak with you briefly about my proposal, and any insight you may have concerning its review by the most appropriate review section.

I would like to schedule a time to speak with you by phone, and I have attached my Specific Aims page for your consideration.

Thank you in advance for your time.

Sincerely,"

Note that the Specific Aims/project summary page is included as an attachment, giving the program officer an idea of the direction in research and allowing him/her to determine if the idea is the right 'fit' for the Program. The follow-up discussion will likely include the program officer's assessment of how appropriate the idea is for the program and whether there is another funding mechanism or program to consider. PDM participants found their research mentors were very helpful in suggesting and assisting with contacts to program officers.

Follow the timetable established by the institutional review panel for their review of your full proposal. The NIH has online instructions for planning and writing grant proposals [11]. Although presented by the NIH, it is an excellent guide that could be generally applied to a general proposal planning and writing process. NSF provides the Proposal & Award Policies and Procedures Guide (PAPPG) for the same purpose.

Your responsibility post-award and beyond

Once the grant has been received, make sure that work is performed. It is important to submit your deliverables in a timely manner. It is essential for future funding. Follow the data management plan; backup digital data; and keep laboratory notebooks associated with the research in a safe place. Establish the parameters and a timeline for publishing the results from each of the studies discussed in the research strategy. In pursuing the research strategy, it is likely that new observations for which hypotheses can be generated will evolve; develop these into new grant proposals. Become active in scientific societies and present research findings at their annual meetings. These meetings can become a source for graduate students, postdoctoral fellows, and prospective collaborators interested in the research area.
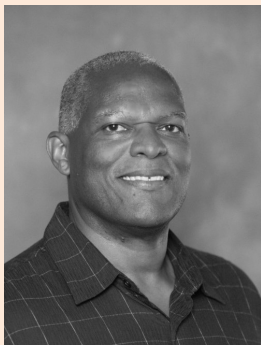
SUMMARY

The process of establishing a STEM research agenda begins with deciding the type of research program to develop, and gaining access to, or obtaining the equipment needed for the program. As confirmed in the QEM PDM program, for STEM early career faculty at HBCUs, establishing professional relationships with research collaborators and mentors will be important for building the research program, as will obtaining research funding. Federal and non-federal funding should be pursued for grants to further ones research agenda. Successful grant submissions can be ensured by using mentors to review your proposals, attending grant writing workshops, and by serving on grant review panels. Maintaining the STEM research agenda will be facilitated by successfully training laboratory personnel, by establishing productive collaborations, and by becoming active in disciplines' scientific societies.

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Integrating Research into Teaching for Enhanced Recruitment and Training of Undergraduates

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ABSTRACT

With the growing concern about the quality of the U.S. workforce to meet economic challenges, there is an increased pressure by business and political leaders on institutions of higher education to train students who think critically, solve problems, and communicate effectively in interdisciplinary teams. Funding agencies now use integration of research and teaching as a criterion for funding. This article provides some ideas on how to integrate research into teaching along with ways to engage and mentor undergraduates in research. A personal experience as an early career faculty at a HBCU is shared and some strategies to apply the ideas suggested. The strategies presented can help early career faculty at HBCUs balance research, teaching, service, and family needs, and help students to develop skills, knowledge, and competencies that they need to meet the rapidly evolving demands of life, work, and global citizenship in the 21st century.
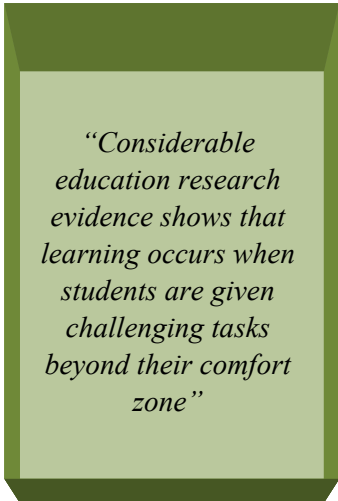
1. INTEGRATION OF RESEARCH IN TEACHING

Integrating research into undergraduate education has become a key criterion in funding decisions by the National Science Foundation (NSF). One of the main challenges for academic institutions today is to remain the backbone of economic growth by being sources of new knowledge, innovative thinking, and skilled personnel. Concern with workforce quality and technological innovation has moved higher education into the forefront of national debates with increasing pressure from business and political leaders who insist that colleges and universities help meet the challenges of a new economy(Barrow, 1996). Universities place increasing demand on faculty to do research and obtain external funding. There also are demands for increased public accountability on universities to strengthen the connection between research and teaching (Commission, 1998; Jenkins, 2005; Ruairc, 2015; Zubrick, 2001).

Linkage of research and teaching in academic work makes university education distinctive, and the most effective teachers are those engaged in research and scholarship that are able to transmit the excitement of science into the classroom (Alfred Posch, 2006; Amaratunga & Senaratne, 2009; Darden, 2003; Schroeder & Weiss, 2008). The relationship between research and teaching is often controversial, with profound differences existing between different disciplines. For example, (Colbeck, 1998) observes that it is difficult to bring current research results into the classroom in the physical sciences and engineering

because the hierarchical knowledge structures in those disciplines put most research well over the heads of most undergraduates, and the rigidly constrained curricula limit opportunities to bring in new material. This may not always be the case. For example, in physics, most of the basic principles are presented in the introductory courses. In their junior and senior years, physics majors usually go into more depth on the major topics covered in the introductory courses and consider applications. The major difference is the mathematical complexity of the upper-level courses.

Therefore, in principle, students with good math background who have done well in the introductory courses can understand results of and be engaged in current research. The literature also shows that students' interest in STEM courses is enhanced when they see the applications of the course material in real life and as it is applied in modern research (Movahedzadeh, 2011). Retention of students in STEM areas can be facilitated by education that integrates research. Students are strongly attracted to issues and findings with societal relevance (National Academy of Sciences, 2005) and show increased enthusiasm about problems of global importance that have practical consequences (Golding, 2009).

"Considerable education research evidence shows that learning occurs when students are given challenging tasks beyond their comfort zone"

The integration of research and education could be promoted by creation of a research and education environment with research programs that provide multi-disciplinary, team-driven, and system-oriented educational opportunities for students (Desai et al., 2008; Tranter, 2007). Complexity of the problem should not be a reason not to integrate research into the classroom. In fact, it should be the very reason to do so. Considerable education research evidence shows that learning occurs when students are given challenging tasks beyond their comfort zone (Pelliccione, 2004; Vygotsky, 1978). Authentic science engagement (e.g., via discovery-based research courses or independent research on faculty projects, as opposed to standard laboratory courses) encourages individual ownership of projects and provides "a direct way for students to experience real discovery and innovation and to be inspired by STEM subjects" (PCAST, 2012).

Common misconceptions exist regarding education and research that were discussed at a National Research Council workshop (Avila, 2003): (1) Instructors often assume that the way they learned is the preferred way to learn; (2) Research faculty often think involving undergraduates is a distraction and believe undergraduates cannot do research; and (3) Scientists often do not think that they have the time to learn about what education experts have to offer. This attitude ignores the wealth of research in cognitive sciences. Avoiding these misconceptions and instead looking toward solutions would aid faculty in their efforts to integrate research and education.

Teaching should enhance the skills, knowledge, and competencies students will need to meet the quickly evolving demands of life, work, and global citizenship in the 21st century. Beyond passing exams and assigning grades, teaching and learning should focus on core transferable skills that include: (1) critical thinking and complex problem solving. According

to (Fisher, 2003), the key function of education is to teach students to think critically, creatively, and effectively; (2) working collaboratively; (3) communicating effectively across disciplines and cultures; and (4) learning how to learn and wanting to learn. These are skills that would allow graduates to be effective employees in the labor force and are developed through the integration of research and education. Using the experience from Australia (Brew, 2010), suggests that once faculty members begin to base the design of curriculum on research and scholarship and engage students in a variety of research based approaches, student skills improve.

A number of conceptual models propose ways of bringing teaching and research together in the learning environment**.** Griffiths (2004) proposed four models of the links between teaching and research:

1) *Research-led teaching* - In this approach, the content of a course is selected based on the special research interests of the faculty member teaching the course with emphasis on understanding research findings rather than research processes. Opportunities for students to actively engage in STEM are optimized by direct experiences in research laboratories and field settings, asking questions, collecting data, making interpretations, and developing scientific skills (AAAS, 1989).

2) *Research-oriented teaching* – In this approach, more emphasis is placed on understanding the processes by which knowledge is produced. Research and teaching can be integrated more effectively by introducing students in their classes to the research process and research skills.

3) *Research-based teaching* - In this approach, courses are designed largely around inquiry-based activities, rather than on the acquisition of subject content. The experiences of faculty members in the processes of inquiry are highly integrated into the student's learning activities, and the division of roles between teacher and student is minimized. It has been hypothesized that students who learn by inquiry-based teaching strategies will show a greater understanding of content and concept acquisition than students learning through expository learning (Brown, 1997; Rutherford, 1964, 2005).

4) *Research-informed teaching* - This approach involves systematic inquiry into the teaching and learning process itself. The connection between faculty research and undergraduate teaching is broadened to include forms of scholarship other than conventional frontier research, such as research on teaching and learning (Bransford, 2000), motivations for student learning (Edelson, 2001), and exploring the non-cognitive aspects of learning such as growth mindset, goal setting, persistence, and delayed gratification (Yeager et al., 2014; Yeager & Dweck, 2012).

If faculty members study innovative instructional methods, evaluate the extent to which the methods improve knowledge acquisition and skill development, apply the outcomes to their own courses, and publish relevant findings that can be used by other instructors to improve their teaching, it is reasonable to hypothesize that improved learning should result.

In terms of education research, the physics education community represents a potentially formidable agent of change. There have been efforts to make the study of physics a more challenging, engaging, and productive experience for all students. Most of the efforts in physics, until very recently, have been dominated by small groups of curriculum developers. They have empirically shown that the reforms improved student learning in introductory, college-level STEM courses. About 24 research-based instructional strategies have been reported in literature (Becker, 2011; Beichner, 2004; Belloni, 2004; Brewe, 2008; Catherine Crouch, 2007; Christian, 2006; Etkina, 2006; G. M. Novak, 1999; P. Heller, T. Foster, and K. Heller, 1997; P. Heller & Hollabaugh, 1992; Hestenes, 1992; Mazur, 1997; R Beichner, 2007; Redish, 2004; Sokoloff & Thornton, 1997; Van Heuvelen & Maloney, 1999). Early career faculty should take time to use research-based teaching methods that are appropriate to their campuses by creating a culturally sensitive learning environment. Making classrooms more "culturally sensitive" is to create lesson plans that are rich with information about the diversity in their community (Morris & Mims, 2012).

Universities should place greater emphasis on pedagogies that are student-focused, treating students as participants with emphasis on research processes and problems. Research-led teaching is not just for high-performing students or just for elite institutions, but all students at all institutions need research-enhanced and research-led teaching and learning to be successful in the 21st century economy.

Best practices employed by the author include use of capstone or senior project courses to integrate research in teaching. This involves literature projects, or experimental projects or interdisciplinary team-based projects. Students learn to communicate their results through report writing and presentations. Students can be taught about current research through lectures and mandatory attendance of seminars or providing assignments requiring evaluation of research papers. When appropriate, examples from an ongoing research can be incorporated as an example and application of a topic covered in a course, to acknowledging that there is no "one best way" to embed research in teaching across all faculties, departments, and disciplines.

"Best practices include use of capstone or senior project courses to integrate research in teaching. This involves literature projects, or experimental projects or interdisciplinary team-based projects."

2. ENGAGING UNDERGRADUATES IN RESEARCH

Engaging students in research projects is frequently cited as an effective way to link faculty research and undergraduate teaching. Research experiences for undergraduates (REUs) have advantages for students, universities, and industry. Benefits of REUs for students include improved skills in problem solving, analysis, writing, communication, and managing time (Emerson, 2007; Millspaugh & Millenbah, 2004; Russell, Hancock, & McCullough, 2007). Institutions benefit because recruitment and retention of good students is increased as a result of undergraduates having research opportunities (Lanza, 1988). Major corporations also are using REU experiences as hiring criteria (Karukstis, 2009).

Undergraduate student research involvement has correlated positively with students' attainment of the bachelor's degree, commitment to the goal of making a theoretical contribution to science, and self-reported growth in preparation for graduate or professional school (Astin, 1994; Heath, 1992). A significant positive correlation between undergraduate research involvement and pursuit of graduate study for both Caucasian and African American students is reported by (Fitzsimmons, 1990; Heath, 1992). REU experiences promote cognitive gains (Rauckworst, 2001) and intellectual development (Felder, 2005). Involving undergraduate students in research also promotes the acquisition of research-related skills (Kardash, 2000; Lopatto, 2004b; Ryder, Leach, & Driver, 1999; Seymour, Hunter, Laursen, & DeAntoni, 2004; Zydney, 2002). Seymour et al., (2004) report student claims that research helped them "think like a scientist," and (Lopatto, 2004a) reports students' self-assessed gains in understanding the research process as a result of their own research experiences, lending substantial support to the proposition that undergraduate research is an educational and personal-growth experience with many transferable benefits.

The different challenges in stimulating and sustaining increased undergraduate research at both public and private institutions are provided by (Merkel, 2003). The major limitations are resources and the rising expectations for faculty research productivity. This latter restriction is increasingly addressed by relying on doctoral students and research staff to provide undergraduate research supervision and mentoring (Katkin, 2003).
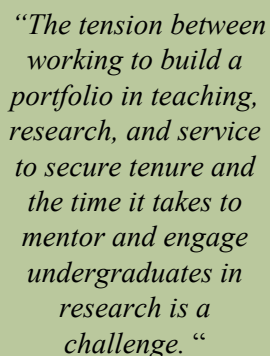
The author's experience as an early career faculty at North Carolina A&T State University (NCA&T) is similar to that of many early career faculty at HBCUs. When he joined NCA&T 23 years ago, he was hired to establish a research program in physics <u>without any start-up support</u>. He was expected to continue writing proposals and secure funding. The easiest way to jump-start his research at low cost was to write a theoretical computational research proposal. He wrote his first NSF proposal in his first year, which was declined. In order to continue conducting research, he contacted his postdoctoral advisor to see if he had funding to support him over the summer. Coincidently, his advisor also was considering having him back in the summer to finish work he had started before he took the position at NCA&T. This gave him a chance to publish and also find the time and resources to improve the declined proposal.

The resubmission was declined again. But he managed to maintain collaboration with his postdoctoral advisor and secured the use of the computational resources to be able to continue with his theoretical research and be able to publish. His ultimate goal was to set up an experimental research laboratory which required substantial funding. To be able to develop a competitive proposal, he needed to spend time in some established laboratories at research universities. For his second summer he was able to use connections through his Ph.D. and postdoctoral advisors to obtain a summer research opportunity at a Research One university and a national lab. This also opened up opportunities for two of his undergraduates to join him and work with him. One of the students went on to earn a Ph.D. in physics and the second was his first M.S. student at NCA&T. The summer allowed him to double his efforts and submit the theoretical proposal for the third time, as well as work on the National Science Foundation Faculty Early *Career* Development (CAREER) proposal. The summer opportunities helped

him publish and submit conference abstracts. These opened more opportunities for summer research at Oak Ridge National Laboratory. During that summer, he received his first NSF award from the Quantum Chemistry division, and the CAREER award was declined.

The NSF funding provided him support for two undergraduate research assistants. He also leveraged the Louis Stokes Alliances for Minority Participation (LSAMP) program support to get more students involved in his research. The graduate program in physics was approved the same year, and he also was able to recruit the first graduate student. In his fourth summer, he was able to secure summer and academic year support for his first graduate student at Oak Ridge National Laboratory to continue the experimental project he started the previous year. He involved undergraduates in campus research while working on the resubmission of his CAREER proposal.

The fifth summer was his most successful year. He received the CAREER award. The funding process required cost sharing from the university. The budget for instrumentation in the proposal exceeded $80,000. NSF required 50-50 cost sharing for everything above $80,000. Securing this matching cost from the university was a major challenge. He was able to minimize the matching cost requirement through equipment loans from Oak Ridge National Laboratory and from the laboratories of his former advisors and collaborators.

> *"The tension between working to build a portfolio in teaching, research, and service to secure tenure and the time it takes to mentor and engage undergraduates in research is a challenge. "*

Even though NCA&T has grown to be a research university and provides some modest start-up support to new faculty, it was not the same in his first 10 years. He had to build everything from scratch purely through external funding and collaborations. When funding is available developing undergraduate research involves recruitment, setting clear goals for the students and faculty, mentoring, and proper design of the educational experience.

The book, *How to Get Started in STEM Research with Undergraduates* (Schuh, 2013), provides a general discussion of these special issues and discusses ways to deal with them. Examples of such issues include: setting up and managing a research laboratory; designing student research projects; working with administrators; writing successful grant proposals; integrating research into the classroom; dealing with information management; and making optimal use of the primary literature.

Recruiting and engaging undergraduate students in research by early career faculty at HBCUs has its own challenges. The tension between working to build a portfolio in teaching, research, and service to secure tenure and the time it takes to mentor and engage undergraduates in research is a challenge.

Mentoring undergraduates without the help of graduate research assistants is challenging in predominantly undergraduate institutions, as most HBCUs are. Students can be engaged in research on campus if the faculty has research funding, or by traveling to national labs with a faculty advisor, or by being part of collaboration, if the faculty is engaged in

collaborative research with faculty at other schools. In all cases, the key elements in engaging undergraduates in research are summarized below:

2.1 Recruitment The best strategy is recruiting students from your own classes, identifying students who are curious and ask questions that go beyond the level of the course. Given the competition for limited research positions, senior undergraduates with high GPAs are often given preference (Merkel, 2001). This criterion often misses underrepresented groups and a critical window during the freshman/sophomore years to motivate students to pursue research careers (Sedlacek, 1998) and enhance retention in science majors (Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998; Melton, Pederson-Gallegos, Donohue, & Hunter, 2005). It is reported (Dahlberg, 2001) that students with a high GPA are not necessarily the best researchers, while students with average GPAs sometimes excel in a laboratory setting. Often, low-income students have to work to be able to attend school, and the demands of work can interfere with their schoolwork and impact their GPA. Very strong students can be left out if GPA is the only criterion used in student recruitment. In the absence of graduate students, it is important to train the mentors (usually juniors and seniors) and develop a pyramid structure where more experienced seniors will train the beginners to keep continuity.

2.2 Setting goals and expectations Despite the talent, effort, and money spent on the problem of underrepresented groups in science and mathematics, there has been minimal progress (Burciaga, 2007) ENREF_107. There is no single barrier that prevents underrepresented groups from going into the sciences—rather, there are many small hurdles, which no single person or group can eliminate entirely. According to a recent study, Black and Hispanic students are entering the STEM fields, but they are not earning enough credits to graduate in six years. The report, "Increasing the Success of Minority Students in Science and Technology" (Kim, 2006) examined six years of U.S. Department of Education data for 12,000 students who entered college in 1995. Black and Hispanic students were able to complete the STEM gate-keeper courses, but after the third year, a significant percentage of those students had dropped out. Only 62.5% of Black and Hispanic STEM students completed their coursework, compared to 87% of White students and 95% of Asians.

The initial steps for engaging students in research include the following:

- Establishing clear expectations with your student about work schedules, responsibilities, and communication channels.

- Evaluating the necessary background knowledge and skills that your student would need to complete the research task, and teaching these things explicitly to them. Even seemingly small gaps in knowledge can create big obstacles for students. Eliminating these gaps can be accomplished by providing supplemental short courses, independent study materials, and lectures related to the project during group meetings.

- Explaining that technical hurdles, disproven hypotheses, and dead ends are a normal part of doing research. Emphasize what can be learned through failures and setbacks

and how such setbacks inform future work. The need to persist and stay the course should be emphasized. While students often need a lot of support initially, the ultimate goal for undergraduate researchers is for them to be able to take ownership of their projects and to think independently.

- Recognizing that lack of questions does not mean that the student understands. Be proactive about catching areas of misunderstanding early to prevent larger problems later.

The expected outcomes of the research experience are:

- *Development of intellectual, technical, and personal skills.* The research experience should enhance students' intellectual growth and give them technical and personal skills that they would not have developed otherwise.

- *Exploration of career interests.* The research experience should give students a variety of opportunities to do work in a field so that they can determine whether they want to pursue further study or a career in that field.

- *An independent lifelong learning path.* The training should enable students to work in teams and to integrate new information into ongoing activities.

- *Development of non-cognitive skills*, self-efficacy, and the desire to learn.

- *Recognition of the value of the experience.* The research experience should help students understand the relevance of the experience and training to the real-life job environment.

- *Creation of personalized professional development plan.* The student development plan provides a way to engage students in their own personalized career and professional development process. The process of goal-setting, and achieving those goals would help students to avoid slipping through the cracks.

2.3 Project design and selection   The undergraduate research activity should be an integral part of the overall research goal of the faculty member and the research group. A graduate or senior undergraduate mentor should be assigned to each student or group of students. Care should be taken not to make undergraduates perform low-level scientific tasks to assist the graduate student but to treat them as equal partners with a defined independent project. The project design should include the following steps:

- *Identify and define project* Identify a project that can be completed within the constraints of time, equipment, logistics, and funding. The projects should be a subset or part of the overall faculty or graduate student project, but the undergraduate student should have ownership. Be understanding and realize that undergraduates are under tremendous stress at times for a number of reasons. They may have underestimated the workload and time commitment their classes require or they may be overwhelmed by the transitions faced in college and the responsibilities of adult life. The projects should be selected neither to overwhelm them nor to bore them. The goal is to get

them interested enough in the project so they can commit willingly to carry out the project and find time to do it. Discerning the level of knowledge and preparation that students bring to the research experience is critical.

- *Literature review* Once the problem and project are identified, mentors should guide students through the research literature.

- *Develop the research plan* This phase involves developing the hypothesis, determining feasibility with respect to time, resources, and level of expertise. One good strategy is to encourage students to develop research proposals and have their peers review the proposals.

- *Collect and interpret data* Properly interpreting data involves peer and one-on-one mentoring and encouraging students to compare their results with published values. Students should be trained in the proper handling of data, keeping a lab book and recording information, along with all the safety issues associated with the specific research.

- *Communicate the results* Providing a meaningful venue for presentations and setting up a mechanism for the review and critique of students' research results is needed. Students should be part of a regular research group meeting in which they are required to report their progress, discuss challenges, and participate in general scientific discussions.

2.4 Mentoring and advising   Mentoring is essential to promoting a positive attitude and understanding of the responsible conduct of research (Eby, 2007; Grogan, Eviner, & Hobbie, 2013; Harding, 2012; Johnson, 2007; Nutt, 2003). Mentoring also involves helping students understand the mechanics of successfully navigating the campus environment, completing a degree, and developing their own identity as STEM professionals. Advising is critical in helping students to articulate and achieve their academic goals and make progress toward their degree. Opportunities for mentoring offer the deeper psychosocial support that can assist students in becoming members of the community of practice.

Some excellent guides have been produced (Gray, 2008; Michigan, 2011; National Academy of Sciences, 1997), and the most widely circulated publication is an article entitled "*Nature's* guide for mentors" (Lee, Dennis, & Campbell, 2007). This article highlights many generic traits of good mentors, such as enthusiasm, availability, and being hard-working and inspiring. Key elements in mentoring include:

- *Mentoring is a shared professional responsibility of all scientists*. Research depends on effective communication, not just about the science but also about the practice of science standards of conduct, and ethical and social responsibility. A mentor should be willing to communicate the experience and the challenges he/she faced. A mentor's role is to provide advice, help, and encouragement - to guide rather than decide for the trainee.

- *A mentor teaches responsible conduct explicitly and by example*. Modeling good skills and behavior is a necessary element of mentoring. Mentoring involves both what is verbalized and what is demonstrated in practice. An absence of adequate mentoring can have significant consequences for the integrity of research. In their survey of 2,000 doctoral students, (Anderson, Louis, & Jason, 1994) found that departmental climate was the strongest predictor for misconduct. The importance of mentoring for training in the responsible conduct of research has been recognized in research studies (Douglas-Vidas J, 2001). Findings (Anderson et al., 1994) are consistent with the view that explicit mentoring serves to promote the responsible conduct of research and to reduce the risk of research misconduct.

- *A mentor is a guide*, helping in technical development; assisting with the job market; socializing in the political, ethical, economic, and social dynamics of academia; working in teams; and helping address special circumstances (e.g., issues related to gender, race, national origin, language, or disability).

For early career faculty the time commitment to support one-on-one mentoring for more than a few students is not easily compatible with the requirements of developing and sustaining an active research program while carrying a full teaching load and participating in the service required by all institutions. Finding the right balance is the challenge, and there are no universal solutions that fit all circumstances.

Despite the challenges, engaging undergraduates in research should start as early as possible and be part of the goal. Keeping an open eye for motivated and curious undergraduates, and taking the time to engage them in any of the research a faculty member is doing, is extremely rewarding, and the joy is often seeing these students blossom and grow as researchers with greater appetite to move on. Some suggestions to help engage undergraduates in research are:

a) Include enough undergraduate and graduate support in proposal budgets.

b) Volunteer to assume responsibility for the undergraduate research course. The time spent in engaging undergraduates in research will count as part of the teaching load.

c) Collaborate with groups who run NSF-funded REU programs or leverage LSAMP and Title III resources when available.

d) Train graduate students or senior undergraduates as mentors.

The key elements for engaging undergraduates in research are common to all STEM areas. However, among the STEM disciplines, physics has its own challenges. Even though physics is one of the core courses needed by all STEM majors, the growth of physics as a field lags behind the growth of all other STEM fields (NSB, 2006, 2008). The retention of students who have already made the choice to become physicists is also low (E. Seymour & Hewitt 1997; Hazari & Potvin, 2005). Even though physics education research specialists are often found in physics departments, the number of physics majors still remains low. According to the Statistical Research Center at AIP (AAS, 2013), over the past ten years, the number of undergraduate degrees awarded in all physics fields has increased by 38% and the

number of African Americans receiving these degrees has increased by 51%. Yet the number of African Americans receiving physics degrees is about the same as a decade ago, even though the number of physics degrees awarded has increased by 55%. Little progress has been made in increasing the percentage of minorities, despite a variety of focused efforts at the departmental and national levels. Historically Black Colleges and Universities (HBCUs) produce a disproportionate share of African American physics majors, but that production has decreased from 50% of the total a decade ago to about 40% of the total now. The top 10 producers of black physics baccalaureates are all HBCUs. Just 20 HBCUs produce 55% of black physics baccalaureates (Stassun et al., 2011; Stassun et al., 2010).

The development of a professional identity or appropriate subject-specific identity is a fundamental part of student development (Luehmann, 2007) and has a strong influence on retention and persistence of students in physics (Pierrakos, Beam, Constantz, Johri, & Anderson, 2009). Students have to overcome several barriers to become professional physicists and identify themselves as belonging to the physics community. But students' development of a physics identity can also influence their persistence as physics majors (Shanahan, 2007). There is a strong link between the level of identification with being a physicist and whether or not a student chooses a physical science career (Barton, 2000; Chinn & Malhotra, 2002; Cleaves, 2005; Shanahan, 2007).

"The development of a professional identity or appropriate subject-specific identity is a fundamental part of student development (Luehmann, 2007) and has a strong influence on retention and persistence of students ..."

Lack of underrepresented groups in physics was the basis of previous research on identity development (Basu, 2008; Buck, Mast, Ehlers, & Franklin, 2005; Hazari, 2013). Now the focus is to look at how a student transforms from a student of physics to a physicist (Irving & Sayre, 2015; Sayre, 2014). The development of students' identities will help students cope with the continuous change and uncertainty that they will face in life in the 21st century (Brophy, 2009; Flum & Kaplan, 2006; Harrell-Levy & Kerpelman, 2010). It also will affect their interactions within the community of practicing physicists. Early career faculty in physics should pay particular attention in developing the professional identity of their mentees.

The Strategic Programs for Innovations in Undergraduate Physics (SPIN-UP) report provided evidence that physics departments that provided undergraduate research experience managed to increase their enrollment and retention rates (Hilborn, Howes, & Krane, 2003). Best practices are provided by a vast literature on undergraduate research (George, 2001; Gregerman, 1999; Boyd & Wesemann, 2009; Nagda, 1998; Russell et al., 2007) and lessons on best practice in successful STEM diversity programs have been documented by several authors. Examples include the need for a peer support group for the SOARS program (Pandya, 2007), the physics program at Vanderbilt University (Ernst, 2008), and the NOAA program (Robinson, 2007). The use of field courses and research opportunities as mechanisms to attract and recruit students into some STEM disciplines has been documented (Gilligan, 2007; Morris, 2007; Serpa, 2007).

As an early career faculty and later on as a Department Chair in the Department of Physics at NCA&T, the author recruited and engaged undergraduates in his research and encouraged students to apply for summer research at R1 universities. As a Department Chair he encouraged faculty to engage students in undergraduate research. The retention of students improved as a result and most of the students who were engaged in undergraduate research continued conducting research as graduate students.

The anecdotes from the author's own journey is not unique to NCA&T. The issues are faced by many early career faculty at HBCUs. The heavy teaching load, the heavy demands for service and the expectation to do research, acquire funding and publish need to be balanced with the needs of family. The author was married in his first year and had his first son a year later, which made it hard to leave during the summers.

One of the challenges that many early career faculty at HBCUs face is the lack of start-up funding to initiate research. Without proof-of-concept or preliminary data, it is often very difficult to win competitive grants. But such challenges can be overcome and early career faculty at HBCUs can gradually establish research programs. Some recommendations based on the author's experience include:

1) Maintaining close relationships with graduate or postdoctoral advisors and finding ways to spend summers in their laboratories doing research and developing ideas for research proposals.

2) Taking advantage of summer research opportunities at national and Federal laboratories, (they usually support faculty student teams and provide adequate funding), and considering taking students.

3) Exploring the possibility of obtaining equipment through loans from national laboratories or major universities to continue research at home institutions. Theoretical and computational projects are easier to bring home and continue during the academic year if arrangements are made to use the computational resources at host institutions.

4) Using the connections at national and federal laboratories to link up and find collaborators at nearby universities. This will open up opportunities to work on projects during the academic year and find collaborators for joint proposals.

5) Persisting in the effort to write proposals and discussing ideas for proposals with established groups. Persistence is the key to being successful in acquiring grants.

6) Building a competitive research program and ambitions to move up the administrative ladder are incompatible. Early career faculty at HBCUs should overcome the temptation of moving into administrative positions before they establish themselves in their profession (field).

7) Setting goals early on and making sure to prioritize activities that will help achieve set goals.

CONCLUSION

Tenure sits on a three-legged stool: teaching, research, and service. Be sure to strengthen each leg of the stool at regular intervals throughout pre-tenure years. Early career faculty at HBCUs face multiple challenges as they try to excel in teaching, research, and service. The heavy teaching loads and the committee assignments usually take too much time. There is often no start up fund for research at most of these institutions and there is a limited administrative or technical support such as machine shops, electrical shops etc to conduct experimental research. But even under these circumstances early career faculty can succeed if they have a focused and realistic goal, adequate connections and collaborators and persistence in their efforts. At a small predominantly undergraduate institution it is difficult to rely on only what one can accomplish in his/her lab alone or with a small number of students to yield a large number of publications. Thus creating collaborations and creating a research program consistent with one's institution's infrastructure (facilities, personnel, and financial support) is very crucial.

Instead of treating teaching, research, and service as unrelated independent activities, one needs to see them as overlapping and mutually supporting activities. Effective teaching in STEM disciplines requires strong research and effective integration of research in teaching. Research provides an effective tool for mentoring and developing the creative gifts of students. Hence strong research helps strengthen the overall teaching-learning-mentoring environment. Success in acquiring funding is linked to success in integrating research and education as there is increasing demand by universities and the public for faculty to do research and improve teaching to develop the modern workforce.

Integrating research and teaching can take several forms. One can use research results or develop course modules related to the research and integrate it in formal classroom, or teach the research process as part of the course or recruit and train students to conduct research. Recruiting students is related to service through engagement in outreach. Working with K-12 teachers and conducting outreach will help develop a pipeline of qualified students. Participating in professional service as proposal reviewer or journal article reviewer will also help early career faculty to understand the funding process and the required quality of proposal to be competitive. Under all circumstances early career faculty need to be seen as collegial, this doesn't mean serving on every committee. Over committing oneself leads to failure. But be collegial to collaborate both inside and outside campus.

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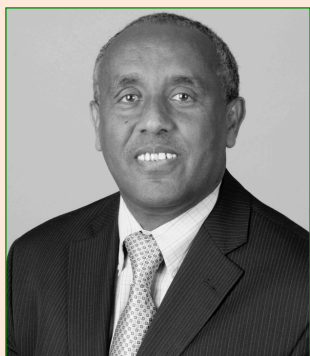
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At NCA&T, Dr. Bililign has provided leadership for high quality training and education of undergraduates in Physics and developed several new courses, degree programs, and interdisciplinary projects. With NSF support, he has provided international experiences for NCA&T students in South Africa, France, and Ethiopia as well as promoted science education locally through summer camps, school visits, science fairs, and teacher workshops. In 2011, Dr. Bililign received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.

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The QEM Approach to Faculty Productivity:
An Adaptation to a University Campus

by

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ABSTRACT

Quality Education for Minorities (QEM) Network designed and implemented a plan to enhance faculty productivity of select junior faculty at HBCUs through targeted intervention: faculty release time, provision of mentors; professional development workshops; and access to experts; and access to scientific resources. The participants have shown success through scholarly productivity in the area of publications and grants. The University of the Virgin Islands presents one model that seeks to adapt tenets of the QEM approach to faculty productivity to a small, comprehensive, primarily undergraduate HBCU through activities aimed at supporting faculty and implementing expectations for productivity.

Quality Education for Minorities (QEM) Network was awarded a 2010 National Science Foundation (NSF) grant from the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) Education Research track for the project "Identifying Minimal Conditions Essential to Enhancing Research Productivity of Early Career Faculty in Selected STEM Disciplines at HBCUs". Through this funding, QEM sought to test their hypothesis that the following components were essential: "adequate release time for faculty to conduct research projects; training in the preparation of research proposals; developing skills to effectively mentor students; mentoring from a senior researcher; opportunities to attend and present at discipline-focused conferences; and an understanding of ways to integrate research into teaching and of how to build and sustain effective collaborations."

The QEM five-year project focused on professional development activities for junior faculty at HBCUs. Through the funding, each faculty member was afforded 50% release time at their home institution during the first full academic year (2011-2012), 25% release time during the second academic year (2012-2013), and summer funding at the rate of 2/9th salary. There was also support for undergraduate researchers. In addition, faculty members' application packet included a research statement outlining research interest and current research. The expectations were clear. Participants had to meet the following criteria:

1. agree to participate fully in the proposed activities, including project-related workshops and in mentoring relationships offered/identified by QEM;

2. agree to remain on the faculty of their home institutions for at least two years following QEM-funded activities or else re-pay to QEM the funds provided to their home institutions for release time;

3. prepare and submit research proposals to NSF;

4. provide meaningful research experiences for two undergraduate student research assistants;

5. identify a senior STEM faculty member on campus with whom planned activities will be discussed to help ensure that the activities are consistent with campus policies governing promotion and tenure; and

6. submit a report/respond to surveys describing their experiences in the mentoring and professional development program.

The QEM faculty development activities included sessions on proposal development and sessions during which participants presented their research and received feedback from mentors and fellow participants.

The results of the QEM project have been encouraging. Between 2010 and 2014, there were 12 participating faculty. These 12 participants were responsible for 33 presentations at scientific conferences and mentoring 39 PDM-supported students. The participants submitted 51 articles to peer-reviewed journals resulting in 39 publications, 2 in press and 7 in review, with six additional articles in preparation. Additionally, the participants were responsible for one book, four book chapters, and seven conference proceedings.

The expectations for submission of grant proposals were also met. Fifty-one (51) proposals were submitted to various funding agencies as of 2014. Thirty-five (35) of these proposals were submitted to NSF. Of the 51 submissions, 24 were funded (13 by NSF), one was invited for a full proposal, and three were in review. At that point, the NSF success rate for the QEM participants was 37% (compared with 24% 2012 overall NSF success rate for proposal submission).

The purpose of this article is to show how this model for increasing faculty productivity was adapted by the University of the Virgin Islands (UVI). UVI is a Land Grant HBCU, founded in 1962. It serves approximately 2400 student body with undergraduate and master's level programs in five units: College of Science and Mathematics; College of Liberal Arts and Social Science; School of Nursing; School of Business; and School of Education. Faculty teaching load at the University of the Virgin Islands is twelve credits per semester, with faculty sometimes teaching overloads.

Based on the documented success of QEM's professional development model, the University of the Virgin Islands is supporting junior faculty to enhance their productivity through adaptation of the following aspects of the QEM model: **clear expectations; faculty release time; faculty development; faculty mentors.**

UVI's Clear Expectations:

UVI's current strategic plan, *Pathways to Greatness*, has a clear goal for faculty productivity: increase faculty productivity and effectiveness, including increasing the number of faculty publications and research funding applications. Thus, it is understood that faculty promotion and tenure will be dependent on faculty research productivity, among other criteria (teaching, university service, community service). Deans and Chairs have been reminded of this goal, and are encouraged to relay the importance of research and publications to faculty. As part of the interview process for faculty, the Provost meets with finalists in order to underscore the university's expectation for faculty productivity.

UVI Faculty Release Time:

Though unable to release new faculty at 50%, Deans are encouraged to work to release new faculty from a course each semester by re-distributing course-load across each discipline. The Dean of the College of Science and Mathematics has been able to implement this at UVI. One new faculty member who received the first year course release indicated that it might have been more effective to have had the release in the second year as the first year adjustment to the University overshadowed their ability to be as productive as they should have been.

UVI Faculty Development

Faculty development initiatives are ongoing at UVI to support the professional growth of faculty across all stages of their career. These initiatives are designed to help retain faculty as well as provide support mechanisms. A range of programs exist that focuses on scholarly writing, mentoring, the grant application process, and work/life balance. The programs that will be discussed are the Faculty Development Writing Group, the Writing Retreat, and the Junior Faculty Mentoring Program.

Faculty Development Writing Group

The Faculty Development Writing Group (FDWG) was developed and piloted in the Spring semester of 2014 with three female faculty members in STEM disciplines. The group was organized by a tenured-teaching faculty who wanted to increase her scholarly productivity. She extended an invitation to a research faculty and a new junior-teaching faculty to join her because she knew they also needed to increase their scholarly productivity. During this time, the organizer was serving as a Provost Fellow and provided bi-weekly updates to the Provost on the group's success. Recognizing the group served as a network and support system especially for the junior faculty member, in the Fall semester of 2014, the Office of the Provost expanded the program to all incoming junior faculty. The group has a facilitator to lead weekly discussions, identify guest presenters, and handle logistics.

The purpose of the group is to serve as a support system to help faculty write scholarly articles, grant proposals, conference abstract submissions, book chapters, etc. Members are asked to specify writing goals at the start of each semester. Throughout the semester, the group meets weekly and Laura Belcher's book, "*Writing Your Journal Article in Twelve Weeks: A Guide to Academic Publishing Success*" is used to guide the weekly discussions.

There were 14 participants in the program since its inception and Table 1 provides outcomes attributed to participating in the FDWG.

Table 1. Faculty scholarly productivity

Scholarly Work	Spring 2014	Fall 2014	Spring 2015
Book (Editor, Chapter, etc)	0	0	2
Book Review	0	0	1
Conference Presentation	5	2	9
Conference Submission	7	3	0
Journal Submission	0	2	0
Proposal Submitted	0	0	0
Total Scholarly Work	12	7	12

At the end of the semester, participants are asked to evaluate the program. One specific question on the evaluation form is, "*How has participating in the program benefited you professionally and/or personally*?" The main benefits reported from previous participants were coded as: (1) helping participants focus on goals; (2) support from group members; and (3) structure of the group. Below are excerpts from responses.

Focus on Goals

"Just knowing that it is on the weekly schedule makes me return my focus to the research agenda my daily life and teaching responsibilities often keep me from considering."

"It required me to focus on my goals, organize them, keep track of them, and continue to work on them."

"In addition to being surrounded by individual with similar writing challenges and blocks, the program also assisted in bringing focus to an area I have been neglecting."

Support from Group Members

"I also felt motivated through group support to submit work to conferences. Personally, sharing among the group was beneficial. I discovered that many among us struggle with similar challenges in completing or even beginning new scholarly projects."

"The people or the academic standing of our cohort helped the function as well. We all are somewhat experienced in our fields and more generally in our profession. Yet we all have areas we know better than others and so our group felt very collaborative despite our different disciplines and backgrounds."

"Participating in the FDW group provided me with scholarly support and encouragement in doing research and academic writing."

Group Structure

"The weekly meeting and in particular the wise choice to take a formal structure from Writing your Journal Article ensured that my move and my classes did not fully take over my thoughts."

"The structured group atmosphere was motivating."

"Providing a clear framework for steady progress toward completing a scholarly project."

Writing Retreat

Following up on the Faculty Development Writing Group, UVI's Office of the Provost will implement a week-long writing retreat. The goal is to provide faculty support for the writing phase. Priority for participation will be given to participants from the FDWG, though, on a space available basis, faculty members who are able to propose a project that could benefit from focused work resulting in a product at the end of the week will be able to participate. Modeled after Jackson State University's Summer Writing Retreat, the goal of this activity is to provide an environment inclusive of other writers, writing coaches, and promoting the "self-discipline of daily writing". Participants will be sequestered at a location for a week, and will be provided with time away from the daily pressures to write each day. They will have to sign a contract which limits online and work related activities, and focuses their efforts on creating a near final draft of an article or grant application at the end of the retreat. This activity will begin in Spring 2016 at UVI.

Faculty Mentoring Program

Prior to developing the Faculty Mentoring Plan, the Office of the Provost obtained input on the status of Junior Faculty Mentoring services at the University of the Virgin Islands (UVI) and also reviewed best practices at UVI's Peer and Aspirational Peer Institutions. A survey was developed and electronically administered to over 30 individuals identified by the Office of the Provost as junior faculty based on hiring date. The survey was completed by 16 individuals representing the five schools and colleges at the university. Respondents were asked about: (a) the level of mentoring received since employment at UVI; (b) mentoring activities they believe would help advance their career; (c) to identify the person who should provide the mentoring services to junior faculty; and (d) frequency of interaction with mentor. Responses revealed that respondents received little to no mentoring, orientation for junior faculty was a needed activity to advance their career, senior faculty within their department should serve as mentors, and the meeting frequency should be dependent on needs.

Reviewing UVI's Peer and Aspirational Peer Institutions did not produce consistent models. A majority of the institutions' website did not mention having a formal program. However, a few did have something in place for new faculty such as an orientation for all new faculty members or a website with a "New Faculty" link on the Faculty Development page which included everything a new faculty member needed to know.

Therefore, the results from the Junior Faculty Mentoring Survey were used to develop the Junior Faculty Mentoring Program (see Appendix A). From the faculty's input, the program was designed to be informal, with no structured meeting schedule. Also, the ideal mentors will be senior faculty in the junior faculty's department. Since the junior faculty surveyed indicated that mentor selection should be based on interpersonal compatibility, teaching effectiveness, and potential for collaboration on research and teaching, mentors and junior faculty will be required to complete a Mentoring Profile Form for Mentee and Mentor (see Appendix B).

Possible Barriers to Adaptation of the QEM Model

Many of the activities that are important for adaptation to the university setting can be integrated into current university practices. In implementing activities, there could be difficulties or deterrents.The faculty development activities, and attention, was housed in the Office of the Provost. An unrelated faculty development and leadership project was that of Provost Fellowships, where tenured faculty members are able to spend one to two years at half time in the Office of the Provost working on leadership projects. The faculty mentoring and faculty development writing group were Provost Fellow activities. It is important to have a home for these activities once established. This could possibly be in a faculty development center if one exists on the campus.

Though Deans are strongly encouraged to provide for release time (a course per semester up to a year) for junior faculty to establish their research agenda, this is not always possible, especially in smaller departments. Here, it may be more beneficial to support the faculty member during the summer, especially if summer classes are offered and are taught to supplement income. Other difficulties include identifying mentors, and identifying time for mentor-mentee interaction. In pairing mentors with mentees, it is important to get information regarding whether or not each might be open to meeting outside of regular hours, and pair accordingly.

SUMMARY

The QEM Professional Development and Mentoring Program has seen great success. Many point to the clear expectations, clear goals, strong faculty support and mentoring as hallmarks to the program's success. The University of the Virgin Islands, through the Office of the Provost, has worked to implement these tenets of the QEM model, and has seen preliminary success. Though the distributed faculty development project at the University of the Virgin Islands has not been as focused as the QEM project, the overall goal to change the expectations at the university, while providing some support for increased productivity was achieved within the means of the institution.

APPENDIX A: UNIVERSITY OF THE VIRGIN ISLANDS GUIDELINES FOR JUNIOR FACULTY MENTORING PROGRAM

PURPOSE

The Junior Faculty Mentoring Program (JFMP) is an informal program designed to help newly hired, non-tenured faculty members adjust to their new environment. The program serves as professional development to help these individuals balance and improve their teaching, service, and research responsibilities. Whether it is academe or the Virgin Islands that are new, a well-respected mentor will provide assistance that is instrumental to be successful. The JFMP is beneficial to mentees and mentors because ideas and viewpoints are exchanged and knowledge and experience are shared. However, the program's success is dependent on mentees' and mentors' active participation in the acclimation process.

PARTICIPATION

Participating in the JFMP is voluntary. Upon being hired, individuals will be contacted by the Faculty Mentoring Program Coordinator to inquire if they are interested in participating in the program. Mentors will be tenured faculty members who have volunteered to serve in this capacity.

The new faculty will be matched with experienced faculty who are knowledgeable about UVI campus and academic life. The mentoring relationship between the mentee and mentor will be informal and last for two years. The mentor will orient the new faculty member to UVI and the expectations of their position, campus support services, and assist the new faculty member in the early stages of their academic careers at UVI. Additionally, the mentee and mentor will sign a confidentiality agreement statement.

JUNIOR FACULTY MENTORING PROGRAM GOALS

Overall goals are to:

- Retain and develop employees by partnering a new faculty with a mentor.

- Help new faculty become familiar with the institution's culture, resources, and other employees.

- Create a culture of inclusiveness by developing positive relationships between mentors and mentees that honor individuality and respect confidentiality.

Help new faculty:

- Learn about UVI and support resources for faculty.

- Learn how to balance teaching, scholarship, and service.

- Adjust and become active members of the university community.
- Learn how to navigate within the Virgin Islands community.

Encourage experienced faculty to:

- Gain professional growth through the exchange of ideas as they share their knowledge and experience with new faculty.
- Address new faculty needs, concerns, or questions as they adjust to campus.
- Promote collegiality on campus.
- Contribute to teaching, scholarship, and service activities on campus.

RESPONSIBILITY OF MENTOR

- Contact the mentee within the mentee's first two weeks of work.
- Stay in touch with new faculty for the first year two years.
- Provide new faculty with informal advice on teaching, scholarship, and service.
- Share knowledge and experience that can benefit the new faculty's progression at UVI.
- Maintain confidentiality about discussions and interactions.

RESPONSIBILITY OF NEW FACULTY

- Regularly interact with mentor.
- Informed mentor of progress, problems or concerns.
- Suggest a list of activities that she/he deems necessary or needed for growth in the profession, school or college, and institution.

MENTEE AND MENTOR RELATIONSHIP

- The mentee and mentor, in conjunction with the mentee's immediate supervisor, may develop the first 3-year Professional Development Plan and review goals periodically.
- The mentee and mentor may create a meeting schedule based on their preference.
- The mentee is not obligated to accept the mentor's recommendations.

SUGGESTED MENTORING ACTIVITIES

- Discuss the following topics:

  o Short-term and long-term career goals and professional interests
  o Publishing
  o Progression towards tenure
  o Collaborating on research at UVI
  o Preparing annual performance reports
  o Collaborate – research outside UVI
  o Integration into UVI culture
  o Advising/mentoring students

- Share information about using teaching resources on campus/school/department.

- Share information about balancing work and family

- Explore professional development opportunities available to new faculty

- Explore possible collaborations on teaching at UVI

CHANGING MENTORS

The new faculty or mentor should consult with the Mentoring Program Coordinator if the relationship is not mutually satisfactory or beneficial, if they are incompatible, or there is a change in commitments. The changes would be made without prejudice and the new faculty is encouraged to seek additional mentors as need arises.

MENTORING PROGRAM COORDINATOR

The Coordinator is appointed by the Provost. The duties of the Coordinator include:

- Recruiting experienced faculty to volunteer to serve as mentors.

- Providing an orientation of the program to new mentors and mentees.

- Matching mentors with new faculty based on information from the Mentoring Profile Form.

- Serving as resource to mentors and new faculty.

- Making changes to mentoring assignment as requested.

- Reporting to the Provost on the progress of the Junior Faculty Mentoring Program.

APPENDIX B: **UNIVERSITY OF THE VIRGIN ISLANDS JUNIOR FACULTY MENTORING PROGRAM MENTEE/MENTOR FORMS**

Name: _____   Title: _____

Telephone Number: _____   Campus: _____

Email Address: _____   Years at UVI: _____

Department: _____   School/College: _____

Answers to the questions below will help us pair mentors and mentees.

Mentee Profile Form	Mentor Profile Form
Please describe in a few sentences your research interests.	Please describe in a few sentences your research interests.
Please describe in a few sentences the kinds of teaching you do or expect to do (i.e., lectures, seminars, laboratory teaching, graduate advising, etc.)	Please describe in a few sentences the kinds of teaching you do or expect to do (i.e., lectures, seminars, laboratory teaching, graduate advising, etc.)
Each mentor/protégé will agree on a plan for the mentoring partnership. Please state 3 areas where you feel a mentor could help you: 1. 2. 3.	Please describe your particular strengths as a mentor (for example: teaching techniques; time management; networking with other faculty; etc.).
Please state any preferences you might have regarding your potential mentor (i.e., gender, race, clinician vs. basic scientist, emeritus vs. current faculty, etc).	Please state any preferences you might have regarding your potential mentee (i.e., gender, race, clinician vs. basic scientist, etc).
Do you desire a mentor inside or outside your department?	Do you desire a mentee inside or outside your department?
If you have already chosen a mentor, please provide that person's name* and college/school/department below:	If you have already chosen a mentee, please provide that person's name* and college/school/department below:

Please return this form by August 30, 2015 to the Office of the Provost, or via email.

*We will need to receive a completed application from him/her also.

ABOUT THE AUTHORS

McKAYLE, Camille

Camille McKayle is Provost and Vice President for Academic Affairs at the University of the Virgin Islands (UVI), where she began her academic career as a mathematics professor. Dr. McKayle spent many years designing and implementing programs aimed at addressing the underrepresentation of minorities and women in STEM while teaching mathematics. Locally, she ran mathematics afterschool programs for 6th grade girls and 3rd through 12th grade students, as well as STEM programs for undergraduate students.

Dr. McKayle spent three years at the National Science Foundation as Program Director for the Historically Black Colleges and Universities-Undergraduate Program (HBCU-UP). She returned to academia as Dean of the College of Science and Mathematics, and now Provost, at UVI. At the national level, Dr. McKayle has served on the Board of Directors for the Mathematical Association of America (MAA), Chair for the MAA Committee on Minority Participation in Mathematics, and member on the Human Resources Advisory Council for the Mathematical Sciences Research Institute, Berkeley. She is also a mentor for young mathematics faculty through Project NExT (New Experiences in Teaching) funded by the MAA and Exxon.

Dr. McKayle has served as a consultant for the QEM Network, assisting with NSF-funded workshops aimed at proposal and professional development for faculty at HBCUs. She also served as a Research Mentor for the QEM Education Research Project's Professional Development and Mentoring (PDM) program. Dr. McKayle received the B.S. degree in Mathematics from Bates College and the M.S and Ph.D. degrees in Mathematics from Lehigh University.

ENGERMAN, Kimarie

Kimarie Engerman is Associate Professor of Psychology and a Provost Fellow at the University of the Virgin Islands (UVI). Dr. Engerman has served as principal investigator (PI) and co-PI on various grants, including an NSF HBCU-UP Education Research Project. As a Provost Fellow, she is providing leadership in the implementation of the Dual Enrollment Initiative between UVI and the VI Department of Education.

Dr. Engerman also is leading the creation of a university-wide advising plan as well as a junior faculty mentoring plan. In this capacity, developed the Junior Faculty Mentoring Program and the Faculty Development Writing Group. Dr. Engerman participated and graduated as a Fellow from the Quality Education for Minorities (QEM) Network's NSF-funded, HBCU-UP Leadership Development Institute (LDI) for early career faculty in STEM at HBCUs. The LDI was a year-long, intensive program of workshops and mentoring to support selected STEM faculty at HBCUs in their career advancement. She completed a postdoc in engineering education at the Center for the Advancement of Engineering Education and has received a Post-Graduate Certificate in Academic Leadership from The Chicago School of Professional Psychology.

Dr. Engerman received the B.S. degree in Psychology from Bowie University and completed graduate studies in engineering education, with the Ph.D. degree in Educational Psychology from Howard University.

ACKNOWLEDGEMENTS