



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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Overview and Home

- [How to contribute to this manual](#)
- [What is Mentoring?](#)
- [Acknowledgments](#)

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

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

How to contribute to this manual

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

Please use our [comments and contribution form](#) to submit:

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

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

What is Mentoring?

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

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

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Basics for Everyone

What is mentoring?

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

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

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

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

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

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

Phrases that make an impression:

"That was great work."

"Good idea!"

"I also struggled with that."

"Based on the goals you've expressed, graduate school would a good next step."

"You are definitely excellent graduate school material."

"If you are not really sure, then working in industry for a couple of years may provide you that insight into graduate level work that motivates you."

"Tell me what you think we should do next."

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

What is a mentee?

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

Characteristics of the ideal mentee include:

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

Programmatic best practices

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

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

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

** additional content to be developed*

Recruitment and selection

A successful mentoring process begins with recruitment and selection, even before any one-to-one mentoring relationship is formed. This can 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 support, 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, Grinnell 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 Kutsko](#), 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.

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.

Tutoring

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

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

Summer research internships

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

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

Mentoring

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

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

help students make those connections." - [Lorraine Towns](#), CUNY AGEP Coordinator, *The Graduate Center, CUNY*

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

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

Faculty involvement

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

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

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

Administrative involvement and public support

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

HOW TO USE THIS IN YOUR PROGRAM PLANS: Getting central administration support for a single program can be challenging. An alliance of programs (e.g. a group of REUs, a cluster of graduate programs) across the university can be more effective. Consider partnering with related

programs. Building a network among programs can provide a means for the administration to provide support that benefits a broad group of faculty and students. Industry and private support can be enlisted to help with financial and 'in kind' support for example-- field trips to research labs, related corporate activities and guest lectures.

Resources

Model Programs

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

[Meyerhoff Scholars Program at the University of Maryland at Baltimore Country](#)

[MIMSUP: Multicultural Initiative in Marine Sciences,](#)

[SOARS: Significant Opportunities in Atmospheric Research and Science.](#)

Reference list of mentoring resources

IBP maintains an [annotated reference list of academic research and expert knowledge](#) about mentoring.

Undergrads

Finding a program

Things to think about when considering applying to a program

The first step in finding a program that is right for you involves thinking about your short and long term goals, as well as your personal needs. Identifying some of these at the start will help you form the questions you will want to ask program personnel. The program features listed in the "[Programmatic best practices](#)" section of this guide will also help you to evaluate each program's offerings as you decide where to apply.

Also, consider the more mundane but important aspects of the program like locale, stipend and time of year. Details about this and more information can be found in the "Resource Toolboxes" of IBP's [Undergraduate Resources](#) and [Graduate Resources](#) web pages.

Where to look for programs

To find particular programs, try these sources:

- [Pathways to Science](#): Search for programs by location discipline and more, or [search by institution](#) to see what programs and resources are offered at your institution of choice.
- Refer to IBP's [How to Search for a Program](#) guide as well as other related resources on our [Undergraduate Resources](#) or [Graduate Resources](#) web pages.
- Reach out to your social networks and their families to gather suggestions and experiences about programs others may have attended.
- Talk to faculty and advisors in the departments at your school that related to the kind of work that interests you.

* Additional content in process.

If you are recruited....

Do your research, ask the program for references by previous students, revisit your own short and long term goals and needs to help you assess your choices.

Adjusting to a new environment

Switching to a new institution or program may not seem like a significant challenge, but even a temporary change to a nearby institution amounts to a change of culture. Students entering a ny new environment can undergo the same process of cultural adjustment as those studying abroad. Knowing the cycles of this adjustment process can help a student to understand her or his own changes in mood or attitude during a placement or program. The Berkeley International Office provides an insightful guide to cultural adjustment ([link](#)) that can be applied to any change of environment.

To ease the adjustment process consider these suggestions: Realize that changes in your mood or attitude are a normal part of the process Keep in touch with friends and faculty at your home institution Take care of yourself with exercise, a healthy diet and plenty of sleep Talk to and others who may be experiencing the same thing Make sure fun and relaxation are part of your routine

Culture – diversity of background, institutional, program, laboratory

Depending on your family background, the institution that you are coming from and even the size of the school that you attended, the environment that you find yourself in for a field placement can be a dramatic change. Faculty and students need to pay attention to and be sensitive to differences in culture and inherent biases that can impact the success of their interactions and expectations. A program at a large research institution or in a research laboratory or field station can be quite a cultural shock if you come from a small undergraduate focused institution.

“I think we often forget that each of our cultures: as a Black person, Hispanic, Native American or Asian, may affect our thinking and responsibility to our family as well as our passion for our work. I think we need to do a better job of acquainting our leaders/mentors with these cultural differences in our students. Some may say that this is not needed, but an appreciation of one’s family life and upbringing can add to the respect and credibility of the mentor as well as the student.” -- *Larry Campbell, Colonel, US Army (Retired), Program Director, Opt Ed, AGEP, University of North Carolina, Chapel Hill*

Institution size and type

The institution size and type may have a dramatic impact on your experience. A small undergraduate focused institution is a very different culture than a large research institution. How you are treated and the resources that you have available can be very different. The key is to understand the differences, to identify your own resources as soon as possible, and adjust your available resources to the support that you need.

Large research focused institutions can feel very impersonal. However, one key is to realize that there are a number of individuals available to provide the support that you need. Ask other students in the laboratory. Ask the office, lab, or shop staff. You may not find that everyone is as helpful as you would like, but there is typically someone very interested in helping. With persistence, one can make the environment in a large research focused institution less impersonal as you get to know people and build your network of support. In fact, your faculty mentor may be used to students and interns going to others for assistance and may not have as much direct experience with who may be available to assist you as your fellow students or student mentors.

Region of the country

"Culture in the United States varies quite significantly between regions, even within a region. You may come from an environment where people are open and say hello and often ask how you are and if they can help. Now you may be in an environment where people will not approach you unless you state a clear need. The differences will likely be particularly noticeable when you are outside of your research group and outside of the institution. Many of the faculty and graduate students are from across the globe. However, support staff and many others you will encounter in the surrounding town or city, are typically local.

The key is to remember that you may not be in the best position to understand the motivation behind a person’s action. If someone says “hi” and little else, they may simply be pressed for time or

need an occasion to talk. Some have a different time scale for conversations. In the upper Midwest, we talk about the weather, sometimes for quite a while. It is a non-controversial topic and some can feel quite connected after a conversation about the weather. In some parts of the country, there are long pauses in a person's statements. Or, any small gap allows time for the next person to start talking. If you are one of those who is raised in a culture where a small pause in a person's statement is an invitation to talk, imagine being in a discussion with someone where long pauses are part of a normal conversation and are not an invitation for you to start talking. Going to an institution near the east coast I found that pauses in conversation led many people in the lab thinking that I was arrogant. It just took a while until I would open up. After some weeks and a few conversations, I developed a camaraderie with people who were comfortable enough to tell me of their impressions from those first weeks.

"The key is to be aware and not assume ill intent."

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

Preparing yourself for the placement

At host institution

To get the most out of your placement, it's worth spending some time preparing in advance. This includes familiarizing yourself with the non-academic setting in which you'll work and taking care of any logistical issues so that you don't have distractions after the program begins. Try to identify in advance the individuals or departments that provide program and campus support.

At your home institution

Develop a relationship with a mentor or mentors at your home institution to help you during your placement. These could be instructors in your discipline, those who wrote letters of recommendation on your behalf, or others who are genuinely interested in your academic and professional success. Ask for commitments from those mentors to be available to you during your placement, and consider scheduling meetings with them to talk about your progress and experience before the placement begins.

How to handle your schedule

For many students, this can be the first experience with an open-ended research question and a flexible work environment. A lab environment with positive role models along with specific discussions about schedules may help. However, in a lab environment without positive role models, it is important for the students to be confident and positive in their own abilities to get the work done and deal with the challenges of life.

Since many placements are relatively short – eight to ten weeks – they may not afford the luxury of a semester where one might be able to procrastinate and cram for exams. While lab groups can get into these habits of working long hours to accomplish work for a report or conference, modeling the consistent and well-organized work habits of a full time job can provide a clearer structure and norms for the student to work within.

Scheduling: guide for students

Treat the field experience as a job; initially, plan to be in at 8am, take an hour for lunch, and leave at 5pm. Force yourself to maintain a schedule. One helpful tool at the beginning is to schedule your time carefully. Break down a day into hour-long times and write out a schedule with specific activities for each hour.

Be flexible, it may take you more or less time than you anticipate for each task. During the first week or two of the placement, this detailed schedule can help keep you motivated. During the last weeks of a placement, the detailed schedule may not be necessary because you now feel that you have transitioned from not knowing how to fill your day to now not knowing how you can get everything done in your day. So at the end of your placement, the task list can help you organize your schedule to get the critical tasks completed.

Requesting time off

Many laboratory environments focus on accomplishing goals rather than counting work hours. Time is considered flexible, ranging from ‘everyone should always be in the lab’, to ‘just get the work done’. However, there are many examples of a student believing that the faculty mentor is fine with a flexible schedule, but then finding out that the flexibility that the student is exhibiting is making the faculty member uneasy and creating doubt regarding the student’s commitment to the work.

Generally, for field placements, it is expected that students will focus primarily and intensively on the fieldwork and that is why the program personnel have set aside time for this program. Do not go into the placement with an expectation that you can leave on a Wednesday or Thursday to have a long weekend at home, with friends, etc.

The key for all parties to remember is that many placements are extremely short (eight to ten weeks, one semester). There is little opportunity for flexible time while also accomplishing significant work during this period.

Students: Plan to ask for time off within the confines of accomplishing the research goals. When requesting time off, always explain how the work will be accomplished. Heading out on Friday afternoon to travel with some friends or fellow students, is generally not a wise choice. If you do decide to take time off, make the request as far in advance as possible. Include your mentor in the decision of whether or when to take the time off. Do not present it as a done deal because this sets up a situation where if the mentor says no then they are ruining your plans.

Also consider that many faculty members have hectic research schedules themselves. It is not uncommon for them to be called out of town for a one to three day business trip, or to suddenly have a day filled with meetings. This may get in the way of your plans to coordinate a trip and meet with your mentor. Again, your primary concern and commitment should be to your successful completion of your placement—this is an important part of your career advancement.

Graduate student mentors: Review your schedule and how you take time off before the new student arrives. If you take off on an afternoon with good wind to sail or wind surf at a local lake, talk to the faculty mentor about how to handle this with the student(s) you are supervising.

Be clear about your expectations for taking time off. Make sure and set a good example yourself. Give examples of the type of activities that you have approved for students to take time off from the work schedule. Establish an expectation of how you will be involved in the decisions that the student makes to take time off. In general, it is best to err on the side of having the student involve

you in the decision as early as possible. While you may see this as overbearing and not allowing students the independence they need, a worse situation is if you get annoyed or inconvenienced. Again, for many students, this may be their first experience of being in a professional scientific/engineering work environment and they may need assistance with establishing professional behavior.

Handling family and other personal emergencies

“I think we often forget that each of our cultures: as a Black person, Hispanic, Native American or Asian, may affect our thinking and responsibility to our family as well as our passion for our work. I think we need to do a better job of acquainting our leaders/mentors with these cultural differences in our students. Some may say that this is not needed, but an appreciation of one’s family life and upbringing can add to the respect and credibility of the mentor as well as the student.”

-- *Larry Campbell, Colonel, US Army (Retired), Program Director, Opt Ed, AGEP, University of North Carolina, Chapel Hill*

Personal and family emergencies can happen during a placement. It is critical for everyone to be in communication as early as possible when this situation arises. The section on personal counseling should be reviewed. There are instances when an emergency can make decisions difficult, and personal counseling can provide assistance with making decisions. Assistance may be needed to determine how best to handle the situation. Before you decide on an action, be sure that the situation is clear to all parties concerned.

Students: Mentors are usually reasonable and almost all have experienced personal and/or family emergencies themselves. Describe the situation clearly articulating what it means to you. The mentor may not have had a similar experience with her or his family situation, so may not relate to the specific situation, but will likely try their best connect to how you experience the situation.

Be prepared to consider the consequence of your action on the research progress of your summer placement. There are emergencies that require your absence from the placement and most mentors will work with you to help you get the most from your field experience. However, keep in mind that this is a unique opportunity, one that can lead to recommendations that will help advance you into your next career move (fellowships, graduate school, job, etc.). You want to handle this as professionally as possible.

Mentors: You may need assistance in determining if a student is making the best decision. Seek advice after you understand the situation. If the student’s decision puts the research progress at risk, be sure to make this clear and discuss the potential consequences with the student. Work with program staff to ensure that the student is getting needed support and that staff are aware of the discussions and decisions that you have made with the student. A meeting with a student when she/he is considering how to react can take several hours. Your patience and professional guidance can play a critical role, modeling how they might make decisions in the future.

Consult with student support service professionals such as the Dean of Students' Office or Student Counseling Service. They have extensive experience and advice that can assist you in the process of providing help. You are the expert in research; they are the experts in professional counseling for students.

How to normalize your expectations

Overcoming the challenges of the first two weeks of the placement

Students: The first two or three weeks of a field experience can be the hardest. While there may be long hours and hard work near the end of the placement, the beginning can be difficult because of all the adjustments to a new institution or organization, student culture, and working in new ways that can challenge students' abilities on the very first day.

Mentors: The beginning of a field experience is the most critical time for your presence and attention. Designing an experience where you assign papers to be read and then head off to a conference or vacation for a week or two can be disastrous for the student.

Another common mistake is to not include the student in other work. During these first weeks, in particular weeks one and two, it can be difficult for a student to fill the time with work limited to only their project. Consider having the student shadow other students for some of the time. In one case, most of the lab group and the faculty mentor left for one day to take some measurements, and left the new student behind to read some publications. The justification was that the field measurements were not directly pertinent to the student's project. However, taking the new student along, even if the student's role was as an observer, would have provided a broader sense of the work and a chance for the student to see her or himself as part of the group. It would have likely encouraged more productivity in the student upon returning to campus.

Mentors must be careful not to confuse the student's motivation to work with the amount of time spent working. An unmotivated student spending lots of time in the lab can accomplish much less than a very motivated student who is spending less time in the lab, but is motivated and focused and inspired when in the lab.

Whether a student or mentor, consider these [suggestions on adjusting to a new environment](#) when structuring program time.

Acknowledge it can be frustrating

The demands of a field program are similar to those of a graduate program. University of Michigan's [Campus Mind Works](#) provides some helpful insights for dealing with a potentially sudden change in academic performance expectations and workload.

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.

What to expect out of your mentor and how to get it

There is often a gap between the expectations of mentors and students and the amount and quality of attention mentors devote to students. The mentor's time and quality of commitment is often the source of praise or complaint about the program experience. It is important for all members of the program to realize that for many students this is the first experience with a sustained mentoring

relationship. The student may have had a supervisor, but often only on well-defined tasks, and not on the types of tasks required for good research.

"What to expect" is best defined clearly from the beginning. Not every mentor or mentee is the same, with the same needs and expectations. Understanding your own expectations from the beginning and being able to articulate them, are critical to setting up your experience.

Establishing communication expectations

The best way to avoid misunderstandings between you and your peers or superiors is to agree with them about the frequency, medium, format and drivers of your communication. Try to be explicit about what you will need from them and ask for clear statements of what they expect from you. Use these [communication guidelines](#) as a starting point for the discussion.

A guide to meetings for students

Bring tangible results in hardcopy form to the meeting. As a mentor, it is frustrating to hear "the data plot looked good ..." when you have not provided the mentor with a copy of the results. There may be something that the mentor can add if you share your results --they may see something in the data that you overlooked. It is always good practice to share your results with your mentor.

Prepare written talking points before the meeting. Focus on what the key points are that you would like to discuss during the meeting. For example:

- Current results – show plots, point out concern(s) about the level in experiment #3 (should these be repeated?)
- Chapter # in book XYZ– summarize my key understanding, ask if there is something that I am missing.
- Ask about helping your mentor on some of his/her other experiments that may have gained your interest.

Productive meetings

A productive meeting is often defined based upon expected outcomes and sometimes unanticipated events, such as break-through ideas for the work or an unintended discussion about professional or personal development.

A productive meeting begins with planning. It is good to have an agreed upon agenda for each meeting. The agenda can be a formal or merely a list of key discussion topics.

It can be helpful prior to discussing a topic to clarify the desired outcome of the discussion. One mentor reflects:

"In the past I have had a mentee come in and start talking about something and I immediately start interrupting and having the discussion focus on something that I see wrong in their initial statements. I think that they have thought through everything they are talking about, but often they have actually just started thinking about their ideas and just wanted me to hear the whole concept and respond. Hearing the mentee's goals before hearing the information would have resulted in a good meeting rather than the one we had that was frustrating for both of us."

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

Questions

While it is good to have questions, there are badly asked questions. It is important to keep in mind that how a question is posed provides an impression of the person asking the question. It is critical for the student to provide information so that mentors have an accurate impression of a student's work ethic and efforts. Further, answering a question provides an excellent mentoring opportunity. A well-asked question gives the mentor insight into the student's thinking and work processes and opens up the potential for a valuable conversation. The mentor can focus on answering key points and often has an opportunity to spend additional time discussing the work or related topics.

Questions: Key points for students

Asking questions well is a skill that can be learned. Some key points to consider when formulating questions:

- How you ask a question can communicate your work ethic and attitude.
- Ask a question in a way that shows what you know, what you have done, and where you need assistance.
- Ask for assistance at overcoming a barrier, not having others do the work for you.

Examples of good and bad questions

Example 1

BAD QUESTION:

“I just don't understand this at all. Where do I start?”

- While this may communicate your current frustration, it likely does not communicate your understanding or where you need help.
- This may leave the impression with the mentor that you are not working, particularly if you do not provide evidence that demonstrates that you have completed the background work necessary to be prepared to start the project.
- This type of statement tends to put the burden on the mentor for your work. Mentors generally expect you to take ownership of the project.

GOOD QUESTION:

“I read the two articles that you gave me, and what I currently understand is However, I am still not sure how to get started on the ... that you asked me to do next. Is there something that I am missing from my reading of the two articles or can you help me make a connection between the two articles and the ... that you asked me to do? I am hoping that this will help me understand how to get started on the task”

- This question shows what you do understand, that you have done your work, and that you are taking responsibility for starting the work. You just want some help getting past the

initial barrier of getting started. An experienced mentor can hear what you understand and help you develop a path to what you need to understand to get started.

- This will leave a mentor impressed with your initiative and your commitment to do the work. You have communicated clear ownership of your work.

Example 2

BAD QUESTION:

“I did what you said and the equipment does not work. What is wrong?”

- It is not clear if you actually did what the mentor said should be done with the equipment.
- There is no sense that you have tried to diagnose the problem.
- It is not clear that you are taking initiative.
- It may sound like you are working through a list of actions (cookbook style work) without interest or effort to understand the reasons behind the steps.

GOOD QUESTION:

“I am having difficulties using the equipment to get the results. Can I tell you the steps that I took and then share some ideas that I have for why it is not working? I hope that you can verify my understanding of the equipment, see if my ideas for the cause of the problem and how to fix it are reasonable, and give additional ideas that I can then investigate.”

- You are being specific and focused on understanding not just actions.
- The mentor will get to hear what you have understood and where additional clarification is needed. (i.e. The mentor does not have to start from the beginning or guess where you are having difficulties.)

Example 3

BAD QUESTION:

“I wrote this program and it does not work. Can you find the error?”

- “Writing a program” includes the effort involved to get the program to run properly – to someone experienced in programming, you are communicating that you are not willing to make the necessary effort.
- It is not clear that you knew what steps you took to make the effort when you wrote the program.
- This can communicate a poor work ethic.

GOOD QUESTION:

“I have written a program to implement these equations. Currently the program is not working. I would like to walk through the logic in the program and the ways that I have tried to find errors in the program. Can you see if there are errors in my logic and help me think of additional ideas for finding errors in the program?”

- You are giving all the information that you have.
- You have indicated that you want to find the errors, and primarily want help in understanding the appropriate steps to take.
- You are taking the initiative and ownership of the program and the process of getting it to work.
- It is clear that you want to know how the program works. This gives the mentor the confidence to follow up and ask you to expand the program if appropriate for the research.
- You are demonstrating that as a student, the process of learning how to accomplish the work is as critical as accomplishing the task.

Example 4

BAD QUESTION:

“I have tried to derive the equations, but can’t get the math to work. Can you find my error?”

GOOD QUESTION:

“I have been working on deriving the equations that we discussed at the last meeting. I have worked through the derivation in two different ways, but they give different results. Both methods are based on books that I found in the library. I would like to show you both methods and hope that you can help identify errors in my logic, and ask you to suggest any other references that I can review for additional information.”

- You are taking ownership of the work – you want help to identify the methods to find the problem in the derivation, not have someone else do the derivation for you.
- You have indicated that you have done extensive work before asking this question.

Example 5

BAD QUESTION:

“I am so frustrated with this not working and don’t see the point of this. Tell me again why I need to do this?”

- This communicates that you were not listening the first time.
- It is not clear that you respect the experience of the mentor to know how the research should proceed.

GOOD QUESTION:

“The experiment is not working well, and I am getting very frustrated. I need to step back and make sure that I understand why this experiment is important and what I should be learning from it. Then I think I can approach the experiment again with renewed clarity. Can I explain my understanding so that you can correct or add to my current understanding? If you have other suggestions, such as putting this aside for example while I work on the computer program, I would appreciate your advice.”

- This shows that you are taking responsibility for your frustration and have developed a strategy to cope with the situation.
- You are willing to explain your understanding, so that the mentor can focus on any error in your understanding and confirm what you do understand.
 - It can be very encouraging for both the mentor and student to recognize that you do understand significant portions of the work.
- You are open to additional suggestions on strategies to deal with your frustration. It is likely that the mentor will also give you examples, personal anecdotal experiences, of when they have coped with similar frustrations.

When to e-mail, phone, or meet face to face

In general, the following is recommended:

Use e-mail for:

- Sending a document or information for review.
- Quick communication – e.g. scheduling a meeting.

Use phone for:

- Clarification to follow up a previous discussion or e-mail.
- An issue that needs to be resolved that may be difficult, but there is no time for a face-to-face meeting.

Face-to-face interaction:

- Always preferred – this provides an opportunity for details to be shared and discussed as well as additional follow-up conversations.

Social media, e-mail, texting, are all very convenient, but also fraught with danger: misunderstandings resulting from not communicating clearly an accurate sense of mood. Conversely, there are times, when a well composed e-mail can be much more constructive than having a face-to-face meeting when frustration about the work progress or having pressures from outside of the program work is dominating a person’s thoughts. So consider the purpose of the interaction and your mood.

Remember, that with any electronic communication it is best to assume that the intended person has not received it until there is confirmation. Similarly, when you receive electronic communication, respond as quickly as possible, even if only to indicate that the communication was received and to provide a time line for when you plan to act on it.

General guide for graduate students in getting the mentoring you want

The Rackham Graduate School at University of Michigan has published an excellent guide to finding and establishing fruitful relationships with faculty mentors: [How to Get the Mentoring You Want: A Guide for Graduate Students](#).

** Additional content under development*

Addressing mentor issues

The skills of Identifying, addressing and resolving conflicts with peers and superiors are important for all members of an organization or project team to learn. Healthy conflict is the soul of creative and productive collaboration, so don't develop the habit of avoiding conflict. Instead, ...

How to plan and map your own progress

It is common in a field placement to have an inadequate assessment of one's own progress. Some of this is because the experience is not structured like a formal course where you have a syllabus, with homework and exams to track your progress and a research environment that may be new to you.

Tracking your progress can help you see what you have accomplished. This can help your self-confidence and also provide a basis for your discussions with mentors.

Mapping your progress should always look forward and backward. Each week, before meeting with your mentors, look back to what you have accomplished in the past one or two weeks and then think forward to plan what you would like to accomplish in the upcoming weeks. Request future reference letters. Each week you will be updating both the forward and backward view. The point is not to exactly predict the future or exactly follow a list of work tasks. These are points in time for you to reassess where you are progressing and also to provide a good basis for a discussion with your mentor on the work to be done.

Write this in a document. It can be a document with ongoing revisions or a new document for each week. As you document your accomplishments, you are simultaneously developing a base of information for presentations and reports.

When planning future work, be sure to write down each task and what goals or objective the task serves. This can be very helpful when looking back at the work that has been completed.

The act of mapping out your progress and plans will help you organize your thoughts. So even if not requested by a mentor or program, these may be documents that you keep for yourself as a reference for future work.

Talk to your mentors about how they document their project progress. They often have large and very complex projects that they are managing.

What is research?

Different areas of study can demand different approaches, methods, and definitions of research. Since research is central to many undergraduate experiences, it will be important for you to understand how your program defines research. Take a proactive role in that process so that you can become clear about the expectations placed on you, and can voice your own expectations and goals for a particular research experience.

References

The Guide for Undergraduate Research, also known as [WebGURU](#), provides plenty of useful information for undergraduates, including a reference list of sources related to conducting research.

Literature searches

Guide for students

Many placement experiences will begin with receiving a list of technical documents to read. Sometimes this can be handed to students with the phrase: “Here is a book, a PhD thesis, and several relevant journal articles. These all describe the main research methods and, in particular, the equipment that you will be using this summer. Please read them so that you have a good understanding of the project. We will meet in a week to discuss what you have learned, and then decide the next steps.”

A couple of key points:

1. You are being given a week because it should take at least that amount of time to read and understand the material.
2. If you have never done this, then it may be intimidating and it is easy to spend a week reading, but gaining little knowledge. It is easy to get frustrated and get very little out of this activity.

It is typical in graduate school to receive such a reading list with a rather open ended assignment to complete them. If you have been enrolled in college courses with well-defined assignments, then such a task may seem overwhelming.

Your Responsibility: Request appropriate support, with knowledge of what you need, while also pushing yourself to read and understand the literature. To begin with it will be important to understand if you are the type of person who needs an overview before being able to explore details, or if you need detailed information before understanding the overview. Knowing this about how you work will help you ask for the appropriate help.

Mentor's Responsibility: Your mentor should help you focus your efforts on the most pertinent papers given your learning style and your mentor should make time available for you in those first few weeks for your questions.

The first key for reading literature is context. If you do not have the context for what you are reading, it can be very difficult to know what to pay attention to and retain. So when you start reading anything, make sure that you have the context for the document.

A few suggestions to begin:

1. Ask for a suggestion on where to begin – e.g. what to start reading. Specifically:
 - a. Tell the mentor if you work best starting with an overview or with a more detailed issue.
 - b. When they suggest a document to start with, ask them to put the document in the context of your specific research project, and if possible summarize the key points that you should get out of the document. For example: “this paper gives an overview of all the work in this area and I want you to understand why people consider this problem an important research question,” or “this paper describes the basic technique that you will be using to gather and analyze data, so I want you to note the key steps in the process of gathering data and then the process to analyze the data.”
TAKE NOTES!!
2. Ask to have a meeting in one or two days so that you can quickly get feedback on your progress and what you have learned. Bring a written summary of what you have learned.
3. When reading technical papers you will likely need to read it multiple times to fully understand the material being presented. In graduate school, it is common to re-read a paper or parts of it several times over a year or two to fully understand what the authors have written.
 - a. Start by reading the abstract, introduction and then conclusion.
 - i. Write a bulleted list of the key points – why is the work being done and what are the main conclusions.
 - ii. Remember – the abstract should be an outline of the paper. If the paper is well done, then an outline of the abstract will be an outline of the paper.
 - b. Then go back and start at the beginning again. Read through once for basic understanding of how the information in the paper is organized, and in general what material is covered. Be careful to not get too frustrated if you do not understand every detail. One of your mentors (faculty, postdoc and or graduate student mentor) should be willing to discuss the paper with you to help you comprehend the key points of the paper.
 - i. Use different color pens - one for concepts or phrases to look up or ask about, and one for concepts or points to remember.
 - ii. Fill in the outline that you started.
 - iii. Note in the outline where you have questions – write out the questions.
4. When meeting with the graduate student/post-doc or faculty mentors.
 - a. Prepare a list of:
 - i. Key points that you learned.
 - ii. Questions you may have.

Documenting your work

Guide for undergraduates

One of the fundamental principles of research is documentation. This is not just the process of writing a paper at the end of the research experience, but documenting all work throughout the research. Documentation has several goals, one is to communicate the results, but the most critical purpose is to provide the information so that the work can be duplicated. Duplicating work requires knowing the details of what was done.

Another issue is being able to verify the results after the work was completed. For example, suppose you have completed your work and you have left the field lab to return to your home campus. Work is being done to publish your work or being used in further work. During that follow up time, someone realizes that there is a transducer that is no longer calibrated or working properly. This was one of four possible transducers to use. Now one needs to know which transducer was used to collect your data. If you did not keep a notebook where the transducer serial number was recorded, then there may be no way to verify that your results were taken with the transducer that was operating correctly. Now someone may have to repeat all your work, to ensure that the results are valid.

Often, 90 to 99% of what is written in a lab notebook is not used. Unfortunately, one cannot always predict which 10% is really needed. The general rule of thumb is – document everything.

Maintaining a lab notebook

Useful information on keeping lab notebooks can be found through the following websites:

www.swarthmore.edu/NatSci/cpurrin1/notebookadvice

www.dartmouth.edu/~chemlab/info/notebooks/how_to

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

Communication guidelines

When to e-mail, phone, or meet face to face

In general, the following is recommended:

Use e-mail for:

- Sending a document or information for review.
- Quick communication – e.g. scheduling a meeting.

Use phone for:

- Clarification to follow up a previous discussion or e-mail.
- An issue that needs to be resolved that may be difficult, but there is no time for a face-to-face meeting.

Face-to-face interaction:

- Always preferred – this provides an opportunity for details to be shared and discussed as well as additional follow-up conversations.

Social media, e-mail, texting, are all very convenient, but also fraught with danger:

misunderstandings resulting from not communicating clearly an accurate sense of mood.

Conversely, there are times, when a well composed e-mail can be much more constructive than having a face-to-face meeting when frustration about the work progress or having pressures from outside of the program work is dominating a person's thoughts. So consider the purpose of the interaction and your mood.

Remember, that with any electronic communication it is best to assume that the intended person has not received it until there is confirmation. Similarly, when you receive electronic communication, respond as quickly as possible, even if only to indicate that the communication was received and to provide a time line for when you plan to act on it.

How to send an update or question via e-mail

E-mail is a professional communication tool. So an e-mail should be written in a formal language. Consider an e-mail to be a memo. Content should follow some basic rules:

- Address the person in agreed terms. Always err on the side of formality.
- Provide sufficient detail.
- Separate information from a request.
- Provide your justification for the request.
- Compose the e-mail so that a single response from the recipient will address your request. If you want to meet, include your available times. If you do not do this the mentor will have to e-mail you back with their available times and then you respond.
- Do not expect a professional e-mail in response.

NO: Hey Dr. M – I got some slick results today and want to talk.

YES: Dr. Mann,

The experiments today were successful. We were able to get results and based on my initial analysis, they appear to be in the range that we expected but are also surprising.

I would like to meet with you briefly, 15 minutes, to show you the results, tell you my plans, and get some initial feedback from you regarding my interpretation of the results and my next steps. I would like to adjust my work plans before our regular weekly meeting since these new results are motivating me to consider a different approach

Today I will be in the lab from 1-5 and then tomorrow morning from 8-11. (note: there is a workshop on applying to graduate school starting at 11 tomorrow and then some lab tours the rest of the afternoon.) Please let me know what time will work best for you.

Writing an update report

Update reports are an important tool for the mentors, students, and program director. While they may be more formal than is typical for a short term program such as a summer research experience, using an update report is an important skill that a student will find useful 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 throughout the placement can be strung together to form the backbone, if not most of the full report.
- Writing a report requires you to reflect on your work. This will help with planning "next steps" as well providing a useful structure for examining both failures as well as the successes of your work.
- Knowing that you need to submit a report will help you to stay on task: 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 that will assist your mentor in providing effective advice and assistance.

Key features of an update report:

- Project goals are clear and stated within the report.
- Conciseness.
- Information is clearly presented and the question(s) are focused and clearly stated.
- 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. This should be written 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 - decide on this with a mentor.
 - b. Address barriers and resource needs - if you know what will be done to overcome barriers, then state the plan.
 - c. Express your needs - if you need something, for example a meeting with the mentor to discuss the work, then state this.

Social media

Many useful tips for improving your teaching and learning experiences can be found on The Chronicle of Higher Education website, including this one on the power of social media.

[Think Before You Tweet \(or Blog or Update Your Status\).](#)

Communicating with an absent mentor

It is inevitable that at some point, mentors engaged in professional or scholarly activities will have to leave the lab or field area for periods of time during your placement. Planning your communication with your mentor(s) during their absence is crucial to receiving the mentoring support you want. When you discover that a mentor is planning to be away, request a meeting to agree on a communication plan that includes the following:

Clear guidelines on:

- the frequency of communication expected from you
- the content to be communicated
- the communication medium to be used

What you need from the mentor:

- specific areas of feedback and comment you expect to continue to receive
- specific time span within which you can expect to receive a reply to a question or issue

If there is any doubt that the mentor will be able to communicate with enough frequency or depth to support you, you and your mentor should consult the faculty supervisor or director to decide whether a new mentor should be found.

Seeking personal support during your placement

The pressures of academic requirements, performing in an unfamiliar environment, navigating new relationships, can all contribute to personal stress. Because your personal well-being is essential to your performance and experience in all other areas, try not to neglect this aspect of yourself during your placement. While mentors can assist you in dealing with the professional and scholarly aspects of these kinds of pressures (with time management strategies, for example), they may not be best suited to help you process the feelings you may have that arise from those pressures. Friends, family members and home institution mentors with whom you have established closer personal bonds can be important supporters of your emotional being during the placement. Also, remember that many institutions have mental health support as part of their health centers - don't hesitate to utilize those services to get the primary or supplemental personal support you may need,

Presenting your work

Effective presentation strategies and designs

Penn State's [Writing Center for Engineering and Science](#) covers all forms of presentation, from Lab reports to posters. It also has a good resource devoted solely to presentation skills:

www.engr.psu.edu/speaking

[Presentation Zen](#) provides research-supported information and tactics as well as sound advice on presentations of all kinds. There are three fundamental principles that underlie the Presentation Zen approach:

- Use a strong narrative to organize your argument for the listeners and to appeal to their interests and emotions. This will help to keep them paying attention.
- Keep your slides as visually simple as possible and focused on the meaning behind your data, not on the data itself.
- Unless you are showing a quote by someone else, avoid using lots of text in your slides. We do not retain information as well through language when receiving it through aural and visual channels simultaneously (this means bullet lists don't work as well as we think they should).

This article, [What is good PowerPoint design?](#) provides a good entry point for browsing the Presentation Zen site.

* *Additional content is in process:* Giving an effective 15-20 minute presentation

Video examples of good presentations

* *Additional content is in process*

Examples of good slide presentations and posters

There are many good on-line resources providing information and strategies for slide and poster presentations. Just to name a few...

Penn State's [Writing Center for Engineering and Science](#) covers all forms of presentation, from Lab reports to posters. The [Washington NASA Space Grant Consortium](#) offers "[The Basics of Poster Design](#)" as a handout.

Poster design

The [Collaborative Learning and Integrated Mentoring in the Biosciences website](#) provides some useful guides from experienced program directors and faculty mentors, including specific [guidance on scientific posters](#).

The [Penn State Writing Center for Engineering and Science](#) also provides [useful guidelines](#) on scientific research posters, as does the [Washington Space Grant Consortium](#).

Working with mentor on the final aspects of the report and/or poster

* *Additional content is in process*

Beyond the placement: What's next?

Your placement experience can enhance distinct goals and plans or mark the beginning of a new academic pathway. Either way, as your placement draws to a close there are several important things you can do to make sure it fully serves next stages of your education or professional development. The mentors, faculty and administrators with whom you worked during the program have gotten to know you and are invested in your success, so don't miss the opportunity to let them help you progress. Here are some suggestions for end of program follow-ups:

- Schedule meetings with your mentor and faculty supervisor to discuss your academic and professional goals. Don't worry about how well developed you think those goals are - just use the focused time to get clarifying and validating your next steps.
- Often, the academic outputs of a research placement include as many areas for future study as conclusions about the work done. Consider working with a mentor on defining followup work and creating a plan for continuing to pursue aspects of the field work that most interest you.
- Use what you learned during the placement to guide your research into graduate school programs. Talk to mentors, faculty and administrators about how the work you completed in the placement might connect to particular graduate programs, and request introductions to any personal connections they may have at graduate programs of interest to you, so that you can get more information directly from program participants.
- Request future reference letters from faculty and mentors.

Grads and Post-docs

Mentoring is a time consuming activity including preparation, follow through and ongoing support. One of the key concepts is balancing challenging and supporting the mentee.

- Too much support can result in a person not learning because everything is done for them and they are just observers rather than learners.
- Too much challenge can lead to discouraging and/or just completing tasks as assigned.

Examples to consider for mentoring and good program design include the [Meyerhoff Scholars Program at the University of Maryland at Baltimore County](#), [MIMSUP: Multicultural Initiative in Marine Sciences](#), and [SOARS: Significant Opportunities in Atmospheric Research and Science](#).

These programs are nationally focused on the success of under-represented minority students in the sciences and they have all received national acclaim for their success and are considered strong models for good program design and implementation throughout the United States. The 13 key concepts drawn from the Meyerhoff program and others can be applied in a variety of program efforts and settings.

** Additional content in process*

Accepting the responsibility of mentoring

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 be 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.

How to choose a mentor

[Alliant International University](#) focuses on preparing students for professional careers in the applied social sciences. They have published informative and straight-forward introductory guides for mentees as well as mentors who are focused on career development. In particular, these guides highlight issues of cultural competency, interpersonal dynamics and psychology, and include several additional references on these topics.

[Guide for Mentees](#)

[Guide for Mentors](#)

What to request from your faculty mentor before you accept the responsibility of mentoring a field placement (REU)

There are two basic things to remember:

- Be clear and do not assume that it will all be OK. Take action before the placement experience begins to ensure that it has the best chance to be a great experience for all.
- Clearly understand your responsibilities, your major professor's responsibilities and the support that you will receive.

Before you accept the responsibility of mentoring, it is critical for you to assess your skill, time, and motivation for mentoring. Mentoring a student will take time out of your schedule with no guarantee that the progress of your work will advance faster or more effectively than if you just did the work yourself. However, you can also look at this as a professional development experience. If you are going into industry, you will likely be given opportunities to learn to mentor before being given people who will report to you, but if you plan on a faculty career, then you will likely need to mentor undergraduate students and graduate students from the day you start your faculty job. So

you can consider working with students as an opportunity to develop your mentoring skills during a shorter term commitment (semester, summer, academic year).

You need two things from the faculty mentor:

- Her or his time to mentor the REU student.
- Mentoring from them or someone else to help you to be an effective mentor.

Such support will help make the REU placement effective for you and the student.

Many students speak to the impact a faculty member has on them. You may be the expert in particular lab work and the primary resource for a student to be successful, but the interaction that a student has with a faculty member has been noted as a critical element from the perspective of the student. It is important to maintain a strong connection with both the student and the faculty member.

One of the most difficult positions to be in as a grad student is to have a faculty mentor state that they will assign the student work while your role will be to describe and manage the work. The student may not be able to do anything beyond what was approved until you talk to the faculty member. This can put you in the difficult position of having completed the assigned work and, if the major professor is unavailable, you and the student have to wait for the next set of instructions. This type of problem can be avoided with some thoughtful planning.

Before accepting (or beginning) an assignment to mentor a student, consider the following list to ask from the faculty mentor:

- A written description of the research plan for the student. This may also include a description of how it connects to your work.
- A description of the expectations of you. Are you there as a resource or are you the primary contact for the student?
- A plan for preparing for the student and working with you during the placement to answer your questions about the research and effective mentoring.
- A plan for how decisions will be made regarding the student's work.

Working with undergraduate mentees

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.”

- *Mark Hernandez, Professor, Chemical Engineering, University of Colorado, Boulder, Director, Colorado Diversity Initiative*

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.*

Overcoming challenges of the first two weeks

The first two or three weeks of a field experience can be the hardest. While there may be long hours and hard work near the end of the program, the beginning can be the hardest because of all the adjustments to a new environment, student culture, and working in new ways that can challenge abilities from the first day.

Mentors: The beginning of a placement is the most critical time for your presence and attention. Designing a research experience where you assign a reading list and then head off to a conference or vacation for a week or two, can be disastrous for the student.

One common mistake is to not include the student in other work. During these first weeks, in particular the first two, it can be difficult for a new student to fill the time with work only on their own project. Have the student shadow other more experienced students for some of the time. In one case, most of the lab group and the faculty mentor left for one day to take some measurements, and left the new student behind to read background papers. The justification was that the

measurements being taken were not directly pertinent to the student's project. Taking the student along, even in the role of observer, would have allowed the student to get a broader sense of the work, to feel part of the group, and potentially increased motivation and productivity upon returning to the lab.

As mentors it is important not underestimate the impact of a student's motivation to work as compared to spending time working. An unenthusiastic student spending lots of time in the lab can accomplish much less than a motivated student who is spending less time in the lab, but is excited and engaged when in the lab.

Normalizing expectations

Expectations can help lead a student to success or failure. Expectations are a potentially powerful force to motivate, but also can be a barrier to success. One critical role for a mentor is to help a student maintain healthy expectations.

Set goals but be encouraging and supportive: "You have worked hard, but unfortunately the results of this experiment have not been good. I know this is frustrating, and something that we all face sometimes in this field. I want you to know that you have done good work. I myself find it easier to persevere when I focus on the good work that I have done and not just on the final results. Based on your work so far, I'm confident that your experiment will be successful. Let's take some time to analyze what you did and your results and see if we can identify some next steps to get you there."

Making explicit the expectations for all

Years ago when I first started taking on summer interns and grad students I decided it was important to be clear not only about what I expected from them, but also what they could expect of me. In the case of my lab, there are usually several grant related projects under way, and 2-3 grad students working on aspects of those projects, as well as 2-3 undergrad interns. There is a fair amount of scuba diving and work on boats, so safety is a huge priority. So, my initial meeting with my students - grad students and undergrads - distills into the following... What you (student) can expect of me: Safety (Create a safe working environment), Scientific leadership (Provide the research direction and focus), and priorities for the lab. Create supportive educational environment with a focus on problem solving. Individual meetings with students on their projects are made as needed. Weekly lab meetings are a center piece of my lab to discuss issues arising: project progress reports and to discuss recent literature on the topic. A student will usually take the lead on discussing a recent publication that has been circulated to others earlier in the week. Be available - I have an open door policy, when I'm at the lab/office. Although I have multiple obligations pulling me in different directions - I am just an email or phone call away if it must be addressed immediately.

What I expect of you: Be Safe - follow safety protocols established in initial training. Be a team player - Because much of the work depends on having 2-5 people in the field, it's important to do your part. Students may be working on independent projects, but depend on help from others to get it done. That's why we spend a fair amount of time planning out a strategy each week. The phrase "Many hands make light work" applies. Timeliness - Because we're depending on each other's support,

it's important to be on time and dependable. Communication - We can't resolve problems if we don't know about them. This is part of doing science. Bring them up at lab meetings or in one- on-one meetings. Don't be afraid to make mistakes. That too is part of doing science. But let us me when you do.

- *Richard A. Wable, Ph.D. Research Associate Professor School of Marine Sciences University of Maine Darling Marine Center*

Productive meetings

A productive meeting is often defined based upon expected outcomes and sometimes unanticipated events, such as break-through ideas for the work or an unintended discussion about professional or personal development.

A productive meeting begins with planning. It is good to have an agreed upon agenda for each meeting. The agenda can be a formal or merely a list of key discussion topics.

It can be helpful prior to discussing a topic to clarify the desired outcome of the discussion. One mentor reflects:

"In the past I have had a mentee come in and start talking about something and I immediately start interrupting and having the discussion focus on something that I see wrong in their initial statements. I think that they have thought through everything they are talking about, but often they have actually just started thinking about their ideas and just wanted me to hear the whole concept and respond. Hearing the mentee's goals before hearing the information would have resulted in a good meeting rather than the one we had that was frustrating for both of us."

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

A guide to meetings for mentors

Help a student plan for their meeting with a faculty member. You probably know a faculty member's preferred meeting style. Maybe he / she likes to just focus on the issues, socialize and then focus on the work, or focus on the work and then socialize. If you do not know – here is a chance to think about it – that may help you in your own meetings! Consider talking to your faculty mentor about this, in the context of helping the student. This may be more comfortable for everyone involved.

Meeting with a student: extended benefits

Meeting with a student can do much more than just move the work forward.

Mentors can help build the student's self-confidence. This can be accomplished by something as simple as giving time and expecting excellence from the student.

One former student talked about her experience in meeting with her mentor. This former REU student, who did not come from a family with STEM professionals, remembered meeting with a mentor as a key experience of the REU program and how it helped prepare her for her professional career. These meetings helped build student skills and confidence as well as simultaneously providing experience talking to a STEM professional about general career development questions.

Key points:

- Expect the student to explain their work and use appropriate/professional language.
 - Listen and expect the student to explain his or her work.

- The student may need help describing their work with sufficient detail using formal descriptive language.
- Model how the student should describe her / his work, then have the student describe the work.
- Maintain high standards for how students describe their work.
- The experience of talking to faculty and learning to communicate on a professional level is important.
 - Communicating with a faculty mentor on a professional level during a field placement is different than asking questions in class or during office hours.
 - The experience of talking professionally to a faculty member builds students' self-confidence
- Just talking can have an impact.
 - Once done with the discussion of the project, talk about the student's professional plans. Students remember and value these discussions.

Questions

While it is good to have questions, there are badly asked questions. It is important to keep in mind that how a question is posed provides an impression of the person asking the question. It is critical for the student to provide information so that mentors have an accurate impression of a student's work ethic and efforts. Further, answering a question provides an excellent mentoring opportunity. A well-asked question gives the mentor insight into the student's thinking and work processes and opens up the potential for a valuable conversation. The mentor can focus on answering key points and often has an opportunity to spend additional time discussing the work or related topics.

Questions: key points for mentors

Things to remember about student inquiry:

- Help the student learn how to ask a question.
- After the student asks a question, indicate how the way that they asked the question may impact your impression of their work ethic or effort.
- Help a student rephrase a question.
- Coach a student on how to ask the faculty mentor questions.
- Students often have more knowledge and have done more background work than they are indicating. You may need to take some time to draw out what they know and help them create a better question – all before answering their question.

Calibrate your mentoring to match the mentee

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.

Examples of good and bad questions

Example 1

BAD QUESTION:

"I just don't understand this at all. Where do I start?"

- While this may communicate your current frustration, it likely does not communicate your understanding or where you need help.
- This may leave the impression with the mentor that you are not working, particularly if you do not provide evidence that demonstrates that you have completed the background work necessary to be prepared to start the project.
- This type of statement tends to put the burden on the mentor for your work. Mentors generally expect you to take ownership of the project.

GOOD QUESTION:

"I read the two articles that you gave me, and what I currently understand is However, I am still not sure how to get started on the ... that you asked me to do next. Is there something that I am missing from my reading of the two articles or can you help me make a connection between the two articles and the ... that you asked me to do? I am hoping that this will help me understand how to get started on the task"

- This question shows what you do understand, that you have done your work, and that you are taking responsibility for starting the work. You just want some help getting past the initial barrier of getting started. An experienced mentor can hear what you understand and help you develop a path to what you need to understand to get started.

- This will leave a mentor impressed with your initiative and your commitment to do the work. You have communicated clear ownership of your work.

Example 2

BAD QUESTION:

“I did what you said and the equipment does not work. What is wrong?”

- It is not clear if you actually did what the mentor said should be done with the equipment.
- There is no sense that you have tried to diagnose the problem.
- It is not clear that you are taking initiative.
- It may sound like you are working through a list of actions (cookbook style work) without interest or effort to understand the reasons behind the steps.

GOOD QUESTION:

“I am having difficulties using the equipment to get the results. Can I tell you the steps that I took and then share some ideas that I have for why it is not working? I hope that you can verify my understanding of the equipment, see if my ideas for the cause of the problem and how to fix it are reasonable, and give additional ideas that I can then investigate.”

- You are being specific and focused on understanding not just actions.
- The mentor will get to hear what you have understood and where additional clarification is needed. (i.e. The mentor does not have to start from the beginning or guess where you are having difficulties.)

Example 3

BAD QUESTION:

“I wrote this program and it does not work. Can you find the error?”

- “Writing a program” includes the effort involved to get the program to run properly – to someone experienced in programming, you are communicating that you are not willing to make the necessary effort.
- It is not clear that you knew what steps you took to make the effort when you wrote the program.
- This can communicate a poor work ethic.

GOOD QUESTION:

“I have written a program to implement these equations. Currently the program is not working. I would like to walk through the logic in the program and the ways that I have tried to find errors in

the program. Can you see if there are errors in my logic and help me think of additional ideas for finding errors in the program?”

- You are giving all the information that you have.
- You have indicated that you want to find the errors, and primarily want help in understanding the appropriate steps to take.
- You are taking the initiative and ownership of the program and the process of getting it to work.
- It is clear that you want to know how the program works. This gives the mentor the confidence to follow up and ask you to expand the program if appropriate for the research.
- You are demonstrating that as a student, the process of learning how to accomplish the work is as critical as accomplishing the task.

Example 4

BAD QUESTION:

“I have tried to derive the equations, but can’t get the math to work. Can you find my error?”

GOOD QUESTION:

“I have been working on deriving the equations that we discussed at the last meeting. I have worked through the derivation in two different ways, but they give different results. Both methods are based on books that I found in the library. I would like to show you both methods and hope that you can help identify errors in my logic, and ask you to suggest any other references that I can review for additional information.”

- You are taking ownership of the work – you want help to identify the methods to find the problem in the derivation, not have someone else do the derivation for you.
- You have indicated that you have done extensive work before asking this question.

Example 5

BAD QUESTION:

“I am so frustrated with this not working and don’t see the point of this. Tell me again why I need to do this?”

- This communicates that you were not listening the first time.
- It is not clear that you respect the experience of the mentor to know how the research should proceed.

GOOD QUESTION:

“The experiment is not working well, and I am getting very frustrated. I need to step back and make sure that I understand why this experiment is important and what I should be learning from it. Then I think I can approach the experiment again with renewed clarity. Can I explain my understanding so that you can correct or add to my current understanding? If you have other suggestions, such as putting this aside for example while I work on the computer program, I would appreciate your advice.”

- This shows that you are taking responsibility for your frustration and have developed a strategy to cope with the situation.
- You are willing to explain your understanding, so that the mentor can focus on any error in your understanding and confirm what you do understand.
 - It can be very encouraging for both the mentor and student to recognize that you do understand significant portions of the work.
- You are open to additional suggestions on strategies to deal with your frustration. It is likely that the mentor will also give you examples, personal anecdotal experiences, of when they have coped with similar frustrations.

About research

The central component of a summer research placement is, of course, the research. For many students, this may be their first exposure to a research project outside of their course work. Thus, based on this experience students may make very broad judgments about what research is and their future interest in research. It is important to keep two things in mind:

1. Normalize how they will be performing research for you compares to all the possible forms of research.
2. Talk to the student about how she or he experience each activity.

The following assumes that your goal for a field placement program is for the student to find their niche in research, so that they have a vision and motivation to pursue their next steps in developing their research career. A goal is to help the student separate their interest in the topic from their interest in research. Motivation in both is needed, but a student can choose to not pursue a research career on topics that they have great interest in, if their experience of the research process turns them off from research.

Normalizing

Place the research that the student is performing with you and the research of the graduate students and post-docs in your research group within the context of the continuum of research approaches. While a commonly taught systematic model of research consists of performing background study, posing and then testing research questions, there are many research projects which do not follow a path confined to such a linear model. If your work fits a particular model, and it is a model that the student is comfortable with, then all should proceed well. However, if there is a mismatch between your research model and the model preferred by the student, then it can be difficult for the student. More work may be needed for the student to see the work within the context of possible research

approaches. In such a situation, the student may love the subject, but then need to learn that there are other options available to approach the research.

In general, the research continuum ranges from research that only starts with a very well defined research question to research that has a very well defined topic but is seeking the research question(s). For example – consider the same issue – improving the ability to predict the vibration of pipe walls just down-stream of a control valve:

1. It is hypothesized that modeling the dynamic pressure using a κ - ϵ model in addition to the acoustic pressure just down stream of a valve will improve the accuracy of the pipe wall vibration predictions.
2. Temporal and spatial analysis of the measured pressure down stream of a control valve will be used to identify the contributions of the acoustic and dynamic pressures in order to determine their relative contribution to the pipe wall vibration.

Approach 1 is a traditional hypothesis driven research model while approach 2 is more of an open ended exploration of the system in order to determine the next steps. While the project in your research may take one of these approaches, be sure to assess the student's comfort with, and interest in, this style and also discuss other approaches to the same research problem.

Talk with the student

Even though a student is performing very well, he or she may not be enjoying the work – the student may not be interested in your research area and/or his or her interest in research generally may be dissipating. During your meetings with the student, always ask what he or she is experiencing. From the beginning, it is important to create an atmosphere where the student feels comfortable and can be honest with you. Make sure the student knows that he or she can dislike aspects or all of the work, but still respect you and you them. It is critical to be able to have honest discussions of what they experience and then work on normalizing their experience.

If the student did great work, but for example, is finding the hypothesis driven work not interesting and would prefer more freedom to explore, talk to the student about how this is or is not possible in your field. This is important information for the students. If the student does not like exploratory work with no definitive pre-defined outcome or hypothesis, then talk about how others in your field are doing hypothesis driven research. If the student likes your research style, but does not find the topic interesting (or motivating), explore other interests. Help your mentee identify alternative research areas and how being successful with you can lead to getting into a different area better suited to him or her.

The most difficult part for most mentors in this situation is to avoid taking the student's comments personally. It is important to keep this in context. You are an accomplished researcher and they are exploring. Focus on helping the student to understand their experience. It is important for the student to learn how to express constructive criticism. The student will likely respect your professional advice and commitment if they are able to candidly express their feelings about the work and then have a discussion with you that helps them explore other opportunities and options that are of more interest to them. In the discussions with the student, endeavor to keep focused on their developmental needs. If they inappropriately express their dislike of the work, help them think of a more productive way to deliver that message.

Consider the following exchange:

Mentor: Greg, you did very good work this week and have good plans for the work during the next week. I was impressed with your interest in the research topic and the way that we do research in this group.

Mentee: To be honest, I hate having to follow these detailed rules. I am just doing it, but glad that you think the work is good. It looks to like this is all that the grad students do. If this is grad school, then it's not for me.

Mentor: I want to talk to you more about this, and am glad that you let me know how you feel. However, first I would like to talk about ways for you to communicate the same information. It seems that the key points for you are (1) you see the work as only following a set of procedures and (2) you view graduate school as the same work. Are those the main points?

Mentee: Sure

Mentor: Those are good points, but here is how I would suggest that you describe them. "I am glad that my work is good. I am finding the work difficult to enjoy because I feel like I am just following a set of directions. There does not seem to be any creativity in the work. From what I see of the graduate students' work, it seems that they are doing the same work. It is difficult for me to be motivated for graduate school if my perception is correct. Is this how the rest of my placement will be, and what going to graduate school will be like?"

Mentee: Wow, I hope that I didn't come across as stupid the way I first said it. How you phrased it is closer to what I was thinking.

Mentor: No problem. Part of the goal for this program is for you to gain more experience in professional communication. I certainly talk to my colleagues differently than I do with many of my closest friends. So, how about if you rephrase your first comment, and then we can discuss your concerns and observations. These are similar issues that I had to face when I was a student....

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.

E-mail standards for communicating with mentees

E-mail is a professional communication tool. So an e-mail should be written in a formal language. Consider an e-mail to be a memo. Content should follow some basic rules:

- Address the person in agreed terms. Always err on the side of formality.
- Provide sufficient detail.
- Separate information from a request.
- Provide your justification for the request.
- Compose the e-mail so that a single response from the recipient will address your request. If you want to meet, include your available times. If you do not do this the mentor will have to e-mail you back with their available times and then you respond.

- Do not expect a professional e-mail in response.

NO: Hey Dr. M – I got some slick results today and want to talk.

YES: Dr. Mann,

The experiments today were successful. We were able to get results and based on my initial analysis, they appear to be in the range that we expected but are also surprising.

I would like to meet with you briefly, 15 minutes, to show you the results, tell you my plans, and get some initial feedback from you regarding my interpretation of the results and my next steps. I would like to adjust my work plans before our regular weekly meeting since these new results are motivating me to consider a different approach

Today I will be in the lab from 1-5 and then tomorrow morning from 8-11. (note: there is a workshop on applying to graduate school starting at 11 tomorrow and then some lab tours the rest of the afternoon.) Please let me know what time will work best for you.

Student communication with mentors and faculty

In general, the following is recommended:

Use e-mail for:

- Sending a document or information for review.
- Quick communication – e.g. scheduling a meeting.

Use phone for:

- Clarification to follow up a previous discussion or e-mail.
- An issue that needs to be resolved that may be difficult, but there is no time for a face-to-face meeting.

Face-to-face interaction:

- Always preferred – this provides an opportunity for details to be shared and discussed as well as additional follow-up conversations.

Social media, e-mail, texting, are all very convenient, but also fraught with danger: misunderstandings resulting from not communicating clearly an accurate sense of mood. Conversely, there are times, when a well composed e-mail can be much more constructive than having a face-to-face meeting when frustration about the work progress or having pressures from outside of the program work is dominating a person's thoughts. So consider the purpose of the interaction and your mood.

Remember, that with any electronic communication it is best to assume that the intended person has not received it until there is confirmation. Similarly, when you receive electronic communication, respond as quickly as possible, even if only to indicate that the communication was received and to provide a time line for when you plan to act on it.

When to let them struggle, when to help

Balancing challenge and support is critical to a successful placement experience for a student. In general, the goal is for students to accomplish as much as possible on their own. Thus the goal is for you as a mentor to balance challenge and support of the student, in essence, decide when it is OK for the student to struggle and when to help.

With too much challenge the student can feel overwhelmed and their self-confidence can suffer and with insufficient challenge a student can experience the work as boring and not perform to their full potential. With too much support the student may never develop their own abilities or self-confidence in their own abilities and with insufficient support the student may not be able to overcome hurdles and may not find out what they are capable of.

One challenge as a mentor is that each student is unique and requires a different level of challenge and support.

Before the beginning of the program, the faculty and graduate student mentoring team should have a conversation about challenge and support. Each can talk about their own experiences and what was a good balance for them. This can be a good practice for having the same conversation with the new students. Note how the best combination of challenge and support for each of you has changed over time, not just as we gain knowledge, but also as you gained work experience and self-confidence.

At the beginning of the program, have a direct conversation with each student about the level of challenge and support that they have had in the past. Ask the student to talk about what was successful. Also talk about your own experience with challenge, and what was successful for you. Comment on how you and the student are similar or different. Ask that students provide feedback during their placement regarding the level of challenge and support that they are receiving.

When assessing challenge and support break both down into (1) background knowledge, (2) intellectual abilities, (3) self-confidence, and (4) resources. During a placement, all of these can be impacted by your actions. Classifying the issue of challenge and support into each of these areas can help the mentors and students determine appropriate action. This can also help the student avoid over generalizing the difficulties that they are having. For example, if resources are determined to be the issue, then you can focus on lining up the appropriate resources, or modifying the activities. Further, if it is resources, but the student is not sure why the work is not going well and their self-confidence is being eroded, then identifying resources as the issue can help them regain their self-confidence.

If the issue is background knowledge, then provide references, topic specific tutoring, and other support. Talk to the student about if they should have the background knowledge. It may have been quite reasonable that they did not have the background. If that is the case, then they may feel better about the education that they are receiving. When the issue is self-confidence, the appropriate action is much more difficult to determine. Sometimes, starting with frequent interactions to provide feedback on the quality of the work can help and then reducing these frequent interactions can then help the student to build self-confidence.

The faculty and graduate student mentors should work as a team to assess their efforts to challenge and support the student. Also consider getting outside advice from the student's mentor at his/her home institution or other colleagues.

Handling family and other personal emergencies

"I think we often forget that each of our cultures: as a Black person, Hispanic, Native American or Asian, may affect our thinking and responsibility to our family as well as our passion for our work. I think we need to do a better job of acquainting our leaders/mentors with these cultural differences in our students. Some may say that this is not needed, but an appreciation of one's family life and upbringing can add to the respect and credibility of the mentor as well as the student."

-- Larry Campbell, Colonel, US Army (Retired), Program Director, Opt Ed, AGEP, University of North Carolina, Chapel Hill

Personal and family emergencies can happen during a placement. It is critical for everyone to be in communication as early as possible when this situation arises. The section on personal counseling should be reviewed. There are instances when an emergency can make decisions difficult, and personal counseling can provide assistance with making decisions. Assistance may be needed to determine how best to handle the situation. Before you decide on an action, be sure that the situation is clear to all parties concerned.

Students: Mentors are usually reasonable and almost all have experienced personal and/or family emergencies themselves. Describe the situation clearly articulating what it means to you. The mentor may not have had a similar experience with her or his family situation, so may not relate to the specific situation, but will likely try their best connect to how you experience the situation.

Be prepared to consider the consequence of your action on the research progress of your summer placement. There are emergencies that require your absence from the placement and most mentors will work with you to help you get the most from your field experience. However, keep in mind that this is a unique opportunity, one that can lead to recommendations that will help advance you into your next career move (fellowships, graduate school, job, etc.). You want to handle this as professionally as possible.

Mentors: You may need assistance in determining if a student is making the best decision. Seek advice after you understand the situation. If the student's decision puts the research progress at risk, be sure to make this clear and discuss the potential consequences with the student. Work with program staff to ensure that the student is getting needed support and that staff are aware of the discussions and decisions that you have made with the student. A meeting with a student when she/he is considering how to react can take several hours. Your patience and professional guidance can play a critical role, modeling how they might make decisions in the future.

Consult with student support service professionals such as the Dean of Students' Office or Student Counseling Service. They have extensive experience and advice that can assist you in the process of providing help. You are the expert in research; they are the experts in professional counseling for students.

How to handle your schedule

For many students, this can be the first experience with an open-ended research question and a flexible work environment. A lab environment with positive role models along with specific discussions about schedules may help. However, in a lab environment without positive role models,

it is important for the students to be confident and positive in their own abilities to get the work done and deal with the challenges of life.

Since many placements are relatively short – eight to ten weeks – they may not afford the luxury of a semester where one might be able to procrastinate and cram for exams. While lab groups can get into these habits of working long hours to accomplish work for a report or conference, modeling the consistent and well-organized work habits of a full time job can provide a clearer structure and norms for the student to work within.

Requests for time off

Many laboratory environments focus on accomplishing goals rather than counting work hours. Time is considered flexible, ranging from ‘everyone should always be in the lab’, to ‘just get the work done’. However, there are many examples of a student believing that the faculty mentor is fine with a flexible schedule, but then finding out that the flexibility that the student is exhibiting is making the faculty member uneasy and creating doubt regarding the student’s commitment to the work.

Generally, for field placements, it is expected that students will focus primarily and intensively on the fieldwork and that is why the program personnel have set aside time for this program. Do not go into the placement with an expectation that you can leave on a Wednesday or Thursday to have a long weekend at home, with friends, etc.

The key for all parties to remember is that many placements are extremely short (eight to ten weeks, one semester). There is little opportunity for flexible time while also accomplishing significant work during this period.

Students: Plan to ask for time off within the confines of accomplishing the research goals. When requesting time off, always explain how the work will be accomplished. Heading out on Friday afternoon to travel with some friends or fellow students, is generally not a wise choice. If you do decide to take time off, make the request as far in advance as possible. Include your mentor in the decision of whether or when to take the time off. Do not present it as a done deal because this sets up a situation where if the mentor says no then they are ruining your plans.

Also consider that many faculty members have hectic research schedules themselves. It is not uncommon for them to be called out of town for a one to three day business trip, or to suddenly have a day filled with meetings. This may get in the way of your plans to coordinate a trip and meet with your mentor. Again, your primary concern and commitment should be to your successful completion of your placement—this is an important part of your career advancement.

Graduate student mentors: Review your schedule and how you take time off before the new student arrives. If you take off on an afternoon with good wind to sail or wind surf at a local lake, talk to the faculty mentor about how to handle this with the student(s) you are supervising.

Be clear about your expectations for taking time off. Make sure and set a good example yourself. Give examples of the type of activities that you have approved for students to take time off from the work schedule. Establish an expectation of how you will be involved in the decisions that the student makes to take time off. In general, it is best to err on the side of having the student involve you in the decision as early as possible. While you may see this as overbearing and not allowing students the independence they need, a worse situation is if you get annoyed or inconvenienced. Again, for many students, this may be their first experience of being in a professional

scientific/engineering work environment and they may need assistance with establishing professional behavior.

Scheduling: guide for mentors

Being unstructured or flexible with time expectations can be difficult for a student. Provide some structure at the beginning. This may also require asking for structure from yourself and others in the lab. In an 8-10 week placement, with the first week or two focused on reading literature, it is very easy for time to slip and for the placement to be wrapping up with the student and mentoring team scrambling to get something accomplished.

One of your key roles as a mentor is to help the student develop work habits for the professional research laboratory. Talk to the student about the use of work time. Not just total time, but what they are doing during work time. After a student describes their day or week of work, reflect on what you thought they did well. Identify work habits that need to change. If possible, relate to the student and provide a personal experience that allows you to demonstrate how you changed an unproductive work habit.

For example, if a student is sitting all day trying to read articles, describe how you initially did this when you were starting out:

"I found that spending less time per article with time to talk to others in the lab about their work, or asking for lab work between articles, helped me focus on the reading. I also found that I could not spend more than two hours reading articles, before needing do another task, even if for 30 minutes."

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

Talk to the graduate students in the lab and ask them to stagger working time with the new student and/or allow the student to look over their shoulder as a means to get a break from studying articles.

Including students in your work

There is always a balance to be struck between the time that it takes to get a student trained so that they can be productive, and the time that it would have taken to just do the work yourself. You need to decide how much you want or are able to commit to mentoring and development of students. You also need to think about how to divide your work so that a student can have an assignment to accomplish independently. One strategy is to identify a project component that is important, but not time sensitive. So if they do well and get the work accomplished, that is wonderful. But if they do not, then it is work that you were planning for later and a delay or misstep will not negatively impact your schedule. Alternatively, it may also be useful to give a student something you are struggling with, in order to get a fresh perspective on it.

Literature searches

Guide for grad student and post-doc mentors

You will typically be the first person that the student approaches as they are reading documents. Review the comments in the student section on methods to read literature and make

sure that you consult the faculty mentor and that you know, and are in agreement with, what the expected outcomes are for the student.

Remember:

1. This may be the first time that the student has been given a list of documents to read without a clearly defined outcome. Previously, most students have only been given literature to read in the context of a class where there is a specific assignment to complete. Many students have developed the habit of using the assignment as a guide to reading documents.
2. Make sure that you know the key points from the literature that the student is reviewing. Review or develop these with the faculty mentor to ensure that there is agreement
3. Meet with the student once or twice a day in the first week to review what the student is doing. Do not allow the student to say "Everything is going well. I do not have any questions." Ask to see the notes that they are taking. Ask the student to describe what the key points are in one of the papers that they have read.
4. Keep the faculty member updated on the student's progress. Talk to the faculty mentor about what you are observing.
5. Coordinate with the faculty mentor on how each of you will work with the student. Plan your time accordingly so that you are available.
6. Allow the student to struggle. Showing the student the key points, while saving your time in the short run, will not in the end help the student learn the skills to read literature.

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.

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.

Camaraderie

Camaraderie is one of the hallmarks of an effective research group. By contrast, some research groups are run on intimidation and fear, but these groups usually experience difficulty attracting or keeping students.

Research groups often have a more informal and flat hierarchy than one might experience in industry. Going to lunch, grabbing a coffee, having dinner, playing Frisbee are activities, often unplanned, that happen with students at the undergraduate or graduate level, post-docs and faculty. One faculty member described his research group as “we would work hard in the morning, play some rugby after lunch and then go back in and work hard in the afternoon.” Another faculty member would go to her lab to have lunch -- that lab always seemed to fill up at lunch time with students from other labs also coming in for the camaraderie.

Communication with your major professor

Surviving the departure of your mentor during your program

** Content currently in process.*

Communicating with your major professor throughout the placement

Communicate with your major professor throughout the placement. Make sure that he or she is aware of the success and challenges with a student - both the work and the process of the work. Plan regular communication for example: during your weekly meeting about your own research, or a weekly e-mail summary. During the beginning of the placement, make the planned contact more frequent, such as once a day or twice a week, depending on your experience with the students. Be clear with your major professor about your mentor role: you are there to help, but your major professor is the one primarily responsible for the student's experience.

Ask your major professor how he or she wants you to communicate about mentoring issues that arise, and get specific examples of issues that range from mild to serious. Have your major professor clearly state the circumstances in which he or she will step in. With these routines and expectations set ahead of time, the communication during the placement will be smoother and more effective.

How to choose a mentor (and tactfully change mentors)

* *Content currently in process.*

General guide for graduate students in getting the mentoring you want

The Rackham Graduate School at University of Michigan has published an excellent guide to finding and establishing fruitful relationships with faculty mentors: [How to Get the Mentoring You Want: A Guide for Graduate Students.](#)

* *Additoinal content under development*

Getting squeezed between a mentee and faculty mentor

It is quite possible that you will end up being the pivotal link between a faculty mentor and the student(s). You may have requests by the faculty mentor to have students accomplish specific tasks, and you may be more aware of the strengths and weaknesses of the student(s). Likewise, you may be the one who the student feels more comfortable with and complains to, quite possibly reasonable complaints. There are cases where the student is accomplishing work at a faster pace than the faculty mentor is allowing work to proceed. For example, the faculty mentor may tell you to have the student accomplish a list of tasks and then not do anything until you present the results to the faculty mentor. In such cases, it can be difficult if the student has completed the tasks, but the faculty mentor is not due back in town for a week.

Hopefully, none of these cases are ones that you will experience, but be prepared for being put in the middle.

One general piece of advice is to always provide either the student and / or faculty mentor with specific actions that they or you will take. Work toward having the student and faculty mentor communicate directly. “That would be a great topic to discuss on Tuesday when we all meet? If you would like, I can raise the subject and then you can make you case.”

How to communicate with your major professor regarding the mentoring load

Assuming that your major professor and the faculty mentor for the student is the same person, the work load for your activities is an important topic for you and your major professor to discuss. In some cases, close to 100% of the mentoring responsibility is placed on the graduate student.

Remember that load can include the following:

1. Directly working with the student
2. Time and emotional energy preparing for a difficult discussion with a student
3. Discussing the student’s performance with the faculty mentor
4. Planning work for the student
5. Communicating with the faculty mentor regarding your mentoring load

If the communication described below is not possible or very strained, then it is likely a symptom of how you and your major professor communicate. While you may not be able to change how your major professor communicates, working at the model given below, can help you develop your own professional communication style.

Before the placement begins: Discuss the expectations for your time commitment. This is as much about the faculty mentor describing what they are expecting as it is about you describing what you are confident and have time to do. What follows is a negotiation. If this is your first time mentoring, this may require more than one meeting with the faculty mentor. It is not possible to set rigid guidelines because the mentoring load will depend on many unknowns, for example, the student's personality and capabilities or equipment breaking. In general the discussions before the placement begins should clarify the following:

1. Define a successful placement experience and the mentoring needed for this. Focus on the mentoring not the research.
2. Differentiate your role and the role of the faculty mentor to accomplish this successful mentoring model.
3. Define who will address problems with the student. For example if the student is coming in late or not prepared for group meetings – who should handle this, how and when.
4. How will your work habits need to change to fit with a student's schedule?
5. Define the types of issues where you or the faculty mentor need outside help.
6. Define how and when you and the faculty mentor want to communicate about the mentoring process.

During the placement: Continue to monitor your mentoring load. Monitor your own research progress. If there is a deviation from the load discussed before the placement began then set up a time to discuss this with the faculty mentor. At such a meeting:

1. Talk about areas where the mentoring is going as planned as well as where it is not. Define the area that is causing a problem with the mentoring load. Be specific by describing actions and the impact on you.
 - a. Be prepared to suggest a solution.
 - b. Do not describe motivation of anyone other than yourself.
 - c. GOOD START: “At the beginning of the summer, we had discussed how the student X would develop a detailed description of their accomplishments that week and the plans for the upcoming week. We agreed that I would work with X to develop a similar format and content to what I provide each week. My goal is to help X learn to write reports as you have shown me. I have worked hard with X to develop and modify her report and the first two you thought were good, but you only provided few comments. Then last week X did not want me to help, saying that I was making the reports too complicated. So X submitted a weekly report that you also said little about. I need your help to determine if I am to go back to working with X on the weekly reports or just allow her to submit them as she wishes and then allow you to provide any critical comments. Taking the time to work on the reports took three hours out of each of the first two weeks and I am unsure about the level of detail that I should require when overseeing X's work. It would help to have clear guidance from you of what is necessary. Was I doing too much with the first two reports?”
 - d. BAD START: “This is crazy. I work hard on the first two weekly reports, basically writing them myself, but you give little feedback. And then out of frustration I do

nothing this week and you still give no feedback. It seems that you have no interest in these reports and that the student is lazy. Just tell me what to do.”

2. Leave with a resolution and specific actions. If you are feeling that the issue is not resolved, then ask to meet again. Ask that the two of you agree on specific tasks for each of you before the next meeting. For example, you will try something different and report back, the faculty mentor will speak with the student, or in the case above, the faculty mentor will read the three reports and make a specific recommendation to you and the student.

Documenting work

Guide for mentors

Demonstrate good documentation skills. Provide examples, both of past students, your own work, and current students in the lab. Try showing students your own project notebooks. For groups that maintain primarily electronic files for a project, show how you organize and share your files. How do you retrieve information? How do you document the work so that the progression of the work is captured?

Recognize that students may have already developed habits of their own. Many undergraduate students have been in program where they are given specific guidelines on documentation. They may have had lab classes where all they do is fill in a document.

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.

Ongoing mentoring relationships

After the program

You are an important resource and connection for students as they continue their educational and professional development. You can have a very significant impact by continuing to keep in touch after the student completes the placement. It is recommended that you maintain a professional role.

It is important for you and for the student to develop long term professional relationships. You can help by sending occasional e-mails asking how the student is doing. Update the student on how the work has progressed or was used after they finished. Let the student know about other interesting work that you see. Check in on progress in regards to investigating and applying for graduate schools. Once a student has entered graduate school, continue to stay in contact for example, providing advice from your own experience as a graduate student, or arranging a meeting at a conference you may both be attending.

Include students in your own professional network. For example, if you are talking with some of the experts in your field, invite the former student over and introduce them. Helping former mentees develop their professional networks is a great way to continue to mentor and to strengthen your own network.

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."

- *Mark Hernandez, Professor, Chemical Engineering, University of Colorado, Boulder, Director, Colorado Diversity Initiative*

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.

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5. Work Plans.
 - a. Describe the planned work for the upcoming period.
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 - 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 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 patterns 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 Miskelton-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 is 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 [individualized 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](#).

Faculty Directors

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

Designing and implementing an effective program

Why mentoring?

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

Why be a mentor?

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

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

Mentoring can be demanding and requires a responsible approach, but at the same time mentoring can provide an enjoyable means for acting in accordance with one's personal values.

"I enjoy seeing what students can accomplish and helping to push them beyond what they think they are capable of. By guiding engineers who are just entering the field, I also feel I am giving something back to a profession and discipline I care about. On the other hand, mentoring takes time - there were some summers when I knew that I did not have the time or energy to effectively mentor, so did not take any interns."

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

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

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

Why diversity?

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

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

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

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

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

Utilizing Difference to build stronger teams

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

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

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

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

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

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

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

Plan for institutionalization

** Additional content is in process*

Re-think resource allocation

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

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

The link for additional information on this program:

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

Examples of successful programs

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

[Meyerhoff Scholars Program at the University of Maryland at Baltimore County](#)

[MIMSUP: Multicultural Initiative in Marine Sciences](#),

[SOARS: Significant Opportunities in Atmospheric Research and Science](#).

Mentoring models to consider

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

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

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

** Additional content under development*

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

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

Offer and implement training/orientation.

For example:

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

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

Materials and resources that can be helpful:

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

Some methods of providing them:

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

- Reference in conversation and attach to follow up emails

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

Preparing faculty and graduate student mentors

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

Promoting diversity: Empower faculty allies

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

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

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

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

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

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

Steps to consider when enhancing your outward focus:

1. Reaching & recruiting students from underrepresented groups:

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

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

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

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

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

Focus on fostering partnerships – real partnerships with specific individuals:

- *Start with your current networks.* Add detail to your proposal about your current collaboration networks that you will tap for recruitment, such as faculty at other institutions, professional societies, etc.
- *Tap into your own campus resources.* Identify the resources on your own campus and within your campus networks that you plan to work with. For example:
 - Office for Campus Diversity
 - Office of Minority Affairs
 - Minority and women student chapters
 - Student Career Services
 - AGEPs
 - LSAMPs
- *Plan on fostering partnerships with faculty and administrators at minority serving institutions.* Realize that joint partnerships are a two-way street, take time to develop, and are built on trust and presence. Reach out, show up, and follow up.
 - Identify and reach out to minority serving institutions in your local area: HBCU's (Historically Black Colleges and Universities), HSIs (Hispanic Serving Institutions), Tribal Colleges and Universities, community colleges and women's colleges.
 - When you travel for conferences or meetings, plan ahead and include site visits to minority serving institutions in the area to meet and talk with faculty and students in person.

Focus on travel and conference participation:

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

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

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

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

Recruitment templates and draft plans

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

Sustaining an effective program

Building and Maintaining the Mentoring Network

Reference list of mentoring resources

IBP maintains an [annotated reference list of academic research and expert knowledge](#) about mentoring.

Technologies to support mentoring

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

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

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

See [IBP's Best practices for social media](#) in Graduate and Undergraduate programs for more detailed information.

Building and maintaining an alumni network

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

Embracing the pipeline: Inspire outward, support forward

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

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

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

Program review

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

How to use this manual in mentor development

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

** Additional content is in process*

Troubleshooting

Identifying and addressing ongoing challenges

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

Role in a mentoring conflict

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

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

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

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

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

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

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

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

Mentor while traveling

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

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

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

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

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

Staffing changes/additions/deletions, Professional Development

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

** Additional content in process*

Partnering with division of student affairs

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

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

Sexual harassment

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

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

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

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

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

Mixed age range of REU participants

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

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

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

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

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

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

Drinking

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

Issues to Consider:

- Student Attitudes:
 - Working with students who are inebriated
 - Students feel we should expect drinking, even heavy drinking.
- Campus Housing
 - While there may be an alcohol policy and a paid person monitoring the housing facility, this person may not be effectively enforcing the policy.
- Campus Policy:
 - The campus police may be instructed in the case of someone being taken to the hospital, to not investigate for under-age drinking or other violations. This policy is in place so that students will call the police when someone's health is in danger without fear of themselves or friends getting in trouble.

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

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

RECOMMENDATIONS:

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

Health insurance issues

Some universities require that students from other institutions have health insurance. You may need to require that the students sign a form indicating that they have health insurance. However, it is not uncommon for students to have no health insurance. At some universities, even if the visiting

student comes in with health insurance, they are not allowed to use the university health center, but rather the local health clinic or hospital. If your program is at a field site you should explore the local health care facilities in case your students need to use them. These situations raise several issues that require attention so that they do not end up detracting from the field placement experience.

Particular issues include:

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

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

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

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

In some campuses, there is an open drop-in policy at the campus medical center. While expenses may be charged to a student's health insurance purchased through student fees, students may not have ever realized the costs involved. In a field placement, the use of a local hospital or medical clinic in that same drop in mind set, may lead to use of the emergency room and hundreds or thousands of dollars of charges that a health insurance policy will not cover.

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

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

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

Program Directors: Make sure to cover this subject thoroughly prior to the start of your program as well as in the orientation program when students arrive. Work with each student before they come to campus or a lab or field site so the student has the correct information for their health insurance. Check with the student health clinic on your campus regarding policies for visiting students to use their resources. If the students are required to use a health clinic or hospital in the

community, make sure that information is available and ask the facility about any issues that you, your staff and your students should be aware of.

Evaluation

Evaluating broadening participation

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

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

Using evaluation to revise program design and elements

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

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

Disseminating and promoting the program

Documenting your success

** Additional content is in process*

List of References

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 provides 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 searches, 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.