The Mentoring Manual

**IBP Guide to Mentoring for
all program participants**

**Produced by
The Institute for Broadening Participation**

Institute for Broadening Participation
Building Partnerships to Support Diversity in Science

The Institute for Broadening Participation

Pathways to Science

Mentoring Manual

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

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

How to contribute to this manual

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

Please use our comments and contribution form to submit:

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

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

What is Mentoring?

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

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

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Basics for Everyone

What is mentoring?

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

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

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

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

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

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

Phrases that make an impression:

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

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

What is a mentee?

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

Characteristics of the ideal mentee include:

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

Programmatic best practices

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

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

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

* additional content to be developed

Recruitment and selection

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

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

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

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

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

Financial aid

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

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

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

Bridging

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

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

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

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

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

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

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

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

Program values

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

Mentor Values:

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

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

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

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

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

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

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

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

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

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

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

Program community

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

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

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

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

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

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

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

Personal advising and counseling

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

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

Study groups

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

Students consistently rank study groups as one of the most positive aspects of their programs. Study groups are viewed as an important part of success and consistently encouraged. Peer support and

respect cultivated in activities such as study groups can build satisfaction with the student's major and career path (Amelink and Creamer, 2010).

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

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Tutoring

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

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

Summer research internships

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

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

Mentoring

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

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

help students make those connections." - *Lorraine Towns, CUNY AGEP Coordinator, The Graduate Center, CUNY*

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

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

Faculty involvement

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

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

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

Administrative involvement and public support

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

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

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

Resources

Model Programs

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

Meyerhoff Scholars Program at the University of Maryland at Baltimore Country

MIMSUP: Multicultural Initiative in Marine Sciences,

SOARS: Significant Opportunities in Atmospheric Research and Science.

Reference list of mentoring resources

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

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 an 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 your 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 commination. 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 you 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/~chemla b/info/notebooks/how_to

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

Communication guidelines

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In general, the following is recommended:

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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. Hare 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 interst 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.

List of References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Dartmouth College, How to Keep a Notebook.

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

A guide for students in keeping a lab notebook.

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

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

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

Engineering Information Foundation (EiF), Grant Programs.

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

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

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

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

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

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

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

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

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

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

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

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

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

On the pitfalls and power of social media.

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

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

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

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

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

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

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

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

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

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

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

Practical tips on improving how you mentor.

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

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

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

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

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

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

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

Engineering ProActive Network   (WEPAN).

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

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

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

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

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

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

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

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

National Science Foundation, Research Experience for Undergraduates Resource List.

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

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

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

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

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

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

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

Swarthmore College, Advice on keeping a laboratory notebook.

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

A guide for students in keeping a lab notebook.

The University of Iowa, Sexual Harassment Can Happen Anywhere.

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

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

University of Michigan, Campus Mind Works.

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

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

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

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

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

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

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

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

Washington Space Grant Consortium, The Basics of Poster Design.

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

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

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

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

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

Web GURU, The Laboratory Notebook.

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

A guide for students in keeping a lab notebook.

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

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

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

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

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

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

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

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

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

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

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