



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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Table of Contents

Overview and Home	5
How to contribute to this manual.....	5
What is Mentoring?.....	5
Acknowledgments.....	6
Basics for Everyone	7
What is mentoring?.....	7
What is a mentee?.....	8
Programmatic best practices.....	8
Recruitment and selection.....	8
Financial aid.....	9
Bridging.....	10
Program values.....	10
Program community.....	11
Personal advising and counseling.....	12
Study groups.....	12
Tutoring.....	13
Summer research internships.....	13
Mentoring.....	13
Faculty involvement.....	14
Administrative involvement and public support.....	14
Resources.....	15
Model Programs.....	15
Reference list of mentoring resources.....	15
Grads and Post-docs	16
Accepting the responsibility of mentoring.....	16
What is mentoring?.....	16
How to choose a mentor.....	17
What to request from your faculty mentor before you accept the responsibility of mentoring a field placement (REU).....	17
Working with undergraduate mentees.....	18
Mentoring underrepresented minority students.....	18
Overcoming challenges of the first two weeks.....	19
Normalizing expectations.....	20
Making explicit the expectations for all.....	20
Productive meetings.....	21
A guide to meetings for mentors.....	21
Meeting with a student: extended benefits.....	21
Questions.....	22
Questions: key points for mentors.....	22
Calibrate your mentoring to match the mentee.....	22
Examples of good and bad questions.....	23
About research.....	26
Socializing.....	28
E-mail standards for communicating with mentees.....	28

Student communication with mentors and faculty	29
When to let them struggle, when to help	30
Handling family and other personal emergencies	31
How to handle your schedule	31
Requests for time off.....	32
Scheduling: guide for mentors	33
Including students in your work	33
Literature searches.....	33
Guide for grad student and post-doc mentors	33
Socializing.....	34
Boundaries	34
Camaraderie	35
Communication with your major professor	35
Surviving the departure of your mentor during your program	35
Communicating with your major professor throughout the placement.....	35
How to choose a mentor (and tactfully change mentors).....	35
General guide for graduate students in getting the mentoring you want	36
Getting squeezed between a mentee and faculty mentor.....	36
How to communicate with your major professor regarding the mentoring load	36
Documenting work	38
Guide for mentors	38
Update reports.....	38
Ongoing mentoring relationships	39
After the program	39
List of References	41

Overview and Home

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

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

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

How to contribute to this manual

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

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

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

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

What is Mentoring?

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

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

Acknowledgments

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Basics for Everyone

What is mentoring?

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

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

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

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

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

Phrases that make an impression:

"That was great work."

"Good idea!"

"I also struggled with that."

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

"You are definitely excellent graduate school material."

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

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

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

What is a mentee?

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

Characteristics of the ideal mentee include:

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

Programmatic best practices

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

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

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

** additional content to be developed*

Recruitment and selection

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

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

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

HOW TO USE THIS IN YOUR PROGRAM PLANS:

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

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

Financial aid

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

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

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

Bridging

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

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

- [Valerie Petit Wilson](#), PAESMEM Awardee and Former Executive Director, Leadership Alliance

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

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

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

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

- [Omayra Ortega](#), MPH, PhD, *Arizona State University*

Program values

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

Mentor Values:

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

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

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

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

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

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

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

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

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

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

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

Program community

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

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

- [Tom Windham](#), Consultant, Former Executive Director of SOARS and Special Assistant to Director, National Science Foundation.

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

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

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

- [Phil Kutsko](#), Director, National Mathematics Alliance, Professor of Mathematics, University of Iowa and PAESMEM Awardee.

Personal advising and counseling

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

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

Study groups

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

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

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

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

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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 AGEPE 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.

Grads and Post-docs

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

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

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

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

** Additional content in process*

Accepting the responsibility of mentoring

What is mentoring?

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

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

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

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

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

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Phrases that make an impression:

"That was great work."

"Good idea!"

"I also struggled with that."

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

"You are definitely excellent graduate school material."

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

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

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

How to choose a mentor

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

[Guide for Mentees](#)

[Guide for Mentors](#)

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

There are two basic things to remember:

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

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

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

You need two things from the faculty mentor:

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

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

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

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

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

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

Working with undergraduate mentees

Mentoring underrepresented minority students

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

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

The following facts were presented in the National Academy of Sciences titles [Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads](#), published in 2010 ([PDF summary here](#)). The report provides references to published literature supporting each of these findings. To understand and better address diversity in your

programs see [“The Road to Diversity: Are We There Yet?”](#) This article talks about the importance of role models and mentoring as well as the need for producing a diverse population of scientists.

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

CREATE AWARENESS AND IGNITE PASSION FOR STEM

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

BUILD CONFIDENCE TO TAKE ON CHALLENGE

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

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

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

** Additional content in process.*

Overcoming challenges of the first two weeks

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

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

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

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

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

Normalizing expectations

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

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

Making explicit the expectations for all

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

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

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

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

Productive meetings

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

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

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

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

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

A guide to meetings for mentors

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

Meeting with a student: extended benefits

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

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

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

Key points:

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

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

Questions

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

Questions: key points for mentors

Things to remember about student inquiry:

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

Calibrate your mentoring to match the mentee

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

Be careful to not treat an undergraduate student like a graduate student. A graduate student is on a 2- 6 year “apprenticeship”, so they have time to understand and adapt to a mentor's style. If the graduate student needs additional support, they have time to develop support networks. A summer

student, typically on an 8-10 week field placement, does not have the time to make such adjustments.

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

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

Examples of good and bad questions

Example 1

BAD QUESTION:

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

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

GOOD QUESTION:

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

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

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

Example 2

BAD QUESTION:

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

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

GOOD QUESTION:

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

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

Example 3

BAD QUESTION:

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

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

GOOD QUESTION:

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

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

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

Example 4

BAD QUESTION:

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

GOOD QUESTION:

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

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

Example 5

BAD QUESTION:

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

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

GOOD QUESTION:

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

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

About research

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

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

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

Normalizing

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

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

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

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

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

Talk with the student

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

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

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

Consider the following exchange:

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

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

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

Mentee: Sure

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

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

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

Socializing

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

E-mail standards for communicating with mentees

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

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

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

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

YES: Dr. Mann,

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

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

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

Student communication with mentors and faculty

In general, the following is recommended:

Use e-mail for:

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

Use phone for:

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

Face-to-face interaction:

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

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

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

When to let them struggle, when to help

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

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

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

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

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

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

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

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

Handling family and other personal emergencies

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

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

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

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

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

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

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

How to handle your schedule

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

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

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

Requests for time off

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

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

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

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

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

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

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

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

Scheduling: guide for mentors

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

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

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

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

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

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

Including students in your work

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

Literature searches

Guide for grad student and post-doc mentors

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

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

Remember:

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

Socializing

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

Boundaries

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

Graduate student, post-doc and faculty mentors should be careful to maintain appropriate boundaries with students. It is important to keep socializing on a professional level. It is critical that mentors maintain a relationship that enables them to provide constructive and objective feedback to

students. There is a level of social engagement that can seriously compromise one's effectiveness as a mentor.

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

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

Camaraderie

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

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

Communication with your major professor

Surviving the departure of your mentor during your program

** Content currently in process.*

Communicating with your major professor throughout the placement

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

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

How to choose a mentor (and tactfully change mentors)

* *Content currently in process.*

General guide for graduate students in getting the mentoring you want

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

* *Additoinal content under development*

Getting squeezed between a mentee and faculty mentor

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

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

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

How to communicate with your major professor regarding the mentoring load

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

Remember that load can include the following:

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

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

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

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

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

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

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

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

Documenting work

Guide for mentors

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

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

Update reports

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

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

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

Writing a report requires you to reflect on your work.

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

Key features of an update report are:

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

- state the next work to be performed

Consider the following outline for an update report:

1. Executive Summary.
 - a. 2-5 sentences giving key points of the report.
 - b. Write this after completing the update report.
2. Report Goal and Action Request.
 - a. Clearly state the goals of the report.
 - b. Clearly state the actions that you want the reader to take.(Ask for a meeting, indicate needed materials, pose questions...).
3. Work Accomplished.
 - a. Summarize your accomplishments since the previous report.
 - b. Include supporting data.
4. Barriers.
 - a. Identify work not completed as planned and the reason.
 - b. Identify new barriers identified for future work.
 - c. Identify resources or information needed from the mentor.
5. Work Plans.
 - a. Describe the planned work for the upcoming period.
 - i. Decide on this with mentor.
 - b. Address barriers and resource needs.
 - i. If you know what will be done to overcome barriers – then state plan.
 - ii. If you need something – for example a meeting with the mentor to discuss the work – then state this.

Ongoing mentoring relationships

After the program

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

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

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

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

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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.

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

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

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

Dartmouth College, How to Keep a Notebook.

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

A guide for students in keeping a lab notebook.

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

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

Engineering Information Foundation (EiF), Grant Programs.

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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.

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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.

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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.

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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.

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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/cpurrrin1/notebookadvice.htm>

A guide for students in keeping a lab notebook.

The University of Iowa, Sexual Harassment Can Happen Anywhere.

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

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

University of Michigan, Campus Mind Works.

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

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

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

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

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

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

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

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

Washington Space Grant Consortium, The Basics of Poster Design.

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

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

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

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

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

Web GURU, The Laboratory Notebook.

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

A guide for students in keeping a lab notebook.

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

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

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

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

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

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

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

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

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

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

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