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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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.

Acknowledgments

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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

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

Ask the experts

Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM)

The PAESMEM Program seeks to identify outstanding mentoring efforts that enhance the participation of groups (i.e., women, minorities, and persons with disabilities) that are underrepresented in science, technology, engineering, and mathematics. The awardees serve as leaders in the national effort to develop fully the Nation's human resources in science, technology, engineering, and mathematics. Awardees are hosted and recognized at the White House and receive a modest financial award from the National Science Foundation. Program and Individual Awardees are listed in the directories that follow.

PAESMEM programs directory

Awardees directory

PAESMEM awardees directory

See IBP's Awardees directory for information on Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) awardees.

General guide to mentoring

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

Why mentor?

Reasons to 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.

Responsibility for the mentoring environment

As the faculty mentor, you are responsible for the mentoring environment. Delegating some of the mentoring to graduate students in your research group can be effective. However, you are responsible for how well that goes. Your responsibility includes your whole team: the undergraduates, the graduate students and the postdocs. It is critical that you carefully review your commitments during the placements you host to ensure that you can fulfill the responsibilities of being a mentor and a mentor of new mentors!

Referring students elsewhere

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 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 may include suggestions to help point the student to a program or professor who would be a better fit. When appropriate offer to help students make those connections.

Mentoring Ph.D. students and postdocs

Graduate students, particularly Ph.D. students, and postdocs should be mentored with the recognition that they are junior colleagues, not students. Thus, there is a considerable difference between their mentoring needs and those of undergraduate and younger students. MS students, particularly those in programs requiring a thesis, have mentoring needs closer to Ph.D. students and Postdocs than to undergraduates.

NSF recognizes 3 types of mentoring responsibilities for Postdocs (and most of these same responsibilities also apply to Ph.D. students): adviser responsibilities, departmental responsibilities and institutional responsibilities.

Adviser Responsibilities Include:

- Encourage, and then assist with, publication of results including advice on appropriate journals; structure, length and content of articles including appropriate analyses and graphics; and assist with publication costs. It is particularly important to assist students and postdocs in responding to reviewers. For example, one's first unfavorable review can be quite devastating.
- Encourage participation in scientific meetings and assist with writing and submitting abstracts, choice of sessions and travel costs. Encourage, and assist with meeting networking.
- When colleagues visit, introduce students and postdocs and "talk them up" when they deserve it.
- Offer advice to students on postdoc opportunities and job advice to both students and postdocs. Encourage both students and postdocs to think broadly about their career, and try not to overly influence their choice (e.g. don't explicitly or implicitly push the student/postdoc towards an academic research career).
- Try to meet regularly with postdocs and students. Keep in mind that young scientists often lack confidence in their own abilities and need encouragement.

- When appropriate, encourage proposal writing, particularly for postdocs. Offer to be co-investigator if you believe that offers an advantage and also make it clear the conditions under which a grant can be moved by the postdoc to a new institution.
- Keep students and postdocs informed on the status of their funding and make sure they know when shortfalls are anticipated or are possible.

Departmental Responsibilities Include:

- Departments should ensure that there is a postdoc mentoring committee that meets with each postdoc and graduate student regularly – at least once per year. This committee generally does not include the adviser, although does solicit input from the adviser along with other input. The purpose of the committee is to provide an evaluation of progress and to discuss any issues that may have arisen.
- Department Chair, or designee, is a go-to person for postdocs and graduate students who need advice or assistance on important professional issues such as resolving conflicts or "issues" with their advisers or others in the department. A designee should not be a departmental administrative assistant but should be another senior faculty member in the department or an Assistant/Deputy Chair.
- Postdocs and senior Ph.D. students should be invited to give a departmental seminar at least once while in residence.
- Encourage occasional social gatherings to which postdocs and graduate students are invited.

Institutional Responsibilities (as represented by a College Dean, College Graduate Program Director, or their designee) Include:

- Arrange opportunities for seminars, panel discussions or other formats with representatives (e.g. alumni) who can discuss different career possibilities, including in different types of academic institutions (e.g. liberal arts colleges, research universities); federal laboratories, including FFRDCs (federally funded research and development centers); private industry and non-profits, including start- ups particularly those of college alumni; program management and other possibilities.
- Arrange training in ethical conduct in research, including the topics now required by NIH and soon by NSF.
- Arrange training in proposal and manuscript writing.
- Arrange workshops on key topics of interest to young scientists, such as how to negotiate for a job.
- Encourage occasional social gatherings to which postdocs and graduate students are invited.

Calibrating your mentoring to meet mentor needs

Each student as well as each mentor is unique. Some students are comfortable with autonomy and others want reassurance. Further, some mentors want to be very involved in a student's experience with multiple informal and formal meetings a week, and some mentors are satisfied with very little contact, sometimes only three to four meeting during the entire field placement experience.

Be careful to not treat an undergraduate student like a graduate student. A graduate student is on a 2-6 year "apprenticeship", so they have time to understand and adapt to a mentor's style. If the graduate student needs additional support, they have time to develop support networks. A summer student, typically on an 8-10 week field placement, does not have the time to make such adjustments.

It may be interesting to note that at many companies, a 6 month internship is considered the minimum amount of time. Commonly, the first month or two is considered the training period. So both the intern and mentor expect the final 4 months to be rewarding for both participants. Compare that to a common summer research experience of 8-10 weeks.

There are multiple styles of mentoring. Some faculty members have been known to say: "I was not expected to meet with my mentor more than once a semester, so a student needing more than that is not appropriate." Other faculty state: "I want to work in collaboration with the student, so I want to be involved in all their work so that it is all done correctly." A student working with the first faculty member may languish because of insufficient mentoring while the second student suffers because of a faculty member with an intrusive mentoring style, who never lets the student learn from her own mistakes or gain confidence from her own accomplishments. Students and mentors may fail when expectations and desired mentoring patterns are not well matched or appropriately adjusted.

Preparation for the program

* Additional content is in process

Short term placements

In a typical 8-10 week placement, the students and mentors have only two to three weeks to orient or adjust to each other's work styles. In this situation, mentors and students need to adjust quickly. BOTH need to adjust. If you don't want to adjust, then consider not mentoring. That may be the best decision for you and a potential student.

Consider how many weeks during an 8-10 week placement can go by with the response from a student of "No we don't need to meet because everything is going as planned." After two or three weeks of a student delaying a meeting, there may be very little time left to fix a problem.

During the program

Initiate your relationship by explaining your approach and the reasons. Do not just say that "this is the way it is" or "this is for your own good." – explain why. Put the discussions in the context of your view of what is required to be successful in future efforts.

If a student wants more of your time than you think is reasonable:

- Assess their skills to determine if they are (1) missing key skills, (2) missing confidence in their skills, or (3) do not have access to required resources.
- If they lack skill – consider spending time, helping them find appropriate resources, or changing the tasks.
- If they lack confidence – consider telling them that they have the skill and that you see them needing to build confidence as a component in the placement. You may not be supporting

them as much as they may want, but you are making a conscience effort to provide them with the professional and personal development that they need to be successful.
- If they lack access to adequate resources - consider taking the time to establish their access to the required resources.

If a student wants less of your time (e.g. to be left alone):

- Assess their progress. Are they covering up a lack of progress?
- Are they covering up a lack of confidence to present their work in a meeting?
- Are they not being challenged enough?
- Do they need the opportunity to work more on their own?

Student background: aspects to consider when mentoring

You have chosen a talented student – now you need to match the tasks and mentoring environment to the background of the student. Talking to the student is the best way to understand his or her background. In addition, consider reaching out to a faculty member at the student's home institution – of course with the student's permission.

Matching the placement tasks with the background and talents of a student are critical for the success of the placement: for the student, graduate student or post doc mentor, and you. Talk carefully to the student to understand his or her technical and work and academic background. If a student's background is hands-on and the project is more theoretical or computer modeling, then try to add some hands-on work to the project as soon as possible, to increase the chances for the student's feeling of early success and to instill self-confidence.

"Today I just had a student say 'this is the first time that I have asked a technician for help. I want to make sure that I am not wasting their time or coming across as stupid." So the student and I talked through the details of what she needed to ask, and I assured her that her questions were good and that the technician would tell her if they have time. I reassured her to just be clear and the technician will also be clear. I went to the lab about an hour later, and the student was working the crane and quite happy. It was a great break from the computer modeling work."

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

Another example would be to consider a student's background in using textbooks.

"One student was reading a book for a couple of days and I asked, 'how is it going?' The response was, 'This is actually the first time that I am just reading a text book. Normally I use the notes in class and examples in the text to get my class work done.' With that sort of background, the student may need additional guidance in how to read a textbook or technical paper when there are not specific homework problems to solve.

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

Mentoring underrepresented minority students

"Underrepresented students need to establish a network of 'classical mentors' and identify strategies to establish these vital reciprocal relationships throughout their careers in STEM."

The following facts were presented in the National Academy of Sciences titles [Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads](), published in 2010 ([PDF summary here]()). The report provides references to published literature supporting each of these findings. To understand and better address diversity in your programs see ["The Road to Diversity: Are We There Yet?"]() This article talks about the importance of role models and mentoring as well as the need for producing a diverse population of scientists.

Review this information. It will guide you in the critical role you play as a faculty member, graduate student, or post-doc mentor. As you mentor, be very conscious of your role which goes far beyond helping the student have a successful placement.

CREATE AWARENESS AND IGNITE PASSION FOR STEM

- Summer internships provide exposure to STEM careers – the exposure must provide information, create awareness, and ignite a passion for science (pg 81)

BUILD CONFIDENCE TO TAKE ON CHALLENGE

- "Much of the research has focused on ways to address issues of student motivation and confidence, as the challenges are likely to incorporate psychosocial factors beyond simple questions of access and opportunity." (pg 105)
- "Thus one of the key ideas has been to enhance student's confidence in their own abilities. This helps students turn the difficulties that students will have to overcome into challenges rather than threats." (pg 105)
- Steering underrepresented students into less demanding courses and programs can be counterproductive when students should be challenged by encouraging them to take the highest level courses for which they are prepared (pg 81).

Dr. Betty Neal Crutcher provides useful perspectives on difference and circumstance within the mentoring experience in her article [Mentoring Across Cultures]().

[Equal Access: Inclusive Strategies for Teaching Students with Disabilities (Case Study 3)]() demonstrates inclusive strategies for recruiting and retaining students with disabilities and women students (with particular emphasis on improving and increasing communication). This document, and others like it, is from the [National Center for Women and Information Technology: Promising Practices]().

* Additional content in process.

From a minority serving or majority institution

* Additional content is in process

Students from different size institutions

The issues are both real and perceived. Focus on the student's talent and realize that your perception of the student's home institution and your comfort and practice with providing a nurturing environment can impact the success of the placement.

One important point is that neither the size of, nor a faculty mentor's perception of, the prestige of an institution is directly correlated with the talent of a student. Research clearly shows that some students, for example Latino/a, choose to attend colleges near their home in order to be near family and also to save costs. Although these students may be admitted to colleges with prestigious reputations, they might choose to attend a smaller and sometimes less prestigious college near home. Focus your assessment and discussions on talent, not skills. Skills can be taught and expanded upon. Identify when an issue is related to a skill and then provide the resources for the student to gain that skill.

Smaller colleges often have a core commitment to maintaining nurturing environments. This is particularly the case for minority serving institutions. Thus, it is imperative that you are able to recognize questions and issues that are associated with a student's expectation of more individual guidance than you may be used to giving, as distinct from questions and issues that are related to skill. Ask the student to assess and describe how they are experiencing the mentoring that you and your graduate student are providing relative to what they experience at their home institution. Their description may help you understand a different model, as well as how to adapt your mentoring and address the student's expectations. For example, if the student suggests that they are used to having a faculty mentor available all the time to answer questions, then help them understand how to work with your schedule and also how to organize their questions into those 1) focused on getting help in a specific area and 2) getting reassurance and approval to proceed with their plan of work.

On some campuses, the enrollment is small enough that students receive a great deal of individual attention, encouragement and recognition. A student with this experience may need assistance with developing self- monitoring work habits. You can do this by discussing both the type of oversight that they received in the past as well as how you or other students managed to develop and practice more independent work habits.

Talking about gender, race, and ethnicity with your mentee

Given the dominant demographics, it is likely that most women in an engineering program will be mentored by men. It is also likely that under-represented minority students will be mentored by people who are not of their race, ethnicity, or nationality.

Some data on mentoring indicates that the race and gender of the mentor can impact the student. There is also evidence that a mentoring relationship with an under-represented minority is improved when the mentor can talk about race.

Mentors: If your student is an under-represented minority student who is attending a minority serving institution and you are at a large predominantly white research university, ask them how they are experiencing their new placement. Ask about how they find your campus or field station. How is it different in terms of size? How do they experience you as a faculty member compared to many of their other faculty? Ask them how they are experiencing working in a research group with international and other students with different backgrounds. Ask how they are being treated in the community. Ask if they have any concerns with how they are being treated as a woman or minority. Be sure to focus a question on them personally (as opposed to as representative for their entire race or ethnicity).

"One summer I had a student from a small HBCU. After about three weeks into the placement he would come into the lab wearing a head wrap and would be working at the computer listening to rap music. When I walked in he would quickly turn off the music and remove his head covering. I talked with him about my expectations – that he neither had to remove his head covering nor stop the music, but just come to the lab and work hard. And we had to talk about what aspect of his habits – coming in late in the morning and taking a long lunch – did need to change. His music or head covering in no way influenced his behavior (always professional). His time at work improved, as did his comfort with what he wore (always professional)."

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

Socializing

Positive and productive socializing

Socializing is a critical part of the experience – it contributes to or greatly impacts the bonds between colleagues who will work hard together, help each other, and then maintain contact after graduating. For an undergraduate, this can be a critical time to develop insight into the life of a graduate student and faculty member. It also provides times for students to receive informal mentoring on their professional development. Some of the best discussions initiated by a student about his or her future plans may happen when walking to get a cup of coffee.

Clear boundaries

It is important to remember that socializing needs boundaries. Boundaries can be different for different cultures, backgrounds and at various institutions. For example, the boundaries between students and faculty at an undergraduate institution of 1,000 to 2,000 students may be very different than the boundaries between students and faculty at a research institution with 25,000 to 50,000 students. It is a common misconception that one's own experience and boundaries are the same for everyone else as well. All parties, undergraduates, graduate student mentors, post- doc mentors, and faculty mentors need to be aware and careful of the differing expectations for these boundaries. In particular, graduate students, post-docs, and faculty who are new to their position may need to adjust their view of boundaries, for their new role as a mentor.

Graduate student, post-doc and faculty mentors should be careful to maintain appropriate boundaries with students. It is important to keep socializing on a professional level. It is critical that mentors maintain a relationship that enables them to provide constructive and objective feedback to students. There is a level of social engagement that can seriously compromise one's effectiveness as a mentor.

Most institutions have established policies to guide faculty and students in these matters. It is a good idea to familiarize yourself with such policies and to find out where and to whom you can direct your questions about them. In some cases, an understanding of social boundaries has been incorporated into the norms of institutional or departmental culture and may not be obvious to a newcomer. Asking colleagues directly about such norms can provide the new mentor with critical information that may not appear anywhere in writing.

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.

Documentation of students' work and progress

Update reports

Update reports can serve the mentors, students, and program coordinator tremendously. While they may be more formal than is typical for a field experience, using an update report is an important skill that a student will need in their future education and professional life.

Considerations for why an update report will help you (the student):

During those final two weeks of the placement when a full report is being written, the update reports from the duration of the placement can be strung together to form the backbone if not most of the report.

Writing a report requires you to reflect on your work.

- This will help with planning the next steps
- Knowing that you need to submit a report will make you complete tasks: for example, completing a data analysis to the point of creating the plot or table that shows key facts.
- A well written report will provide information for your mentor to provide the effective advice and assistance.

Key features of an update report are:

- report goals are clear and stated within the report
- concise
- information and the question(s) are focused
- provide critical data
- make a clear request of the reader
- state the next work to be performed

Consider the following outline for an update report:

1. Executive Summary.
    a. 2-5 sentences giving key points of the report.
    b. Write this after completing the update report.
2. Report Goal and Action Request.

    a. Clearly state the goals of the report.
    b. Clearly state the actions that you want the reader to take.(Ask for a meeting, indicate needed materials, pose questions...).
3. Work Accomplished.

   a. Summarize your accomplishments since the previous report.
   b. Include supporting data.
  4. Barriers.

   a. Identify work not completed as planned and the reason.
   b. Identify new barriers identified for future work.
   c. Identify resources or information needed from the mentor.
  5. Work Plans.

   a. Describe the planned work for the upcoming period.
     i. Decide on this with mentor.
   b. Address barriers and resource needs.

     i. If you know what will be done to overcome barriers – then state plan.
     ii. If you need something – for example a meeting with the mentor to discuss the work – then state this.

Tracking the progress of students

Tracking the progress of multiple grad students can be a challenge. UMaine's School of Marine Sciences has implemented a " Milestone" form that the student and mentor fill out together and submit periodically to the Graduate committee.

Giving feedback to a mentee

E-mail standards for communicating with mentees

Research shows that leading by example is one of the most effective ways to encourage professional development. It is easy to forget to model professional communication and/or to provide feedback to students on their communication style—particularly with the ease of e-mail communication.

During the time leading up to a student's placement, you will likely have e-mail exchanges. Make sure that you are writing professional e-mails. Once the student arrives take the opportunity to point out what they do well as communicators and how they could improve the professional style of their e-mail communication.

During the placement, if you receive an e-mail from a student that is not professional, return it with a suggestion such as: "I want to respond to your e-mail once you have sent a more professional e-mail. Your concern or question is well thought through, but it is important that you learn to communicate more professionally. Give it another try…here's an example."

How we handle our frustration, both with the work of the student and our other struggles can have a tremendous impact on the student There are times when a face-to-face meeting is not wise, a time where a well composed e-mail may be something that we can do in a more appropriate way. Consider this when choosing a means of communication.

If the topic is difficult, address or discuss it in a face-to-face meeting. Let the student know in advance what the topic will be. For example, in an e-mail you can state: "Today I would like to meet

and discuss your use of the lab and cleaning arrangements. We have discussed these issues before but we still seem to be having some problems. Please be prepared to suggest ideas and/or and needs for additional changes. Please remember the core goals: order and cleanliness in the lab is needed for quality data and respects the needs of others in the lab." While this may make the student nervous, it will allow them time to prepare a thoughtful response to the problem.

Balancing challenge and support

Time

Some faculty members have been known to say: "I was not expected to meet with my mentor more than once a semester, so a student needing more than that is not appropriate." Other faculty state: "I want to work in collaboration with the student, so want to be involved in all their work so that it is all done right." An intern for the first faculty member may languish because of not sufficient mentoring and the intern for the second languish because of a faculty member with a suffocating mentoring style, never letting the intern make a mistake or gain confidence from their own accomplishments. I have seen interns and mentors fail when expectations and desired mentoring patters are not matched well.

Literature searches

Guide for faculty

It is critical to remember that most students have not developed the skills to read literature analytically. While reading is a skill that all students will have, reading documents for a research project requires both a skill and context that few have. It is the role of the mentor to ensure that the student has the support to develop the skills, as well as the time to understand the context for the information that they need to pull from literature.

It is critical to be well prepared for the initial weeks of a field placement. This is typically when reading literature will be the focused activity, and therefore this is the time to set the tone for how you and your graduate students and/or post- docs will work with your new student(s). It is also extremely important that materials given to the new student(s) are appropriate for their technical level and fit within the context of how they learn.

Suggestions:

1. Preparing:
    a. Ask a student before they arrive if they prefer to start with a global view or a detailed view.
    b. Select literature based on the background of the particular student including what you might know about her or his learning style.
    c. Discuss all the literature with the graduate student and / or post doc who will be supervising the student(s). Identify the key points that students should get from each document. Do not share this list with the student(s).

        d. Plan to be available to provide assistance, daily if possible – so work time into your schedule.
2. Launching the new student:

        a. Present the literature in the context of what you expect the student(s) to get from the literature.
        b. Ask the student(s) to describe her or his experience with reading literature
        c. You and your graduate student/postdoc can review the techniques that you yourself use to read literature that is completely new. Consider whether such techniques might assist students who are facing a similar situation.
        d. Be specific on what you are expecting from the student(s).
        e. Plan the next formal meeting and when you are available for the student(s) to check in.
3. Monitoring student progress:

        a. Check in with the student(s) on an agreed schedule.
        b. Ask the graduate student and / or post-doc how the student(s) are progressing. Do the graduate students or post docs need some advice? Do you need to provide more guidance to the new students?

Modify expectations as seems appropriate. You may quickly see that the learning style for the student is different than expected. Maybe it was decided to start with a broad overview, but it is clear that the student wants to focus on detail. Possibly redirect the student to focus on the broad overview or ask the student to read different documents, ones that are more focused on a detail of the planned work.

Guide for home institution mentor

Often, it is difficult to get students to either ask for help, ask in an appropriate way, or to persevere with the work and ask later. As a person who knows the student's work and learning style best, you can review the expectations that were provided by field placement faculty and student mentors and make sure that your student understands them. If the student is, or the expectations seem, unclear, you may have the opportunity to coach the student in how to review the documentation and/or how to approach the mentors for additional clarification or guidance. You may be better placed to help the student understand if she/he is not clear what to do. If the student seems to have done a good job and is at the point where she/he needs to discuss the technical content of the document the student may welcome your suggestions and guidance on other documents to read or other avenues to pursue.

Keeping in touch with the student while they away will also make the transition back to your home campus smoother for the student. In addition, many programs have formal mechanisms for involving home institution faculty directly. If you are interested in participating with a field institution consider contacting them about possible formal partnerships and program activities.

* Additional content is in process.

Virtual mentoring

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.

MentorNet

MentorNet provides resources, training and an e-mentoring network to promote virtual mentoring at all levels in engineering and science. This case study gives an introduction and overview.

Use of social networking tools for mentoring

* *Additional content is in process*

Handling the unexpected

As faculty we are all used to reacting to the dynamic situations of funding, research, and graduate student experiences. The only difference for a field placement student is that the time scale for their experience is much shorter than graduate students. Further, because they are early in their academic career, the student will also likely have fewer personal resources to handle the unexpected situation. Thus your attention and support is even more time critical than for most graduate students.

How to "salvage" a placement

Unlike a well-designed course, where the lectures are carefully divided, and assignments, quizzes, and exams designed and scheduled, research can sometimes appear more like a random, chaotic sequence of events where we say "Oh cool – look what we found…" While this is clearly an exaggeration, the point is to expect the unexpected in research. Remember, the Mickelson-Morely experiment failed – it is often referred to as the most famous experiment to fail. If research moves along in a smooth methodical pace, then one could argue that risks are not being taken. Equipment breaks, experiments do not work, fields flood, people forget to order chemicals … plan for these barriers as well as those that you cannot predict.

Message:

- Students: persistence
- Mentors: plan contingency work and plan to spend additional time with a student as needed

Mentors: If equipment breaks or chemicals run out, causing a critical element of a student's research project to be put on hold, one of the worst choices is to give the student more papers to read. Before the placement begins, devise multiple projects or approaches to the project. You may start the student on one project, but if this really does not work, then a change is easily made. Avoid having a student who showed up at the beginning of the summer, excited with a vision of possibilities, leave the experience saying "the equipment broke so I had to sit and read papers about what I might have done."

Contingency planning takes more time and it may be inconvenient, but it improves the program and averts disaster for the student.

What to do if a mentor leaves or is planning to leave the university

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*

Maintaining a long term relationship with your mentee

Looking beyond recruiting for graduate school in your research program

You are an important resource and connection for your students. As you know you will be called upon to write reference letters for other placements, full time jobs, or graduate school. Your role as a student mentor should be comprehensive and rewarding for both you and the students as they continue in their education and professional development.

Maintaining a relationship with a student in a research placement may not only benefit your own research program directly by recruiting the students to your graduate program, but should also benefit you (and them) beyond their graduate years. You are, in effect, building your own professional network. Even if students do not choose to attend graduate school in your research group or at your institution, they may well become an exceptional prospect for a post-doc or faculty member at other institutions. Following a student's career development can be a good means to both increase their interest in your institution and also provide you and your department with a network and resources to recruit and attract a diversity of talented faculty candidates. In particular, there is evidence that for candidates from under-represented groups this type of personal connection can be a critical means to recruit a diverse faculty and student body. Even if the student does not choose to return to your institution, they can influence friends and acquaintances to attend. This can be extremely effective in building a long term network for your field of research and your institution.

People can usually tell the difference between someone who mentors out of a desire to see them succeed, rather than for furthering their own goals. Be sure and focus your mentoring on the personal success of the student, and it is likely that sometime in the future, this will have a positive impact on your success.

Recruiting a mentee for graduate school

A summer placement can be an exceptional opportunity for you and the mentee to interview each other for graduate school. If you have identified the student as a good prospect for graduate school in your research group or your department, then start early to build a relationship that develops beyond the placement. If you are not able to recruit the student to graduate school, then there is always a post-doc or faculty position to recruit her or him for at a later time. You can do this by maintaining a professional mentoring relationship beyond the initial placement.

Talk directly to the students about your interest in seeing them attend graduate school in your research group or department. Be specific, describe what they have demonstrated as a unique contribution to your research group. Make it clear from the beginning of this discussion that you would understand if they don't have an interest in your research group. This allows the student to be more honest with their response. There may be a misperception on their part that is generating the disinterest. If you can get to speak of this honestly, then you have a chance to correct their perception. Consider the following:

1. Introduce the student to other faculty so that the student can see that there is more than your group to consider.

2. Ask the student to describe what they think graduate school is. If there are misconceptions, then helping them correct them can help them consider graduate school, and also further establish you as one of their critical mentors.
3. Talk to the student about the value of prestige compared to fit in selecting the institution or person that they choose to be their faculty mentor.
4. Talk about the types of reference letters that serve you and your colleagues well when making a decision regarding admission to graduate school.
5. Talk about how admission decisions are made. For example, some departments admit a class of students and others admit students that each faculty member chooses. These differences suggest different approaches.

Offer to continue to check in and provide advice once they have returned to their home institution. While the student may choose a different university for graduate school, maintaining this connection will help you in the next stage, recruiting them to your department as a new assistant professor. Never underestimate the time- line for recruiting!

Beware of biases

A study by Trix and Psenka (2003) reveals systematic differences between letters of recommendation written for women versus those written for men. Language and the perception of language may create and reflect biases when evaluating program candidates.

In The Architecture of Inclusion: Advancing Workplace Equity in Higher Education, Sturm (2006) outlines a comprehensive approach to rethinking institutional roles in supporting and promoting workplace equality. It may be useful to consider the role of your faculty and your institution in supporting program diversity.

Providing advice or counseling on personal issues

Personal counseling often requires you to have access to a student's private information. Faculty and administrators should always be conscientious and careful about handling and discussing students' private information.

For Mentors: Student counseling services at most universities have a very robust business. This speaks to the challenges of being a student. This can be a particularly intense time for personal and professional growth. The key for every student is to see the counseling service as a resource.

During a summer placement, initiating counseling for a long-term issue is not usually feasible. However, stress from the new placement, in particular with roommates, issues related to self-confidence, and romantic relationships, can be areas where counseling can be effective during the placement period.

Each institution has a different policy on the use of counseling services. If the university will not allow you to use the services, there are typically community services available. The university counseling service should be able to help you identify those services. Most of these services will accept health insurance payment and most health insurance policies cover some short-term counseling.

For Students:

CONFIDENTIALITY: On a large campus, the Counseling Center offices are typically isolated and separated from your work or study area. So it is quite easy to go there without all your friends knowing your business. Further, the professionals are obligated to confidentiality. Unless you give permission, they cannot even acknowledge that they are seeing you, let alone tell anyone anything about your sessions.

CONTINUING CURRENT COUNSELING: If you are currently in a counseling relationship, it may be important for you to see someone at your placement. This can be arranged, and it would be advisable to have your counselor at your home institution help you set this up. They can brief the counselor at your placement institution, of course only with your permission.

How to best represent mentoring as a part of your program

National Science Foundation (NSF) resources

This presentation, National Science Foundation Funding Opportunities and Proposal-Writing Strategies, by an NSF senior science advisor, provides useful overview of the NSF and the proposal process, including tips for writing a strong proposal.

In addition to following the NSF Grant Proposal Guide (GPG), you can make your NSF proposal stronger by detailing the broader impacts of your project. Guidelines and examples of including mentoring and broadening participation in your proposal can be found here.

Looking Beyond the Borders: A Project Director's Handbook of Best Practices for International Research Experiences for Undergraduates developed by the NSF Workshop on Best Practices for Managing International REU Site Programs includes good guidance for domestic as well as international programs.

Additionally, Carnegie Mellon University provides a guide to the NSF GPG, which simplifies and makes the Grant Proposal Guide more concise for the proposal writer.

Postdoctoral Researcher Mentoring Plan: A template from the NSF to assist faculty and directors.

An example of a postdoctoral researcher mentoring Plan for an NSF Proposal produced by University of California, Merced can be found here.

The University of Nebraska-Lincoln's Suggested Postdoctoral Mentoring Language for NSF Proposals provides samples for considering in your proposals.

NASA resources

The NASA guidelines for unsolicited proposals.

The NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreement Notice (CAN).

Hints on Preparing Research Proposals from the American Astronomical Society.

National Institutes of Health (NIH) resources

Tips and information from the U.S. Department of Health and Human Services (HHS) for applying for NIH grants.

Other resources

National Postdoc Association Mentoring plans for postdoctoral scholars sample plans and related articles

Advice for developing an individualiz ed mentoring plan (Harvard Medical School)

The Engineering Information Foundation, funds innovative instructional projects and training.

Annotated list of mentoring literature

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

Also see IBP's list of diversity references.

List of References

ASME, "Pick a Mentor". *Professional Practice Curriculum: Studying Engineering.*

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

This is one topic within a larger practical resource aimed at helping engineering students navigate their academic and early professional career.

Barker, L., &J. Cohoon, M. (2008). Promising Practices. MentorNet, National Center for Women & Information Technology.

http://www.ncwit.org/images/practicefiles/MentorNet_ExampleEffectiveElectronicMentoring.pdf

Introduction and overview of MentorNet, which provices resources, training and an e-mentoring network to promote mentoring at all levels in engineering and science.

Bonetta, L. (2009). The Road to Diversity: Are We There Yet? *Science.* AAAS.

http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2009_04_24/science.opms.r0900070

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.

http://www.cur.org/publications/broadening.html

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.

http://www.ibparticipation.org/pdf/framework-evaluating-impacts-broadening-participation-projects_1101.pdf

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.

Crutcher, B.N. (2007). Mentoring Across Cultures. *Academe Online.* American Association of University Professors.

http://aaup.org/AAUP/pubsres/academe/2007/JA/Feat/crut.htm

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.