The Mentoring Manual

IBP Guide to Mentoring for all program participants

Produced by
The Institute for Broadening Participation

Institute for Broadening Participation
Building Partnerships to Support Diversity in Science

The Institute for Broadening Participation
Pathways to Science
Mentoring Manual

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www.pathwaystoscience.org/edit_www/manual.asp

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Overview and Home

Mentoring: to mentor, or be mentored? That is the question! And the answer is: both! All of us encounter many opportunities in our lives to either mentor, or be mentored; and in any mentoring relationship the responsibility to foster and guide the process falls to both the mentor and the mentee. The goal of this online manual is to highlight the value of mentoring and to help students, faculty, and administrators be better mentees, and become better mentors.

This version of the manual focuses generally on mentoring within the science, technology, engineering and mathematics (STEM) fields, especially on the mentoring process for underrepresented students, and in some cases specifically on the context of summer research for undergraduates. However, it provides information that mentors and mentees alike may find valuable in variety of circumstances.

How to contribute to this manual

This manual is a living document and will continue to develop with your help. While we strive to include the most up to date and relevant content, there are resources of which we are as yet unaware, and there is first hand expertise and experience that can enhance and supplement the existing material; we can only get this additional content from a greater community of mentors and mentees. We welcome your input!

Please use our comments and contribution form to submit:

- Suggestions for changes or additions to particular content in the manual.
- Online resources or other publications that would support and enhance existing topics.
- Personal anecdotes that highlight or would help illuminate particular topics for readers.
- Any other helpful feedback. (see "What we post" for details)

A link to the comment and suggestion form can be found in the right menu bar of every page.

What is Mentoring?

Mentoring is giving your time, attention, insights, and advice. Mentoring is about helping a mentee develop social capital within an environment where they have the resources and support to develop technical and intellectual capital. Simply providing resources for a mentee to accomplish a research project (i.e. develop technical/intellectual capital) is not mentoring. That is the minimum requirement to setup an appropriate learning environment. Mentoring takes place in the personal interactions with the mentee.

All the aspects of mentoring that are described in this manual focus on how to proceed with these personal interactions.

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Basics for Everyone

What is mentoring?

Mentoring is giving your time, attention, insights, and advice.

Mentoring is about helping a mentee develop social capital to complement their development of technical and intellectual capital. Simply providing resources for a mentee to accomplish a research project (i.e. assisting a mentee in developing technical/intellectual capital) is not mentoring. Mentoring involves moving beyond technical/intellectual assistance and entering into a meaningful personal interaction with the mentee.

A well-run research group can assist with the technical development of the students' work. But what can a mentor provide? Sometimes the most valuable contribution a mentor can make is just time and attention. It is always surprising to talk to former mentees about their experiences and what they found valuable. Often, their comments focus on a few themes: (1) it helped to have someone believe in my potential, (2) it helped my confidence to know that I could talk or write to someone of your stature, (3) it helped to have you listen to some of my professional development plans and then hear your suggestions.

When mentoring, don't forget that just your time and attention can have a very significant impact. The combination of the mentor's accessibility and approachability is critical and even small actions can be impactful. Examples may include having lunch with a student and establishing an open-door policy, or in a class setting learning students' names and making a point of requesting student feedback on course material during class time (Gall et al. 2003).

You can set up sufficient support for a student to get the resources for the technical accomplishments, but you alone can give them attention from an accomplished professional.

The NASA First Mentoring Program Handbook adds this useful summary: "A mentor is an experienced individual that serves as a trusted counselor, loyal adviser and coach who helps and guides another individual's development. The mentor is a confidant who provides perspective, helps the candidate reflect on the competencies they are developing, and provides open, candid feedback. Mentors have a unique opportunity to serve as a 'sounding board' for the candidate on issues and challenges they may not share with individuals within their own organization" (2008, p. 6).

Phrases that make an impression:

"That was great work."
"Good idea!"
"I also struggled with that."
"Based on the goals you've expressed, graduate school would a good next step."
"You are definitely excellent graduate school material."
"If you are not really sure, then working in industry for a couple of years may provide you that insight into graduate level work that motivates you."
"Tell me what you think we should do next."

These kinds of phrases and the interactions that support them show mentees that they are valued as thinkers, learners, and future practitioners.

What is a mentee?

One will find as many different answers to this question as people asked, but the NASA First Mentoring Program Handbook probably captures most of them: "A mentee is a self-motivated individual seeking to continuously promote personal development. A mentee recognizes personal strengths and weaknesses and actively seeks methods for personal growth. […] A successful mentoring relationship not only depends on the characteristics of the mentor, but also on the characteristics of the mentee" (2008, p. 6)

Characteristics of the ideal mentee include:

- Eagerness to learn.
- Team player.
- Patience.
- Not afraid to take risks.
- Positive attitude.

Programmatic best practices

What to do as a program director, and what to look for as a program participant

Although we might commonly perceive mentoring as something that occurs between two individuals, a mentoring attitude can infuse the entire programmatic process and environment, significantly benefiting program participants. When investigating programs and potential working environments, students should look for signs that show a widespread awareness and adoption of supportive mentoring practices in the environment they are considering joining. Mentors and program directors should keep in mind that they are creating a mentoring-infused environment, recognizing that the mentoring relationship starts before it is formalized, and recognizing that mentoring support flows from a variety of programmatic elements.

The Meyerhoff Scholars Program at the University of Maryland, Baltimore County, the Significant Opportunities in Atmospheric Research and Science (SOARS) Program and the Multicultural Initiatives in Marine Sciences: Undergraduate Participation (MIMSUP) Program are all examples of successful programs that have adopted this strategy. We briefly describe Meyerhoff's 13 Key Components here as a demonstration of how the mentoring mentality can infuse an entire programmatic environment and lead to remarkable success. The Key Components are available in their original form on the Meyerhoff Scholars Program website.

** additional content to be developed*

Recruitment and selection

A successful mentoring process begins with recruitment and selection, even before any one-to-one mentoring relationship is formed. This make take the form of a campus preview program such as the "Getting you into IU" program at Indiana University Bloomington, and it may also involve a holistic recruitment strategy that focuses on identifying unrealized talent. Stassun et al. (2010) uses the metaphor of a minor-league baseball team in describing a holistic recruitment process:

"Rather than build a team by recruiting only "starters," the idea is to develop an infrastructure that scouts early talent while it is still rough, that provides the resources and training to allow that talent to blossom and mature without lowering standards or expectations, and that thereby sustains the future vitality of the team" (Stassun et al. 2010, p141).

During the application process personal contact with applicants by phone and/or email and in person when possible, is critical. This in-depth conversation acknowledges that each student is a unique individual, and helps identify students who are a good fit for the program and programs that are a good fit for the student. This provides an opportunity for students to assess the program they are considering and for the program to identify students who are not only academically prepared for a science, engineering, or math major, but, often more importantly, are genuinely committed to the goals that the program endorses – for example, a postgraduate research-based degree and career. When a mentoring attitude infuses the entire program atmosphere students feel the effects of that welcoming and supportive attitude even before they become admitted to the program. See also IBP's Sample Recruitment Plan.

HOW TO USE THIS IN YOUR PROGRAM PLANS:

Program Directors: Give the recruitment and application process the weight it is due, acknowledge the importance of making a good match between students and program, and institute processes that allow you and/or your faculty and administrators to make a holistic assessment of your student applicants (background, strengths and interests), and give students a chance to be inspired by the essence of your program.

Students: Examine your goals and interests. Carefully evaluate the programs that interest you and recognize the importance of a good match for you and the program you are considering. And remember that it is your passion for your field of interest and your commitment to excellence that will propel you through the challenging times.For specific tips on applying, see IBP's Tips for Applying.

Financial aid

For students, financial aid is often generous, but it may also be also contingent on a student's persistence and maintenance of good academic standing. Financial support is often a critical element of the success of underrepresented minority students in STEM.

For Program Staff: For students in search of funding, it is important to remember that students don't always know where to look, and they don't always know that, for instance, they can get paid to go to graduate school. They may not know they can apply to multiple funding sources, or how to leverage different complimentary funding packages. Be prepared to direct students to funding sources that have worked well for past students of your program, and / or refer them to IBP's Funding Your Graduate Education.

For programs offering financial suport, such as summer research programs, make it clear to students what the financial package includes (preferably in writing, as well as through discussion). Some programs offer a base salary from which the student is expected to pay room and board. Some packages include travel and /or equipment. Also, the timing for payments can be crucial. Do not assume that all students will come to the summer program with funds in a bank account. Do not forget to check with students to make sure they are receiving their funds/checks and that their financial situation and / or a bureaucratic 'snafu' is not creating a distraction or impediment to their success in your program.

Bridging

Good mentoring acknowledges that mentees are unique individuals coming to a new environment with varying backgrounds and skill levels, and, accordingly, seeks to assess skill levels and provide training and orientation where needed in order to equalize a diverse peer group and give everyone a good start. Many programs (Cornell University's College of Engineering, Grinell and Bowdoin Colleges, and others) accomplish this process for groups of incoming scholars with a 'bridge program'. This is a 'pre-formal' program orientation that prepares scholars for upcoming expectations and requirements of college courses, and helps develop a close-knit peer group.

"More 'value-added' programs are needed at each phase of the academic pathway. I believe that 'mentored-transitions' are the key to success at each level."

- Valerie Petit Wilson, PAESMEM Awardee and Former Executive Director, Leadership Alliance

HOW TO USE THIS IN YOUR PROGRAM PLANS: Many students may benefit from a transition into a research program or placement, and making this transition in the beginning is a critical step for the student's success.

Program Directors: Keep in mind that both faculty and students need training and orientation. You can plan bridge activities and assessments (for both faculty and students) into pre-program and early-program stages, such as creating a Facebook group for a new cohort prior to the start of the program, which will help group members begin bonding prior to even meeting each other. You can conduct a skills- assessment survey with all participants within the first week, in order to ascertain and address strengths and weaknesses. Do not make assumptions!

Students: Reach out when you need help – a good mentee speaks up (tactfully)! No one is expected to be an expert or proficient in every phase of this journey, so do not hesitate if and when it becomes clear to you that some of your skills could use shoring up; say something, and get the help you need – both you, your mentors, and the program will be better off for it in the long run. Take advantage of the many campus opportunities at the Office of Student Affairs or Advising. Furthermore, recognize your strengths, and realize your potential for being a peer mentor!

"The social activities in the math department started even before the start of classes. I was invited to an orientation workshop for students who were receiving minority fellowships. The purpose of this meeting was three-fold, first, we needed to understand how the fellowship worked, second, we needed to choose the right courses based on our past preparation, and third, we needed to meet each other. Phil Kutzko and Gene Madison ran this orientation that went on for two weeks before the start of classes. We all knew what courses we should take during our first year, but the orientation helped us choose what level we should begin at. Some students were able to jump right into PhD level courses, I had to begin at the Master's level, and some students needed to retake some undergraduate courses. These choices were available to us, but not forced on us. We were able to sign up for the level we felt most comfortable at, and nothing less. Senior graduate students who were also receiving similar fellowships would attend from time to time to welcome and get to know the new students. This was a great resource for us newbies, so we would have familiar faces we could look to if we had any questions about grad school."

- *Omayra Ortega, MPH, PhD, Arizona State University*

Program values

From the recruitment phase, effective programs emphasize long-term goals for students (for example, to achieve a research-based Ph.D. degree) and embrace the value of striving for outstanding achievement, seeking help, supporting one's peers, and participating in community service.

Mentor Values:

Credibility: The better we are at what we do, the better mentors we will be.

Integrity: It is not enough to talk about integrity, one must live the example. Many students do not take it seriously. Mentors must.

Confidence: Many students start with little but can become outstanding when properly encouraged and appreciated.

Cooperation: Discourage aggressive competition among students. Encourage cooperative efforts and openness.

Chores and citizenship: Engage students in professional responsibilities: reviewing, proposal writing, presentations, mentoring. This does not mean handing these tasks off and letting them sink or swim. It means, for example, having a student write a review and then writing your own. Let them see how it changes. Give them the opportunity to learn all of the skills they will need later in their career.

Communication skills: Brilliant research is of little use if not clearly understood. Correct English with good style is critically important. Practice writing and speaking skills constantly.

Professional Activity: Send students to conferences to attend and give talks. Rehearse them extensively. Introduce them to colleagues. Get them plugged in. After graduation, recommend them for program committees, technical committees, reviewing chores.

Credit: Give credit generously to students. It helps them and makes you look good.

Intolerance of harassment: Although many institutions have programs for diminishing sexual harassment, it still exists. Be sensitive to potentially embarrassing or dangerous situations and do not accept inappropriate behavior from colleagues towards your students. Institutions should have a zero tolerance policy towards any mentors who abuse their position.

(This list from: PAESMEM Proceedings at Stanford University Values for Mentors)

HOW TO USE THIS IN YOUR PROGRAM PLANS: Develop program values that all the mentors (faculty, post-docs, and graduate students) buy into and use these values, in addition to the exciting research as a recruitment tool. Design the program and rewards based on these values. Make sure to incorporate these values in writing in your program description, program activities, policies and outreach materials. It is important that the mentors lay the foundation and serve as an example for a value centric research team.

Program community

Student-centered programs strive to provide a family-like atmosphere with social and academic support. Faculty and staff regularly hold meetings with students (formal and informal).

"One of the goals of a good mentoring plan is to maintain interest and improve performance. People do not learn well under high anxiety, so it is important to identify the comfort zone of the mentee and the mentor, together with the organization. It is important to have everyone, students, faculty and staff moving toward the same goal. Learning is a social practice, so it is imperative for directors and faculty to create an environment conducive to this social context."

- Tom Windham, Consultant, Former Executive Director of SOARS and Special Assistant to Director, National Science Foundation.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Improve your approachability as a faculty member by making an effort to learn students' names (use a seating chart, table tents, or a printed sheet with student names and photos to help you if you have a large group of students). Organize students into small groups and rotate the groups through weekly office hours with you – the small group format will help students who find it intimidating to meet with you one-on-one (ENGAGE: Engaging Students in Engineering).

Consider weekly meetings. Break the group up as needed. Think carefully about the best faculty or staff member to facilitate the meetings. Consider having a training session with professionals in the Student Affairs Office or a related unit in your organization. Do not wait until these meetings are needed. It is best to be proactive and provide opportunities to address issues early.

"Our program is successful because we have developed a community. Our department has lots and lots of different people who understand each other a lot more than we used to. We look like America."

-Phil Kutzko, Director, National Mathematics Alliance, Professor of Mathematics, University of Iowa and PAESMEM Awardee.

Personal advising and counseling

Program staff should be clearly assigned to provide academic counseling and relevant staff should be involved in advising on any personal issues that the students may have.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Understand the difference between academic / career advising and personal counseling. A research program experience is a magnificent opportunity for professional and academic advising. Sensitize everyone to the limits of their abilities for personal counseling. When professional counseling is needed make sure procedures are in place to access the right expertise. Have staff available for students to talk to about any personal issues that they are facing. Be aware of group dynamics between and among the students, faculty and staff that may need addressing.

Study groups

"I don't know many people who make it through engineering without a study group or at least friends who are going through the same thing. I feel like that is one reason people drop out of engineering; they don't feel like they have a group of people that can help them. The work here is not to be done on your own" (undergraduate student, Amelink and Creamer, 2010).

Students consistently rank study groups as one of the most positive aspects of their programs. Study groups are viewed as an important part of success and consistently encouraged. Peer support and respect cultivated in activities such as study groups can build satisfaction with the student's major and career path (Amelink and Creamer, 2010).

How to use this in your program plans: Consider developing student teams. Even if they are working on different projects, similarities can be leveraged for students to support each other.

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Tutoring

Strong programs encourage students to take advantage of departmental and university tutoring to maximize student achievement – other students may serve as peer tutors.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Set high expectations for excellence and also provide the infrastructure for the students to meet these expectations. For a research experience, the term "consulting" may be more appropriate than "tutoring.". A group of graduate students and undergraduates can be encouraged to form a set of consulting resources for their group.

Summer research internships

Effective program staff use an extensive network of contacts to arrange science and engineering placements.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Develop relationships with faculty and staff in departments and programs such as such as Louis Stokes Alliances for Minority Participation (LSAMP), Alliance for Graduate Education and the Professoriate (AGEP), Research Experience for Undergraduates (REU), and McNair Scholarship program for Graduate Education, among others. They can provide resources that can assist you in strengthening your program effort, recruiting students that fit your program, and advising and supporting participating students.

Mentoring

Each scholar should be paired with one or more mentors who are professionals in science, technology, engineering or mathematics. Some of these mentors may be in other geographic regions and/or other organizations.

"It's important to keep in mind that mentoring need not come from the designated advisor but that all faculty can contribute to students' development. So even if a student comes from another department and requests a meeting with a professor, s/he should agree to an appointment to listen to what the student has to say before steering them away. For example, students may be taking minors or considering changing majors and want to hear a variety of faculty perspectives about a particular field. Faculty should be aware of how they present their recommendations (e.g., personal awareness of tone and affect). For example, a prospective student may approach a faculty member to join their lab or enroll at their institution, and after their initial conversation, the faculty member may ascertain that the lab or college isn't appropriate for the student's proposed objectives. Rather than abruptly turn the student away, s/he must make clear the reasons for the suggestions so as not

to make the student feel "unwelcome". This should include suggestions to help point the student to a program or professor who would be a better fit. Ideally, a good faculty mentor should offer to help students make those connections." - *Lorraine Towns, CUNY AGEP Coordinator, The Graduate Center, CUNY*

HOW TO USE THIS IN YOUR PROGRAM PLANS: In addition to a designated mentor within their research group or department, provide students with access to additional professionals outside of their immediate research group. A good example is an alliance of professionals whereby students from one institution may network with students and mentors from another alliance institution in order to broaden their professional network and success. These are opportunities for students to broaden their professional network, describe their work, and ask advice regarding their future professional and academic success.

Recognize that mentoring happens at various scales, and that even small interactions can be impactful. For example, improving faculty approachability and making an effort to link academic work with future careers improves student motivation and self-efficacy. High quality mentor feedback and high mentor expectations of students can positively affect student persistence and performance (ENGAGE: Engaging Students in Engineering.)

Faculty involvement

Successful programs often manage to keep department chairs and faculty involved in many aspects of the program, including recruitment, teaching, mentoring research, and special events and activities. Faculty involvement promotes an environment with ready access to academic help and encouragement, fosters interpersonal relationships, and raises faculty expectations for a student's academic performance.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Encourage faculty to be actively involved, not only to promote the success of the students, but also to enable the faculty to develop relationships with students and set reasonable expectations. In many cases, this requires that faculty learn more about their own limitations and inherent biases (perhaps in a pre-program workshop or meeting). Be clear about the professional boundaries and courtesies that must be maintained between members of the faculty, mentors, program director and students. Broadening the understanding of where talented students are (learning more about minority serving institutions for example) and expanding their methods of assessing different backgrounds and talent, will help faculty identify more excellent students for their programs. It is important for faculty members to carefully review their time commitments and ensure that they can devote the necessary attention to a range of program activities. This kind of assessment and orientation work can be done in a planning meeting or incorporated into a general faculty meeting before students arrive.

It is important to note that there are professional boundaries and courtesies that must be maintained between members of the faculty, mentors, program director and students.

Administrative involvement and public support

It is considered good practice to have programs supported at all levels of the university. Faculty and administrators can assist program efforts by identifying and recruiting funding partners to support programs. These might include federal agencies, foundations, and companies and local organizations.

HOW TO USE THIS IN YOUR PROGRAM PLANS: Getting central administration support for a single program can be challenging. An alliance of programs (e.g. a group of REUs, a cluster of graduate programs) across the university can be more effective. Consider partnering with related programs. Building a network among programs can provide a means for the administration to provide support that benefits a broad group of faculty and students. Industry and private support can be enlisted to help with financial and 'in kind' support for example-- field trips to research labs, related corporate activities and guest lectures.

Resources

Model Programs

These are just a few of the most successful programs we have found that integrate mentoring and diversity into their program designs. Many of the important elements of these programs have also been documented and are available to learn from or borrow as is appropriate for your experience.

Meyerhoff Scholars Program at the University of Maryland at Baltimore Country

MIMSUP: Multicultural Initiative in Marine Sciences,

SOARS: Significant Opportunities in Atmospheric Research and Science.

Reference list of mentoring resources

IBP maintains an annotated reference list of academic research and expert knowledge about mentoring.

Faculty Directors

Information for Faculty Directors is organized according to phases of effort in the life of a program. Topics range in scope from broad to narrow within each phase, and may be best introduced by previous sections, Basics for Everyone section, especially, Programmatic best practices.

Designing and implementing an effective program

Why mentoring?

The NSF has made clear its view that mentoring in STEM is crucial to developing national intellectual capital. By improving retention of students in the discipline, the enhancement of the student experiences in research, and the professional challenges and satisfaction brought to mentors, the mentoring experience is beneficial to students, faculty, the program in which mentoring occurs and the greater STEM community.

Why be a mentor?

There is much written about why we mentor. The motivation to mentor will differ from person to person, and role to role, but it is likely comprised of a combination of practical, professional, and personal imperatives, including:

- Potential graduate students can be identified.
- Including undergraduates and underrepresented minorities and women is sometimes required for the funding, or satisfies the broader impact criteria.
- Undergraduates can contribute effectively to a research program.
- Having additional students adds positive energy to the research group.
- This opportunity for my graduate students to perform the daily mentoring will help their job prospects and professional development.
- This is my role and obligation as an educator.

Mentoring can be demanding and requires a responsible approach, but at the same time mentoring can provide an enjoyable means for acting in accordance with one's personal values.
"I enjoy seeing what students can accomplish and helping to push them beyond what they think they are capable of. By guiding engineers who are just entering the field, I also feel I am giving something back to a profession and discipline I care about. On the other hand, mentoring takes time - there were some summers when I knew that I did not have the time or energy to effectively mentor, so did not take any interns."

- Dr. J. Adin Mann, M.E., faculty mentor, Iowa State University

Among a number of compelling reasons to mentor, Richard Myer of UC Davis highlights the learning experience of mentoring. In his article, "Why You Need To Mentor, No Matter What Your Level" he cites mentoring as a unique means to advance the knowledge and capabilities of the mentor through the act of teaching and guiding others.

The National Academy of Science publication, Advisor,Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering, provides additional information on the benefits of mentoring.

Why diversity?

A growing body of research suports what many teachers and professionals know from expereince: diversity improves academic outcomes and suports innovation in science. This research has informed the NSF Strategic Framework for Broadening participation, which states: "The creative engagement of diverse ideas and perspectives is essential to enabling the transformative research that invigorates our nation's scientific and engineering enterprise. Broadening participation infuses science and engineering excellence into varied individual, institutional, and geographic networks and provides for the discovery and nurturing of talent wherever it may be found." Additionally, refer to IBP's online presentation The Diversity Brief for more information on the importance of diversity to your program.

A well-considered, well-rounded, comprehensive plan for broadening participation directly addresses at least the following *five areas of focus* (for example, in the Diversity Section of a proposal) and also presents a number of *concrete actions, activities and practices* that, implemented, will achieve the goals of each area.

Areas of focus (expanded below with subsections and examples of concrete activities):

A. Growing the diversity awareness and cultural competency of project faculty and partners.
B. Developing and implementing a comprehensive plan for outreach and retention.
C. Embracing the pipeline.
D. Evaluation: putting the systems into place that will enable you to track your efforts and assess change.
E. Dissemination: sharing your work, findings and successes at conferences and in publications.

In addition to these areas, provide introductory context describing your awareness of diversity issues and your vision for creating change in this area. If you and your partners have an excellent record for diversity or strong areas – highlight them.

Utilizing Difference to build stronger teams

Select students who can bring something unique to your research group.

In his book, The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies (2007), Dr. Scott Page has demonstrated that teams with members holding a diversity of perspectives outperform those teams comprised of like-minded individuals. At the core of these findings is the observation that people with diverse backgrounds look at the same set of information differently, whereas people with the same background will look at the same set of information in roughly the same way. From a design engineering perspective, broadening viewpoints broadens the design space.

One of the sources of diversity within research teams is ethnic/cultural diversity, which can give people different perspectives.

"One of the best pieces of advice that I was given when starting as a faculty member was 'get graduate students who can do what you can't do otherwise it is easiest to just do the work yourself.'

Applying this to research teams, I have typically selected students with different educational backgrounds, but backgrounds related to the work. For example, a student from an HBCU (that typically does not include a large engineering college) will have a stronger background in mathematics, physics, or chemistry than many students from a large predominantly white mid-western university with a well-known engineering college. Teaming the student with stronger physics background and a student with strong practical engineering skills will likely produce better work than two with the same skill set."

- Dr. J. Adin Mann, M.E., faculty mentor, Iowa State University

The Women in Science & Engineering Leadership Institute at University of Wisconsin-Madison has also published an excellent primer on the topic: The benefits and Challenges of Diversity in Academic Settings.

Plan for institutionalization

* *Additional content is in process*

Re-think resource allocation

If mentoring is a significant aspect of your program, it is worth considering the creation of a position dedicated to mentoring development, maintenance and assessment tasks. The Graduate College at Western Michigan University established a Mentor Coordinator position as part of its effort toward fulfilling AGEP's objectives. Specific duties and responsibilities of the position include:

- Monitoring student progress.
- Fostering faculty/student mentoring relationships.
- Developing mentoring programs for doctoral and master's degree students that include meetings each semester.
- Developing a faculty mentor training program in collaboration with the Director of the Graduate Center for Research and Retention.
- Preparing written evaluations of all mentoring programs and activities.

The link for additional information on this program:

www.michagep.org/promising-practices/mentor-coordinator

Examples of successful programs

These are just a few of the most successful programs we have found that integrate mentoring and diversity into their program designs. Many of the important elements of these programs have also been documented and are available to learn from or borrow as is appropriate for your experience.

Meyerhoff Scholars Program at the University of Maryland at Baltimore Country

MIMSUP: Multicultural Initiative in Marine Sciences,

SOARS: Significant Opportunities in Atmospheric Research and Science.

Mentoring models to consider

How to Mentor Graduate Students: A Guide for Faculty produced at the University of Michigan, covers many issues related to mentoring grad student mentors, including a section (chapter 8) on mentoring underrepresented minorities. . Similarly, the Faculty Handbook: Mentoring Undergraduates in Research and Scholarship has been developed and is offered by the University of Alaska, Anchorage.

More Graduate Education at Mountain States Alliance conducted a faculty doctoral mentoring institute and captured many short video segments addressing common questions about mentoring and diversity.

This practical mentoring guide to some of the fundamental skills of mentoring was developed by Mentoring Physical Oceanography Women to Increase Retention (MPOWIR).

* *Additional content under development*

Focusing inward: Growing the diversity awareness and cultural competency of project faculty and partners

Designate a diversity point person, offer training, improve access to support materials, and follow up on an individual basis. All of the above keep broadening participation in the spotlight. Here are some tactics for implementing this inward focus.

Offer and implement training/orientation.

For example:

- Include diversity focused workshops, training, or orientation sessions at annual meetings or other gatherings
- Webinars
- Online training modules

Improve access to materials and resources that can help faculty succeed in their efforts to address barriers to participation and increase diversity.

Materials and resources that can be helpful:

- Relevant research or other publications that provide context, statistics and understanding
- Checklists and topic-based handouts
- Case studies and narratives highlighting strategies used by other programs, how they carried them out, and the impact that resulted
- Contacts who are willing to discuss certain topics and strategies
- Templates and draft plans that can be adapted

Some methods of providing them:

- Include in presentations and materials at training sessions and workshops
- Gather resources into one easy-to-access web portal, or use the resources already gathered on IBP's www.pathwaystoscience.org
- Include links in emails, newsletters or messages to listservs

- Reference in conversation and attach to follow up emails

Follow up with project faculty, partners and leaders on a low-key, individual basis during calls, small meetings, or networking at conferences and events.

Preparing faculty and graduate student mentors

Some faculty and grad student mentors have never been asked to spend time or effort developing themselves as mentors, and may benefit from some guidance. The Wisconsin Center for Education Research has developed a set of curricula and website, Research Mentor Training, designed to facilitate a collaborative approach to developing faculty and grad student mentors. Another useful resource is offered by ENGAGE (Engaging Students in Engineering) on "Faculty-Student Interaction: Faculty Focus" which provides a simple set of strategies to improve programs .

Promoting diversity: Empower faculty allies

At the Rackham Graduate School at the University of Michigan, department chairs, graduate chairs, and program directors associated with each program were asked to identify people in the program who might fulfill the role of "Faculty Allies."

"The precise nature of the diversity challenges varies by program, as does the nature of the best solutions. For that reason, the Graduate School sought to identify aculty allies within the programs. Our hope was that in this way we could support and encourage 'local' efforts to recruit and retain diverse students" (University of Michigan staff, 2011).

They asked their Faculty Allies to perform a new role, including:

- To be visible to the faculty and students in their program as someone who cares and is available as a resource or can help find the right resource.
- To be willing to consider volunteering for new initiatives the college or program proposes to enhance diversity.
- To suggest new initiatives to enhance diversity.
- To provide the college or program with feedback on its efforts as well as areas where improvement is needed.

For additional information: www.michagep.org/promising-practices/allies-for-diversity

Focusing outward: Developing and implementing a comprehensive plan for outreach and retention

Steps to consider when enhancing your outward focus:

1. Reaching & recruiting students from underrepresented groups:

Set specific goals. I.e. "Recruit [x number] of underrepresented students per program year . . . increasing the participation of underrepresented students by [x%] in three years."

Use IBP's web resources and widespread recruitment activities to support your efforts. For example:

- Post your project's opportunities for undergrads, grads and post-docs on IBP's www.pathwaystoscience.org. IBP's family of sites features opportunities searchable by institution, discipline, keyword, level of study, and geographic area. Our travel and virtual outreach, focused on reaching and supporting underrepresented students, generates over 60,000 visits (400,000 page views) per month during peak portions of the academic calendar.
- Submit inspirational student and faculty profiles to be posted on www.pathwaystoscience.org.
- Use the Partners Directory and Institution Hub on www.pathwaystoscience.org to identify contacts at institutions, programs, and minority serving organizations in your area or where you'll be traveling.
- For more detailed plans and tips, tap IBP's diversity-focused draft plans and handouts, checklists and handbooks on topics such as making the most of conference travel and attendance, and making your website into a more effective recruitment tool.
- Tap IBP's Online Diversity Reference Library. It provides an annotated list of resources (policy documents, studies, and other publications) that relate to broadening participation in the sciences, divided into the categories of:

- Demographic Patterns of Diversity in the Sciences and Higher Education
- How People Learn in Diverse Communities
- Culturally Responsive Science Instruction
- Establishing Mutually Beneficial Partnerships
- Programmatic Approaches to Broadening Participation in the Sciences
- Culturally Reliable and Valid Program Evaluation

Focus on making your website and admissions and enrollment processes friendly, clear and multi-cultural. For example:

- Conduct a review of your admissions and enrollment processes that asks questions like: are your admissions criteria appropriate? Does your program follow up promptly and thoughtfully with interested faculty and students?
- Conduct a review of your website and check off or identify areas that need work, for example:
    - Inspiration: gives students an idea of what their experience will be like and inspires them
    - Features images and bios of current faculty and students carrying out research and activities
    - Bi-lingual
    - Addresses topics that may be of concern to family
    - Provides contact information for a real, live, specific individual who handles inquiries.
    - Clear dates and deadlines

Focus on fostering partnerships – real partnerships with specific individuals:

- *Start with your current networks.* Add detail to your proposal about your current collaboration networks that you will tap for recruitment, such as faculty at other institutions, professional societies, etc.
- *Tap into your own campus resources.* Identify the resources on your own campus and within your campus networks that you plan to work with. For example:

  - Office for Campus Diversity
  - Office of Minority Affairs
  - Minority and women student chapters
  - Student Career Services
  - AGEPs
  - LSAMPs

- *Plan on fostering partnerships with faculty and administrators at minority serving institutions.* Realize that joint partnerships are a two-way street, take time to develop, and are built on trust and presence. Reach out, show up, and follow up.
  - Identify and reach out to minority serving institutions in your local area: HBCU's (Historically Black Colleges and Universities), HSIs (Hispanic Serving Institutions), Tribal Colleges and Universities, community colleges and women's colleges.
  - When you travel for conferences or meetings, plan ahead and include site visits to minority serving institutions in the area to meet and talk with faculty and students in person.

Focus on travel and conference participation:

- *Leverage your current travel and conference participation*. For example:
  - Create a powerpoint slide about your project's opportunities and give it to involved faculty to include when they do presentations at conferences or meetings.
  - Look for events and opportunities at conferences (such as the annual AGU or OSM meetings) that are oriented towards supporting underrepresented students, such as poster sessions, research symposiums, meet-and-greets, career center activities. See how you can be involved: attend poster sessions and talk with students, volunteer to be a conference mentor, seek to be a presenter.
  - Plan ahead and include site visits to minority serving institutions in the area to meet and talk with faculty and students in person.
- *Expand your travel and conference participation.*
  - To get the word out more broadly about your opportunities, you can target specific national organizations for recruitment, such as AISES (American Indians in Science and Engineering Society), SACNAS (Society for the Advancement of Chicanos and Native Americans in Science), SHPE (Society of Hispanic Professional Engineers), NSBE (National Society for Black Engineers), WEPAN (Women in Engineering Proactive Network) and others – all have excellent national conferences annually.

- *Plan events that will increase your project's visibility to the students you seek to recruit.* For example:
  - Host a poster presentation/competition for students, to be judged by project/program faculty. Winning students receive a travel grant to attend a national

conference and present. These kinds of activities can really raise awareness about your program.
- Host bi-weekly or monthly seminars open to the broader community.

Request a targeted student mailing list from IBP'S National Student Directory of 40,000+ students, most of whom are underrepresented minority students.

2. **Retention:** *Implement program structures and activities that build program community, help students connect with support systems, and provide checkpoints and response on student progress throughout the program.*

Recruitment templates and draft plans

IBP offers several tools to assist directors, including a guide to recruitment strategies , a template for drafting a recruitment plan as well as one for assisting with a retention plan . Each of these can be easily adapted to individual programs or used to enhance approaches, especially in trying to make the most of conference participation with an eye to recruitment. Additionally, IBP's guide for writing diversity plans into proposals can be found here. These resources and others can be found on the Pathways to Science Faculty link in the Resource Toolbox.

Sustaining an effective program

Building and Maintaining the Mentoring Network

Reference list of mentoring resources
IBP maintains an annotated reference list of academic research and expert knowledge about mentoring.

Technologies to support mentoring

There is no substitute for personal interaction in mentoring, but online technologies can extend and enhance existing mentoring practices. In conjunction with appropriate effort and resources, freely available tools such as Facebook and Linked-In may support your programmatic efforts. Several to mention are:

Facebook: A properly maintained Facebook page can serve as a program community hub where mentoring relationships can form or continue. For shorter duration programs, such a page can be used to begin mentoring relationships before all participants are together on site.

Linked-In is an effective platform for mentoring of students who are just beginning to develop their professional presence in the discipline. Mentees can be engaged and encouraged to post updates about ongoing research or related activities, and can be coached on how to shape their online professional identities.

See IBP's Best practices for social media in Graduate and Undergraduate programs for more detailed information.

Building and maintaining an alumni network

Keep alumni engaged and expand culture of mentoring to this group from your program.

Embracing the pipeline: Inspire outward, support forward

Embracing the pipeline involves far-thinking in a system built around supporting and assessing results on the (relatively) short term. But persist! Reaching backward and forward in the pipline is critical to creating a broad community of program support as well as deep and lasting change - and fortunately, including just a few concrete activities focused on this end can make a difference.

1. INSPIRE backwards and outwards: Reach out from your program to younger students and bring your science back to community and family.
2. SUPPORT forwards: Continue support for participants on a successful career pathway and transition into grad school, the post-doc experience, and the junior faculty or early professional stages of their academic, research or industrial careers.

For details and examples of the on-the-ground project components and activities, visit www.pathwaystoscience.org.

Program review

In addition to providing funders with program performance information, ongoing program assessment also provides you with tools to make adjustments to your program in stride. Decide early what you would like periodic program reviews to assess and make sure all participants (faculty, students and administrators) see themselves as partners, understand the value of the review to the program goals, and embrace their roles in the review process.

How to use this manual in mentor development

Incorporate this manual in to your program by using sections of it in conjunction with ongoing training for mentors.

* *Additional content is in process*

Troubleshooting

Identifying and addressing ongoing challenges

IBP offers several tools to assist directors, including a guide to recruitment strategies , a template for drafting a recruitment plan as well as one for assisting with a retention plan . Each of these can be easily adapted to individual programs or used to enhance approaches, especially in trying to make the most of conference participation with an eye to recruitment. Additionally, IBP's guide for writing diversity plans into proposals can be found here. These resources and others can be found on the Pathways to Science Faculty link in the Resource Toolbox.

Role in a mentoring conflict

Directors can play both a direct and indirect role in helping resolve dissatisfaction in mentoring relationships.

Early in an REU program, for example, a student may come to you stating that the match will not work and she or he wants a different mentor. The risk of this can be reduced by promoting contact between the mentor and student before the placement begins. However, once faced with it, a quick

assessment of the core issues is needed. Start by asking the student to explain his/her concerns. Part of your role is to help the student learn how to articulate problems professionally. If the student is not able to clearly express concerns, then make some suggestions. Help the student identify and label the issues. For example problems may be related to the project, the faculty mentor, the grad mentor, communication, the work environment or language.

Without offering a solution, first restate the issues so that the two of you can agree on the key points. If the student is not expressing him or herself in a professional manner, then help generate a professional description of the issue. Whatever the two of you conclude, make sure that the student also restates the more professional form. For example, a student may say, "I just have no interest in the project, it seems really boring, and I can't understand a thing that my grad student mentor is saying." Help the student define what aspect of the work she or he finds boring, and what part seemed interesting when they accepted the placement. For example, restating this in the form: "When I corresponded with my faculty mentor about the project, the relationship to acoustics was interesting since I like stereo systems. However, now that I see the work, much of the focus is not related to musical acoustics and designing loudspeakers. At this point, I need help understanding how the work relates to future opportunities for my career. Also, in the initial discussions with my grad student mentor, we had to work hard to communicate. It is not easy for me to understand some of the terminology he uses. Combining this with a topic that I don't understand is making it very difficult to have a discussion." In this case, you have also helped the student focus his concerns which suggests possible avenues for fixing the situation.

If there is a true conflict then you may need to intervene. Now the issue is what sort of working relationship you have with your colleagues. For example, imagine a student enthusiastically starting the placement, but then the lab has an equipment failure that makes the planned project impossible for the summer. If the faculty member responds by giving the student readings instead of field or research work the student may have a very reasonable grievance. At this point, you can work with the mentor on how to proceed. If the faculty member does not have the time to develop a new project for the student, then it may be best to find a different faculty member willing and able to work with the student during the remaining time in the placement.

As the director, you will need to take responsibility for have the student's successful placement experience.

If the student is contributing to the problem, for example missing meetings, not working sufficient hours, not following laboratory procedures, not talking to others in the lab in a respectful manner, then as director, you may need to follow up and take action.

In general, you are in the weakest position if you enter a conversation with a student having only heard second-hand information about his or her performance. It is important to create mechanisms from the beginning of your program that serve the functions needed for both the research process as well as for monitoring individual and team progress. For example, require weekly meetings with the student and ask the student to prepare a written summary for the meeting. This is not only good for the meeting, but also provides you with information on performance. Require that mentors provide written feedback after the meeting. Again, this would clearly document the meeting outcomes for the student and for the faculty, grad students and post doc participants.

Mentor while traveling

A traveling mentor is one of the main complaints from students in field placements. These students want the time and attention from a professional with the accomplishments of a faculty member. Traveling, however, does not need to be a problem. If you can establish sufficient support for the student, establish a strong mentoring relationship before traveling, and remain in contact through electronic means to provide mentoring, then the problems created by your absence can be substantially reduced. Remember, providing sufficient support for the students to accomplish the planned research is a minimum requirement, but not mentoring. Mentoring is the time and attention that you provide the student to assist with their intellectual and professional development. Consider not traveling at the beginning of the placement. This can be a critical time for the mentoring relationship. Significant face-to-face time during this initial period is critical. After the first 2-3 weeks, then your physical absence can be partially replaced with electronic presence. All the comments below, assume that you have established a mentoring relationship before traveling. Here are some ideas for communicating when you travel:

- Request a weekly document providing updates on the research progress. Make this consistent with what you ask for when you are not traveling.
- Request that the student send any exciting results or insights as soon as possible. Do not let them wait to engage you in results that they consider important.

  Establish an electronic communication means – e-mail, text, facebook. Communicate ahead of time, the frequency that you will check for their communication

- Make it clear if and when they can call you on your cell phone. If something will take extensive discussion, state that and defer the discussion until you have returned.

If you have a graduate student serving as a mentor for the student, set up a similar communication system and expectation with the graduate student regarding the mentoring. NOTE – you can have this communication with the graduate student focus on just the mentoring since you would expect the graduate students to make progress on their own research without contact with you during your travels.

Staffing changes/additions/deletions, Professional Development

If faculty or administrators know they are going to be leaving their post, but are mentoring students, they should do what they can to make certain the students receive the needed guidance before they leave. Coordination with administrators and other faculty can smooth the transition to a new mentor for any affected students. Graduate students may be especially vulnerable to this.

* *Additional content in process*

Partnering with division of student affairs

Your colleagues in the division of Student Affairs are trained to work with issues regarding student development. In cases of conflict and misbehavior, consider your colleagues in the division of Student Affairs an important resource. In some cases, you can consult them and they can provide you with advice and in other cases they may work directly with the students.

Develop a working relationship with them before your program begins. It is hard to develop a working relationship in a crisis, so make sure that you already have the connections in the event of a crisis.. Your colleagues in the division of Student Affairs can also be wonderful consultants on student development and provide basic mentoring advice.

Sexual harassment

Review your campus' harassment policy. Be sure to clarify who is in a supervisory role. For example, if a university requires that a supervisor take action when a supervisee brings up concerns of harassment, then doing nothing is a violation of that policy. If the graduate student mentor is supervising the undergrad then that graduate student needs to know the policy and may need orientation and guidance in preparation for mentoring students.

Some campuses have a system/office in place (e.g. an ombudsperson) that can be consulted anonymously. Questions can be answered and directions provided regarding potential steps for a person to take in the event of this kind of concern. These people are resources, not only for a student but also for mentors who need to consider the action that they need to take.

If your school does not have easily accessible information on sexual harassment, The University of Iowa provides an excellent easy to access online resource that is available to everyone, and could supplement your school's established policies.

Harassment can occur within the research group and also within the student group.

Faculty: If there is a marked change in how a student and a graduate mentor or other students in the research group interact with each other, consider that this is a situation that you need to investigate. For example, if a graduate student has made an overture to date a student they are mentoring, while the student may have said no, the situation may have resulted in making the student uncomfortable. In such a case, the situation may need to be addressed for both the student and the grad student. It may necessitate changing mentors. In addition, it may be a 'teachable moment' for the graduate student on how they may have violated the harassment policy.

Mixed age range of REU participants

Creating community among the students must be done carefully when there is a large age range among the students. If an undergraduate program takes place at the same time as a program for high school students, then the directors must take care to arrange for different levels of supervision and advising. Further, even among college students, the age range can be large, and depending on the state laws, you may be likely to have students who are of legal age for alcohol and some who are not.

The issues typically surface during hours where the students are not directly involved in the research activities. The issues can be divided into "attitude" and "behavior."

The attitude of individuals can create significant problems in a student community. A good research placement experience pushes many students beyond their comfort zone in research in order for them to reach their own potential. Some students, often younger, who have not been pushed to perform independent work may complain and create discontent among the group. These students may need additional mentoring and socializing to understand the research/work ethic and related goals of the program.

Typical behavior issues include harassment and alcohol. It is important to make sure that students are aware of the local state and campus policies. Nevertheless, it is likely that students of all ages will

drink alcohol together in social settings. You will want to ensure that the most appropriate response can be taken quickly in case of an emergency situation. This is planning for what we all hope is an uncommon scenario, but a nasty once if it does occur. Some programs employ graduate student supervisors to live with the undergraduates or at least provide general oversight of them. As a program director provide training and direction for these graduate student supervisors and set clear expectations. Define how they can socialize with the undergrads. If they are allowed to attend undergraduate parties, set an expectation on alcohol. If they are supervising the students, be sure and check on your campus or research lab policies. On some campuses any sexual relationship between a student and a supervisor may be considered sexual harassment.

Consider requiring one graduate student supervisor be available at all times for emergencies and make it clear that the supervisor must abstain from any alcohol or drug consumption when on call. Have the graduate students develop relationships with the undergrads, so that the students feel comfortable contacting the graduate students if there is a problem. In short, make sure mature supervision is available and accessible and that the graduate student supervisor who is dealing with an emergency was not part of drinking alcohol at the party or in an inappropriate relationship.

Drinking

It is likely that alcohol will enter into the social activities, whether you are directly aware of it or not.

Issues to Consider:

- Student Attitudes:
  - Working with students who are inebriated
  - Students feel we should expect drinking, even heavy drinking.

- Campus Housing
  - While there may be an alcohol policy and a paid person monitoring the housing facility, this person may not be effectively enforcing the policy.

- Campus Policy:
  - The campus police may be instructed in the case of someone being taken to the hospital, to not investigate for under-age drinking or other violations. This policy is in place so that students will call the police when someone's health is in danger without fear of themselves or friends getting in trouble.

So imagine, after enjoying working with students to help them envision their career, build their confidence and develop themselves as professionals, you may be suddenly faced with a group who will not freely talk and some you are sure are not telling the truth. As a program director, you are now in a role that you have no experience with: A situation with liability and life learning for which you were never trained.

The biggest mistake is to think that you can handle it on your own! Consider when it's time to ask for help.

RECOMMENDATIONS:

- Expect alcohol to be an issue and don't expect the default policies or procedures in campus housing to work. Some programs engage a graduate student to live with undergraduate students.
    - Be clear at the beginning of what the limits are for student behavior and how they will be dealt with.
    - Be practical – only plan and announce what you are willing to do and can enforce.
- Know when you need to bring in the experts in Student Affairs!
    - Build a relationship with the Dean of Students. Ask them to step in when the situation is beyond your experience. (Dealing with students who are not putting in their work time is very different than dealing with a group of students who have violated drinking policies and created an environment where someone was at risk.)

Health insurance issues

Some universities require that students from other institutions have health insurance. You may need to require that the students sign a form indicating that they have health insurance. However, it is not uncommon for students to have no health insurance. At some universities, even if the visiting student comes in with health insurance, they are not allowed to use the university health center, but rather the local health clinic or hospital. If your program is at a field site you should explore the local health care facilities in case your students need to use them. These situations raise several issues that require attention so that they do not end up detracting from the field placement experience.

Particular issues include:

1. Cost for short term health insurance for your program. This may need to be covered by your program
2. Out of pocket expenses, for the student or the program.
3. Visiting students may not be allowed to use the student health clinic. Explore other options.

Examples of problems have included: (1) finding additional financial resources for the program to pay for short term insurance, (2) loosing talented students who could not afford to meet the requirement, (3) large out of pocket expenses because of multiple emergency room visits when normal office hour visits are appropriate.

"In one case, a student left a placement with over $1000 in out of pocket expenses that were generated by multiple emergency room visits for minor health issues. The leadership and mentors when hearing of this realized that they had not even considered that a person would use an emergency room for that type of care, so had not even considered making sure that students knew all of the options for medical attention."

- Dr. J. Adin Mann, M.E., faculty mentor, Iowa State University

In some campuses, there is an open drop-in policy at the campus medical center. While expenses may be charged to a student's health insurance purchased through student fees, students may not have ever realized the costs involved. In a field placement, the use of a local hospital or medical

clinic in that same drop in mind set, may lead to use of the emergency room and hundreds or thousands of dollars of charges that a health insurance policy will not cover.

Students: Understand your health insurance policy and where you will be able to receive medical attention. Be sure that you understand the allowable expenses, visits, and required out of pocket expenses. Do not assume that the health insurance will work the same way that it does when you are at your home institution.

Mentors: Ensure that your program is providing adequate advice/guidance/support for health insurance and access to medical resources. If it comes to your attention that a student is in need of medical attention or is seeking medical attention, ask if they understand how their health insurance is handling the situation.

It is not your role to solve all the issues here, but to flag an issue and help get the student to the person that they need to consult about these issues.

Program Directors: Make sure to cover this subject thoroughly prior to the start of your program as well as in the orientation program when students arrive. Work with each student before they come to campus or a lab or field site so the student has the correct information for their health insurance. Check with the student health clinic on your campus regarding policies for visiting students to use their resources. If the students are required to use a health clinic or hospital in the community, make sure that information is available and ask the facility about any issues that you, your staff and your students should be aware of.

Evaluation

Evaluating broadening participation

For evaluating the effectiveness of diversity initiatives associated with your program, consider reviewing the American Association for the Advancement of Science (AAAS) publication, Measuring Diversity: An evaluation guide for STEM graduate program leaders.

Additionally, refer to the NSF Framework for Evaluating Impacts of Broadening Participation Projects: for information on metrics and indicators you may use for your program.

Using evaluation to revise program design and elements

During the program design process is it helpful to establish clear evaluation goals so that program elements can be developed to support or accommodate them. These goals can and should be reviewed each year as they are used to guide annual reviews of your program. Take the opportunity to use the results of ongoing evaluation to improve program design and practices, as well as adjust expectations.

NSF's User-Friendly Handbook for Project Evaluation is good place to start if you are just beginning to think about evaluation for your program (start with chapter 9 written specifically for NSF funded programs), but also provides detailed yet easy-to-read information on theory and approaches that can be useful to well-developed programs.

Disseminating and promoting the program

Documenting your success

* *Additional content is in process*

List of References

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http://professionalpractice.asme.org/Transition/Studying/Tips_Success_Studying.cfm

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Article to help in understanding and better addressing diversity in your programs.

Boyd, M.K., & Wesemann, J.L. (2009). Broadening Participation in Undergraduate Research. Council on Undergraduate Education.

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Engaging undergraduate students in research, scholarship, and creative activity is a proven and powerful practice for enhancing educational outcomes and expanding frontiers of knowledge. This book is a rich collection featuring institutions that are maximizing the impact of this practice by including: underrepresented ethnic and racial minorities, students with disabilities, females, students of lower socioeconomic status, first- and second- year students, and others not traditionally involved in the development of new knowledge.

Burroughs Wellcome Fund, & Burroughs Wellcome Fund (2006). Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty.

http://www.hhmi.org/resources/labmanagement/mtrmoves_download.html

The purpose of the manual is to alert beginning scientists to the importance of the leadership and managerial aspects of their new (or soon-to-be-acquired) jobs and to give them practical information that will help them succeed as planners and managers of research programs. Not only will the researchers benefit, but the scientific enterprise will benefit as well.

Clewell, B.C. & Fortenberry, N. (Eds.), Bramwell, F., Campbell, P.B., Clewell, B.C., Davis, D., Fortenberry, N., García, A., Nelson, D., Thomas, V.G., Stoll, A. (2009). Framework for

Evaluating Impacts of Broadening Participation Projects: Report from a National Science Foundation Workshop. The National Science Foundation.

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This report grew out of a workshop sponsored by the National Science Foundation (NSF) in Arlington, Virginia, on April 17-18, 2008. The workshop was structured around responding to two questions: What metrics should be used for project monitoring? What designs and indicators should be used for program evaluation? The workshop resulted in providing information for NSF about what it should require for program monitoring and for program evaluation and advice and data gathering information relevant to awardees.

Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline; Committee on Science, Engineering, and Public Policy; Policy and Global Affairs; National Academy of Sciences (2011). Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads. The National Academies Press: Washington, D.C.

http://www.nap.edu/catalog.php?record_id=12984#toc

Expanding Underrepresented Minority Participation analyzes the rate of change and the challenges the nation currently faces in developing a strong and diverse workforce. Although minorities are the fastest growing segment of the population, they are underrepresented in the fields of science and engineering. Historically, there has been a strong connection between increasing educational attainment in the United States and the growth in and global leadership of the economy. Expanding Underrepresented Minority Participation suggests that the federal government, industry, and post-secondary institutions work collaboratively with K-12 schools and school systems to increase minority access to and demand for post-secondary STEM education and technical training. The book also identifies best practices and offers a comprehensive road map for increasing involvement of underrepresented minorities and improving the quality of their education. It offers recommendations that focus on academic and social support, institutional roles, teacher preparation, affordability and program development.

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Mentors need not have the same cultural or social background as their mentees. But they must pay close attention to the implications of the differences

Dartmouth College, How to Keep a Notebook.

http://www.dartmouth.edu/~chemlab/info/notebooks/how_to.html

A guide for students in keeping a lab notebook.

ENGAGE, Engaging Students in Engineering, Faculty-Student Interaction (FSI).

http://www.engageengineering.org/?page=24

Communication strategies and research to help faculty improve the quality of interactions with students.

Engineering Information Foundation (EiF), Grant Programs.

http://www.eifgrants.org/info/index.html

The mission of the Engineering Information Foundation is to improve worldwide engineering education and practice through information technology and the recruitment of women. This page outlines their funding criteria.

Flint, K., & Phillips, C.J.F Mentoring Plans for Postdoctoral Scholars. National Postdoctoral Association.

http://www.nationalpostdoc.org/publications/mentoring-plans

Mentoring can have a profound influence on the relative satisfaction and success of postdoctoral scholars. Mentoring plans are tools to help optimize the mentoring experience by providing a roadmap for both the mentor and the postdoc of the activities that will be undertaken to further the postdoc's professional and career development. This includes support for the enrichment of a postdoc's research knowledge, skills, and productivity as well as assistance in furthering the postdoc's career prospects. This mentoring toolkit includes resources developed by the National Postdoctoral Association (NPA) for how to draft a mentoring plan, suggestions for effective mentoring activities, and other resources on effective mentoring.

Hall, A. (2011). Social Networking and Scientific Connections. SACNAS.

http://sacnas.org/about/stories/sacnas-news/spring-2011/social-networking-and-scientific-connections

Thoughtful article on social media to assist with program preparation and networking.

Handelsman, J., Pfund, C., Lauffer, S.M, &Pribbenow, C.M. Entering Mentoring. The Wisconsin Program for Scientific Teaching, supported by the Howard Hughes Medical Institute Professors Program.

http://www.ibparticipation.org/pdf/EnteringMentoring.pdf

An eight week seminar resource book. The goal of the seminar outlined in this manual is to accelerate the process of learning to be a mentor. The seminar provides mentors with an intellectual framework to guide them, an opportunity to experiment with various methods, and a forum in which to solve mentoring dilemmas with the help of their peers.

Hara, B. (2011). "Think Before You Tweet (or Blog or Update a Status)". *The Chronicle of Higher Education*.

http://chronicle.com/blogs/profhacker/think-before-you-tweet-or-blog-or-update-a-status/30949

On the pitfalls and power of social media.

Harvard Medical School, Office of Postdoctoral Fellows, (2009). NSF Postdoc Mentoring Plan Requirement for Proposals.

http://www.ibparticipation.org/pdf/nsf_pdoc_mentoring_plan_propreqs.pdf

One of the most significant changes to the PAPPG is implementation of the mentoring provisions of the America COMPETES Act for proposals that include support for postdoctoral fellows. Proposals without a separate section will be returned without review.

Institute for Broadening Participation, (2011). Recruitment Plan.

http://www.ibparticipation.org/pdf/IBP_Recruitment%20Plan_2010_1220.pdf

IBP offers a template of a recruitment plan that can be adapted easily to individual programs and ideas on how to make the most of conference participation with an eye to recruitment. These resources and others can be found on the Pathways to Science Faculty link in the Resource Toolbox.

Kenrick M., & Murphy, E.S. (Eds.) (2010). The Faculty Handbook: Mentoring Undergraduates in Research and Scholarship. University of Alaska Anchorage.

http://www.uaa.alaska.edu/ours/for-faculty/faculty-mentoring-manual.cfm

This handbook is intended as guidance for mentoring undergraduates in research and scholarship at UAA. To get a broad picture of how undergraduate researchers are mentored at UAA, we solicited and received essays from twenty-one faculty members across different disciplines, schools, and colleges.

Lakoski, J.M. (2009). "Perspective: Top 10 Tips to Maximize Your Mentoring". *Science*.

http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2009_08_14/caredit.a0900101

Practical tips on improving how you mentor.

Loretz, C, (Ed.) (2002). Looking Beyond the Borders: A Project Director's Handbook of Best Practices for International Research Experiences for Undergraduates.

http://www.nsf.gov/pubs/2006/nsf06204/index.html

Developed by the NSF Workshop on Best Practices for Managing International REU Site Programs. This document includes good guidance for domestic as well as international programs.

Muller, C. (2011). Talk to Me Facilitators Toolkit and Student Handouts. Women in Engineering ProActive Network (WEPAN).

http://www.ibparticipation.org/pdf/TalktoMeFacilitatorsToolKitStudentHandouts0210.pdf

"Talk To Me": A Toolkit for Engineering Educators. Talk to Me is a project aimed at improving faculty-student interactions for 1st and 2nd year women engineering students.

Muller, C. (2011). Talk to Me Seminar: Secrets of Success presentation powerpoint. Women in

Engineering ProActive Network (WEPAN).

http://www.ibparticipation.org/pdf/SecretsofSuccessTalktoMePowerPoint0210.pdf

"Talk To Me": A Toolkit for Engineering Educators . Talk to Me is a project aimed at improving faculty-student interactions for 1st and 2nd year women engineering students.

Myers, R. (2010). "Why You Need To Mentor, No Matter What Your Level". BitesizeBio.

http://bitesizebio.com/articles/why-you-need-to-mentor-no-matter-what-your-level/

In this article, Richard Myer of UC Davis highlights the learning experience of mentoring. He cites mentoring as a unique means to advance the knowledge and capabilities of the mentor through the act of teaching and guiding others.

National Academy of Sciences, National Academy of Engineering, Institute of Medicine (1997). Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering. The National Academies Press.

http://www.nap.edu/openbook.php?record_id=5789

This guide offers helpful advice on how teachers, administrators, and career advisers in science and engineering can become better mentors to their students. It starts with the premise that a successful mentor guides students in a variety of ways: by helping them get the most from their educational experience, by introducing them to and making them comfortable with a specific disciplinary culture, and by offering assistance with the search for suitable employment. Other topics covered in the guide include career planning, time management, writing development, and responsible scientific conduct. Also included is a valuable list of bibliographical and Internet resources on mentoring and related topics.

National Science Foundation, Research Experience for Undergraduates Resource List.

http://www.nsfreu.org/articles/Useful_Resources.htm

New York State Department of Civil Service, Ten Tips for a Successful Mentoring Program.

http://www.cs.state.ny.us/successionplanning/workgroups/Mentoring/tentips.cfm

Non-academic institutions also provide valuable perspective and information that can inform academic program design.

Riskin, E., Ostendorf, M., Cosman, P., Effros, M., Li, J., Hemami, S., & Gray, R.M. (2005). PAESMEM Proceedings at Stanford University: Values for Mentors. Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM).

http://paesmem.stanford.edu/html/proceedings_3.html#1

There is no single agreed upon set of best practices to serve as guides for mentors, but the presentations and discussions produced a collection of variations on common themes that provide a good start.

Swarthmore College, Advice on keeping a laboratory notebook.

http://www.swarthmore.edu/NatSci/cpurrin1/notebookadvice.htm

A guide for students in keeping a lab notebook.

The University of Iowa, Sexual Harassment Can Happen Anywhere.

http://www.sexualharassment.uiowa.edu/

The University of Iowa provides this easy to access online resource that is available to everyone, and could supplement your school's established policies.

University of Michigan, Campus Mind Works.

http://www.campusmindworks.org/students/preparing_for_college/grad_Academicdemands.asp

A resource to assist graduate and professional school students with the challenge of managing academic demands, stress, work, courses and personal needs.

University of Michigan, Rackham Graduate School, (2010). How to Get the Mentoring You Want: A Guide for Graduate Students.

http://www.rackham.umich.edu/downloads/publications/mentoring.pdf

Guide for graduate students who seek to improve the quality of their relationships with faculty.

University of Wisconsin, Madison, Women in Science and Engineering Leadership Institute (WISELI).

http://wiseli.engr.wisc.edu/

The Women in Science & Engineering Leadership Institute (WISELI) is a research center at the University of Wisconsin-Madison. WISELI was formed in 2002 with funding from the National Science Foundation's ADVANCE: Institutional Transformation program. The center is currently funded with a combination of: contributions from eight UW-Madison schools, colleges, or units; grant funding from national scientific funding agencies; gift funds; and funds earned through WISELI's income-generating activities.

Washington Space Grant Consortium, The Basics of Poster Design.

http://www.ibparticipation.org/pdf/SpaceGrantBasicsOfposterDesignWorkshop.pdf

The Washington NASA Space Grant Consortium offers this handout as a guide to instruction on poster design.

Wayne State University School of Medicine, Department of Physiology, Guidelines for student mentor relationships.

http://physiology.med.wayne.edu/phd-physiology/

The Wayne State University School of Medicine Department of Physiology offers insightful guidelines for student mentor relationships as a powerpoint presentation that could be viewed by an entire research group.

Web GURU, The Laboratory Notebook.

http://www.webguru.neu.edu/lab/laboratory-notebook

A guide for students in keeping a lab notebook.

WebGURU - Guide for Undergraduate Research, WebGURU References for Undergraduate Research.

http://www.webguru.neu.edu/references

Resource list of practical guides to literature seraches, time management, and other research related activities.

Women in Engineering ProActive Network (WEPAN), Women in Engineering ProActive Network (WEPAN) Knowledge Center.

http://www.wepanknowledgecenter.org/research-and-reports/mentoring-networking

Directory of mentoring and networking resources for graduate and undergraduate engineering students.

Women in Science and Engineering Leadership Institute (WISELI) (2009). References: The benefits and challenges of diversity. WISELI.

http://www.ibparticipation.org/pdf/benefits_of_diversity_references.pdf

Women in Science and Engineering Leadership Institute (WISELI) (2010). Benefits and Challenges of Diversity in Academic Settings. WISELI.

http://www.ibparticipation.org/pdf/BenefitsAndChallengesOfDiversity.pdf

The diversity of a university's faculty, staff, and students influences its strength, productivity, and intellectual personality. Diversity of experience, age, physical ability, religion, race, ethnicity, gender, and many other attributes contributes to the richness of the environment for teaching and research. We also need diversity in discipline, intellectual outlook, cognitive style, and personality to offer students the breadth of ideas that constitute a dynamic intellectual community.