Physics Research

Mentor Training Seminar

UW-Madison Institute for cross-college Biology Education

APS physics

Wisconsin Program for Scientific Teaching
University of Wisconsin - Madison

NSF

The University of Wisconsin Madison

DELTA
Integrating Research, Teaching, and Learning

CIRTL Network
Center for the Integration of Research, Teaching, and Learning

HHMI

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Forward

The *Physics Research Mentor Training Seminar* is a facilitation guide to a training seminar for physics faculty, postdocs, and graduate students who are in mentorship roles. The guide is intended to help physics researchers improve their mentoring skills, and to improve the research experiences of the next generation of physicists. It is part of a series of guides developed at the University of Wisconsin-Madison's Center for Education Research (WCER) with support from the National Science Foundation. The guides were adapted from the published curriculum, *Entering Mentoring*, developed at Wisconsin by Dr. Jo Handelsman, Dr. Christine Pfund and colleagues with support from the Howard Hughes Medical Institute and the National Science Foundation.

This guide provides an outline for a ten-week seminar that includes themes such as establishing expectations, maintaining effective communication, addressing diversity, and dealing with ethical issues. Within each topic, the guide provides learning objectives, suggested activities and assignments, and case studies for discussion, along with discussion guides. The guide also includes a broader set of mentoring-related resources for facilitators.

Even though all research faculty and many postdocs and graduate students are placed in mentorship roles, they rarely receive formal training in how to be an effective mentor. Pfund and her colleagues reported in a 2006 *Science* article that research mentors who have undergone mentor training communicate more effectively with their mentees and are more likely to engage mentees in discussions on topics such as diversity and student expectations. In addition, undergraduates reported having better experiences with trained mentors than with mentors who had not received training. Good mentorship is also broadly recognized as being important to increasing the diversity of the science community.

This physics guide was prepared by a team consisting of two faculty members, a postdoc, and a graduate student from the physics community, as well as two staff members from the University of Wisconsin who have previously adapted several mentor training curricula. The work was jointly supported by the APS and the NSF-funded Center for the Integration of Research, Teaching and Learning Network. The team drew heavily from previous mentor training manuals, and developed new materials when needed. The most significant addition to the manual is an appendix that provides a record of the insights of expert facilitators on typical participant responses, to help new facilitators know what to expect the first time they facilitate a workshop.

Development Team Members

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Pfund and Hooper were involved in the development of previous research mentor training materials which can be found at www.researchmentortraining.org.

Table of Contents

Introduction for Facilitators
Physics Research Mentor Training Seminar Overview

Course Objective: Seminar participants will work with a community of peers to develop and improve their mentoring skills. By the end of the seminar, participants should be able to clearly articulate a personal mentoring philosophy to anyone inside or outside their discipline, and have multiple strategies for dealing with mentoring challenges.

Content

The content of each session in this curriculum is designed to address the key concerns and challenges identified by research mentors. The topics include:

- Establishing Expectations
- Maintaining Effective Communication
- Assessing Understanding
- Fostering Independence
- Addressing Diversity
- Dealing with Ethics

Many people have a much easier time talking about topics such as expectations or communication style than they do talking about issues of diversity and power hierarchies. People who use this guide are encouraged to explore issues of diversity and power dynamics in *all* activities because these issues can often be a subtext for miscommunication, misunderstanding, and conflict in mentoring relationships.

The *Physics Research Mentor Training Seminar* is designed to address issues that are relevant to mentoring relationships in physics research. Much of the content of this seminar is adapted from *Entering Mentoring: A Seminar to Train a New Generation of Scientists*, created by Jo Handelsman, Christine Pfund, Sarah Miller Lauffer, and Christine Pribbenow, with support from Howard Hughes Medical Institute Professors Program (PI: Jo Handelsman). A PDF version of the book is available at: www.hhmi.org/grants/pdf/labmanagement/entering_mentoring.pdf. The original, biology-focused *Entering Mentoring Seminar* materials were adapted for use across science, technology, engineering and math through the Delta Program in Research, Teaching, and Learning with funding from the National Science Foundation (Grant # 0717731; PI: Christine Pfund). This adaptation process involved a full collaborative effort between faculty and staff from Astronomy, Biology, Chemistry, Engineering, Math, Physics, and Psychology. The process was supported by existing NSF-funded projects at the University of Wisconsin-Madison including the Midwest Alliance, Wisconsin Alliance for Minority Participation (WiscAMP), Interdisciplinary Graduate Education in Research Training (IGERT), Center for the Integration of Research Teaching and Learning (CIRTL), Nanoscale Science and Engineering Center (NSEC) and Undergraduate Research and Mentoring (URM). The Physics adaptation was supported by the American Physical Society (APS) and the CIRTL Network.

Format

Experiential learning and facilitated discussion form the structural foundation of this research mentor training seminar. The content and process are based on the experiences of faculty and staff who have implemented the mentor training seminar at the University of Wisconsin-

Madison. These seminar facilitators have learned that the best results come from keeping an open discussion format to allow participants to integrate their diverse experiences into the course materials and activities. In order to accommodate the unique idiosyncrasies of each mentor-mentee relationship, this seminar focuses on core principles that apply broadly across disciplines. Simply asking the mentors a few guiding questions typically leads to vigorous discussion. The case studies and reading materials can provide a tangible starting point, and the mentors will often move quickly from the hypothetical examples to their own experiences with undergraduate researchers. The seminar is most effective with mentors who are working with undergraduate research mentees full-time, for example, in an undergraduate summer research program. The short duration of such a program intensifies the urgency of dealing successfully with challenges that arise. Likewise, the frequent contact with the undergraduate researchers provides mentors with the opportunity to implement immediately the ideas generated by the discussions.

Implementation: Facilitating the Seminar

Facilitating the Research Mentor Training Seminar is not the same as teaching it. Your role as facilitator is to enable the seminar participants to take ownership of their own learning by helping them to engage in self-reflection and shared discovery and learning. Your role in the group is to get others to work through their thoughts and ideas---it is not your role to be the expert on mentoring. As a facilitator, you may also walk a fine line between facilitator and participant, but remember that the group members will look to you for guidance and structure. Your own experiences and ideas should enhance the discussion but should not dominate and become the focus of the discussion.

Being an effective facilitator is the key to helping the research mentors in the seminar meet the learning objectives and become more successful mentors. To assist you in your own facilitation abilities, we have included a brief facilitator guide in the next section which contains additional information, tips, and tools for facilitation.

Implementation: Using this Guidebook to Facilitate Weekly Sessions

Ideally, it is best to hold the first seminar session with research mentors BEFORE they begin working with their research mentees. You should prepare for each session by copying the readings, descriptions of session themes and learning objectives, case studies, and any worksheets for each mentor in the group. Alternatively, all of the materials can be copied at the start of the seminar and distributed at the first meeting or posted on a course website. The specific themes and objectives for each session are included at the beginning of the seminar materials. You might consider asking participants to review the themes and learning objectives at the beginning of each session. As an alternative, you can review the objectives and themes after a few weeks to check in on their progress.

Detailed notes for group facilitators are also included in each session plan. Time estimates for activities and facilitated discussions for each of the sessions are indicated in parentheses and can be adjusted at your discretion. The facilitator notes provide directive signposts (e.g., ACTIVITY, TELL, ASK, NOTE, DISCUSS) to support the facilitation process. “ACTIVITY” indicates that participants are to engage in some process on their own, in small groups or as a large group. “TELL” means that the information that follows needs to be shared with the whole group. “ASK” means a specific question or questions needs to be put to the group. “NOTE” means that

some particular issue or content needs to be emphasized. "DISCUSS" means that a broader discussion, usually supported by guiding questions, needs to occur. The appendix includes "typical responses" to guiding questions recorded by seminar facilitators who have used the materials. Sometimes more discussion questions are provided than can reasonably be addressed in the time allotted for the activity or group discussion. The questions suggested for the case studies in this seminar are based on experiences of those who have facilitated the seminar in the past. A "Reflection and Notes" space is provided for you to make your own notes about how each session went and things you want to remember, change, or do differently the next time you facilitate the session. You can find additional questions for the case studies, as well as additional case studies, at the "Build Your Own Curriculum and Workshops" section of the "Curriculum Options" tab at www.researchmentortraining.org.

Grading

The seminar emphasizes experiential learning and the integration of knowledge—drawn from reflection, discussion, readings and seminar activities—with practice. The seminar is often graded using a contract "A," which means that attending the seminar, doing the assignments, and participating in the activities will result in an "A" for the class. This approach allows each participant to invest personally in the learning experience and develop a unique and authentic identity as a mentor. In some cases, the seminar has been offered as a practicum in which credit is given for participating in the research mentor training seminar and engaging in the practice of mentoring an undergraduate student.

Physics Research Mentor Training Seminar Facilitation Guide

Role of Facilitators

- **Make it safe:** Take time to tell the group members that the seminar is a safe place to be honest about their ideas and feelings. Everyone's ideas are worth hearing.

- **Keep it constructive and positive:** Remind members of your group to keep things positive and constructive. Ask the group how they want to deal with negativity and pointless venting. Remind them that the seminar is about working together to learn, not complaining about their current situation or discounting the ideas of others in the interest of a personal agenda.

- **Make the discussion functional:** At the start of each session, explain the goals of the session to the group. Try to keep the group on task without rushing them. If the conversation begins to move beyond the main topic, bring the discussion back to the main theme of the session.

- **Give members of the group functional roles and responsibilities:** Assign or ask for volunteers to take notes, keep track of time, and report out in the larger group at the end of the session. Functional roles help keep participants engaged.

- **Give all participants a voice:** In a group, there are likely to be issues of intimidation and power dynamics that can play out in ways that allow certain members of the group to dominate and others to remain silent. At the start of the conversation, mention that the group is mixed by design, and point out that a diversity of perspectives is an essential part of the process. Remind group members to respect all levels of experience. It's important that everyone's voice is heard!

Facilitating a Group

General Notes*

Each group will take on its own feel and personality based on the people in the group, the facilitator's approach, and a whole host of external factors beyond your control. It helps if you adopt a "no fault" clause that states that if a group is not working well, it is through no fault of a single individual, but rather a set of circumstances. It's hard to not take it personally if someone drops out or if a group doesn't function well, but remember, you are just one part of the whole dynamic. Remember, you are a facilitator, not a teacher; and the people enrolled in the seminar are participants, not students.

It also helps if you are able to release your expectations for how a meeting or group "should" go, and instead focus on the core aspects of the process. Your role as facilitator is to be intentional and explicit while remaining flexible and not overly prescriptive. You can only do so much as a facilitator – to a large extent it is up to the participants to take ownership of their own learning, especially since this seminar is designed for adults. Individual ownership, self-reflection, and shared discovery and learning are where the deepest learning will occur for this particular type of program.

As challenges and normal group dynamics surface, the group will look to you to "fix" the problem. But part of your role is to help others see that they are responsible for the "fixing" also. You can help them realize this by holding on tightly to the following core ideas of group dynamics (and periodically reminding the team of them):

- Respectful interactions are essential (listening, non-judging, non-dominating, genuine questioning, etc.) are a must.

- Relevant tangents that tie back to central topic/issue/question are fine, but don't let them derail the central purpose of the discussion.

- You need to keep moving ahead, but there is no need to push the schedule if it seems the group needs time to reflect or slow down. (If you slow down or skip something, you can anticipate that participants will feel as if they are "behind" or missing out, so reassure them this is normal and the initial schedule is only a guide and there will be time to revisit topics if needed.)

- If you try something and it doesn't go well, don't abandon it right away. Step back and think about what went wrong, talk to the group, learn from it and try it again. You may need to try something a couple times to get the group warmed up to something new.

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* Adapted from the Creating a Collaborative Learning Environment Guidebook, Center for the Integration of Research, Teaching, and Learning
http://www.cirtl.net/files/Guidebook_CreatingACollaborativeLearningEnvironment.pdf

- Discomfort and silence are ok, but with a clearly stated context and purpose. Silence may seem like a waste of time in meetings, but it gives people a chance to think, digest, and reflect. Allow for a few silent breaks before, during, and at the end of a meeting.

- Make it easy, rewarding, and fun for people to participate, and encourage others to do the same for each other. Simple things like friendly reminders of meetings, coffee, and follow-up calls to check in with someone if they miss a meeting, can send the message that you care, and make it easier to participate.

Group Dynamics
Suggestions for How to Handle Challenges

What do I do when no one talks?

- Have everyone write an idea, thought, or answer to a question on a piece of paper and toss it in the middle of the table. Each participant then draws a piece of paper from the center of the table (excluding their own) and reads it out loud. All ideas are read out loud before any open discussion begins.

- Have participants discuss a topic in pairs for 3-5 minutes before opening the discussion to the larger group.

What do I do when one person is dominating the conversation?

- Use a "talking stone" to guide the discussion. Participants may only talk when holding the stone. Each person in the group is given a chance to speak before anyone else can have a second turn with the stone. Participants may pass if they choose not to talk. Importantly, each person holding the stone should share his or her *own* ideas and resist responding to another person's ideas. Generally once everyone has a chance to speak, the group can move into open discussion without the stone.

- Use the "Constructive/ Destructive Group Behaviors Exercise". Each participant chooses their most constructive and destructive group behavior from a list (see following page). Each person writes the two behaviors on the back of their table tent (a card with their name on it folded in a wedge). Participants then share their choices with the larger group and explain why they chose those behaviors.

What do I do when the group members direct all their questions and comments to me, instead of their fellow group members?

- Each time a group member talks to you, move your eye contact to someone else in the group to help the speaker direct his or her attention elsewhere.

- Ask the participants for help in resolving one of *your* mentoring challenges. For example, ask them for advice on how to deal with an apathetic undergraduate researcher. This helps the group members stop looking to you for the *right* answers and redirects the problem-solving and discussion to the entire group.

What do I do when a certain person never talks?

- Have a different participant initiate each week's discussion so that different people have the chance to speak first.

- Assign participants in the group different roles in a scenario or case study and ask them to consider the case from a certain perspective. Ask the participants to discuss the case in the larger group from the various perspectives. For example, some participants could consider the perspective of the mentee while others consider the perspective of the mentor.

- Try some smaller group discussions (2-3 participants per group) as the person may feel more comfortable talking in the smaller group.

What do I do when the group gets off topic?

- Have everyone write for 3 minutes about the ideas they want to share on a given topic. This short writing time will help participants collect their ideas and decide what thoughts they would most like to share with the group so they can focus on that point.

- Ask someone to take notes and recap the discussion at the half-way and end-point of the session to keep the conversation focused.

Constructive and Destructive Group Behaviors*

Constructive Group Behaviors

Cooperating: Is interested in the views and perspectives of the other group members and is willing to adapt for the good of the group.

Clarifying: Makes issues clear for the group by listening, summarizing and focusing discussions.

Inspiring: Enlivens the group, encourages participation and progress.

Harmonizing: Encourages group cohesion and collaboration. For example, uses humor as a relief after a particularly difficult discussion.

Risk Taking: Is willing to risk possible personal loss or embarrassment for the group or project success.

Process Checking: Questions the group on process issues such as agenda, time frames, discussion topics, decision methods, use of information, etc.

Destructive Group Behaviors

Dominating: Takes much of meeting time expressing his or her own views and opinions. Tries to take control by use of power, time, etc.

Rushing: Encourages the group to move on before task is complete. Gets "tired" of listening to others and working as a group.

Withdrawing: Removes self from discussions or decision making. Refuses to participate.

Discounting: Disregards or minimizes group or individual ideas or suggestions. Severe discounting behavior includes insults, which are often in the form of jokes.

Digressing: Rambles, tells stories, and takes group away from primary purpose.

Blocking: Impedes group progress by obstructing all ideas and suggestions. "That will never work because…"

* Adapted from Brunt, J. (1993). Facilitation Skills for Quality Improvement. *Quality Enhancement Strategies.* 1008 Fish Hatchery Road. Madison WI 53715

Physics Research Mentor Training Seminar Syllabus

Sessions	Topics	Assignments Due	Readings
Week 1	**Getting Started and Project Design**		
Week 2	**Establishing Expectations**	1. Description of mentee's research project 2. Draft mentoring strategy or philosophy or a draft mentoring contract	National Academy of Sciences, (1997). "What is a Mentor?"
Week 3	**Maintaining Effective Communication**	Summary of the discussion about expectations	
Week 4	**Assessing Understanding**	A short biography of mentee	
Week 5	**Fostering Independence**	Thoughts on what to do if you don't get along with your mentee	
Week 6	**Mentoring Challenges and Solutions**	Bring in copies of your own case study to share with the class (or be prepared to present one verbally)	Handelsman, Pfund, Miller Lauffer, & Pribbenow, (2005). "Mentoring Learned, Not Taught."
Week 7	**Addressing Diversity**	1. Solution to a Mentoring Challenge 2. Reflection on differences and how they affect the research experience	Fine & Handelsman, (2005). "Benefits and Challenges of Diversity." Crutcher, B.N., (2007). "Mentoring across cultures."
Week 8	**Dealing with Ethics**	Look over the general ethics guidelines for your discipline. Be prepared to talk about how they apply to you and your work. Bring a copy of them to class.	Lee, Dennis, & Campbell, (2007). "*Nature's* Guide for Mentors."
Week 9	**The Elements of Effective Mentoring**	Summary of a mentor's response to a mentoring challenge	
Week 10	**Developing a Mentoring Philosophy**	Revised mentoring philosophy	

Resources for Physics Research Mentors

- Resources on Mentoring
  - Research Mentor Training: http://researchmentortraining.org/
  - MentorNet: http://www.mentornet.net/
  - Handelsman, J., Pfund, C., Miller Lauffer, S., and Pribbenow, C. M. (2005). *Entering Mentoring: A Seminar to Train a New Generation of Scientists.* Madison, WI: University of Wisconsin Press.
  - National Academy of Sciences, (1997). *Adviser, Teacher, Role Model, Friend: On Being a Mentor to students in Science and Engineering*, Washington, DC: National Academies Press.
  - Lee, A., Dennis, C., & Campbell, P. (2007). Nature's Guide for Mentors. *Nature, 447,* 792-797.
  - Crutcher, B. N. (2007). Mentoring across cultures. *Academe, 93,* 44-48.

- Resources on Bias
  - Women in Science and Engineering Leadership Institute (WISELI) at the University of Wisconsin, Madison: http://wiseli.engr.wisc.edu
  - Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69,* 797-811.
  - National Academies Summer Institute on Undergraduate Education in Biology: http://www.academiessummerinstitute.org
  - Biernat, M., & Manis, M. (1994). Shifting Standards and Stereotype-Based Judgments. *Journal of Personality and Social Psychology, 66,* 5-20.
  - Dovidio, J. F., & Gaertner, S. L. (2000). Aversive racism and selection decisions: 1989 and 1999. *Psychological Science, 11,* 319–323.
  - Martell, R. F. (1991). Sex bias at work: The affects of attentional and memory demands on performance ratings for men and women. *Journal of Applied Social Psychology, 21,* 1936-1960.
  - Steinpreis, R. E., Anders, K. A., & Ritzke, D. (1999). The impact of gender on the review of the curricula vitae of job applicants and tenure candidates: A national empirical study. *Sex Roles, 41,* 509-527.
  - Yee, D. K., & Eccles, J. S. (1988). Parent perceptions and attributions for children's math achievement *Sex Roles, 19,* 371-333.
  - Trix, F., & Psendka, C. (2003). Exploring the color of glass: Letters of recommendation for female and male medical faculty. *Discourse & Society, 14*(2), 191–220.

- Professional Society Ethics Statements and Resources
  - **American Physical Society:** Professional Conduct and Ethics resources (http://www.aps.org/policy/statements/02_2.cfm)
  - **Society of Physics Students:** Professionalism & Ethics Resources for SPS Chapters (http://www.spsnational.org/governance/ethics/)
  - **Materials Research Society:** Publication Ethics and Responsibilities resources (http://www.mrs.org/publication-ethics/)

- Resources on Professional Development of Researchers
  - The Web Guide to Research for Undergraduates (WebGURU) http://www.webguru.neu.edu/
  - Council on Undergraduate Research (CUR) http://cur.org/

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Nakamura, J., & Shernoff, D. J. (2009). *Good Mentoring: Fostering Excellent Practice in Higher Education.* San Francisco, CA: John Wiley & Sons, Inc.

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Physics Research Mentor Training Seminar
Session 1
Getting Started and Project Design

Objectives

Learning Objectives for Mentoring Seminar

Mentors will:

- Explore their perceptions of research mentoring relationships in their field or sub-discipline
- Become oriented to the process and expectations for the seminar sessions
- Identify qualities of good research projects for their mentees
- Prepare to establish effective research mentoring relationships with their mentees

SESSION OUTLINE

Core Activities

Visual Explorer
Seminar Process and Logistics
Developing Research Projects
Getting to Know Your Mentee

Participant Materials

Table tents and markers
Copies of syllabus
Roster
Chalkboard, whiteboard, or flip chart
Visual Explorer pictures (bring in pictures from websites, magazines, or ordered from http://www.ccl.org/leadership/index.aspx)

Assignments for Next Session

Write a paragraph that describes a research project for your mentee
Write a first draft of your mentoring philosophy/strategy
Read "What is a Mentor?" (National Academy of Sciences, 1997)

FACILITATOR NOTES

Core Activities

- Visual Explorer Activity (15 minutes)
  - ACTIVITY: Have participants choose a picture from ~30 pictures spread across the room. See Appendix: Session 1 for alternative introductory activities.
  - TELL: Tell participants to "choose a picture that represents the typical mentoring experience for undergraduates in physics."
  - ACTIVITY: Have participants introduce themselves around the room and explain their picture choice. Participants should also state if they are mentoring an undergraduate mentee and what they hope to get out of the seminar. (This activity is adapted from Paulus, C.J., Horth, D.M., and Drath, W.H. (1999). *Visual Explorer: A tool for making shared sense of complexity.* Center for Creative Leadership Press).

- Introduction of Seminar and Logistics (15 minutes)
  - TELL: Provide participants with details about the seminar process and logistics.
    - The important roles research mentors play and the need for research mentor training
    - Expectations for attendance and participation in weekly meetings
    - How readings and assignments will be distributed and collected for the course
      - If there is a course website, provide information about how to access and use the website.
      - You may ask participants to submit assignments ahead of time and compile them for everyone to read or simply bring copies of their assignments to class to share.
    - Confidentiality is important to the seminar, and everything discussed in seminar or on the course website will remain confidential. Participants will also need to vote on whether they want their names removed from compiled assignments when all participants' work is shared with the entire class.
    - How to enroll in the seminar if participants are taking the seminar for credit. Typically, work in the seminar is graded as a contract "A," which means if you show up, do the assignments and participate, you will get an "A."
    - The seminar is designed for mentors actively working with a mentee. Research mentors who are taking the seminar but are not mentoring someone concurrently can use their past experience in the discussions and adapt the assignments to plan for future mentoring relationships.
  - DISCUSS: Have participants reach consensus about how to deal with missed classes.
    - How does the group want to handle participants missing class:
      - Do we want participants to email the whole group or just the facilitator if they are going to miss class?
      - Do we want participants who miss class to send their thoughts on the discussion topic so we can still have their input in the seminar?

- Large Group Discussion about how to design research projects for mentees (15 minutes)
  - ASK: What are the elements of a good research project in physics for an undergraduate?

- WRITE: Make sure to write the ideas generated on the board or a flip chart. Transfer the summary of ideas to a blog/wiki or some other discussion forum so that participants can come back and refine the list.
  - [NOTE: Make a point of noting the differences that come up from different sub-fields of physics.]
- See Appendix: Session 1 for typical responses from participants.

❖ Establishing a good relationship with your mentee (10 minutes)
- ACTIVITY (5 minutes): Have participants pair up to discuss with each other what they may want to do in their first 30 minutes with their mentees.
- DISCUSS (5 minutes): Each pair shares ideas with the large group.

❖ Assignments for next session (5 minutes)
- Write a paragraph describing your mentee's research project (or one you would have mentee do). Think about the image of science this research project may convey to your mentee.
- Begin to develop a mentoring philosophy/strategy
  - A mentoring philosophy is a work in progress and mentors should think about revising it both throughout the seminar as well as after the seminar is over. You may wish to revisit the philosophies at the end of the seminar. See the "Writing a Mentoring Philosophy" handout on following page.
  - The mentoring philosophy can be included as part of a teaching philosophy; many scientists include a paragraph on mentoring as part of their two-page teaching philosophy. This philosophy can be used on the job market or in a tenure application packet.
  - Mentors may want to consider including a mentoring philosophy and specific examples of mentoring approaches in a teaching portfolio.
  - Mentors might consider using the philosophy as a basis for a statement to hand out to mentees to help establish and communicate expectations.

[Details on how to structure this assignment vary. Some facilitators have participants draft the document and turn it in for feedback at the following seminar. Since discussion of the philosophies does not occur until the third session, this allows you one week to read the assignments and provide feedback. Other facilitators have participants draft the philosophy in an online forum (blog or wiki) and revise regularly during the course of the seminar series. Thus the structure for this assignment is very facilitator-dependent, but should be made quite clear for the participants.]

- Reading: "What Is a Mentor?"

Space for Reflection and Notes

Writing a Mentoring Philosophy

- Why write one?
  - Help provide a "punch line" for the entire seminar.
  - Capture major lessons from a summer mentoring experience/seminar while they're fresh.
  - Have a personal mentoring handbook ready for the next time you begin to mentor a new student. (If fully realized, this would be more than a philosophy statement.)
  - Be ready to write a mentoring section in a teaching philosophy.
  - Help with NSF proposal broader impact statements.
  - Be ready to develop mentoring plans as specifically called for in many funding proposals.
- What is your intended audience and scope?
  - A large, comprehensive, and not especially polished statement to capture as much as possible. This would be for personal use only, from which mentoring philosophies and working plans would be derived later.
  - A one or two paragraph contribution to a teaching philosophy or broader impacts discussion in a proposal. This should be compact, tight, and well-polished.
  - Something intermediate between the first two, a prototype for the mentoring philosophy/strategy of a big research/education proposal.
- If you were on a review committee, what would you want to read about?
- How to review or evaluate your own or someone else's mentoring philosophy?
  - Who is the intended audience? How successful is the statement at addressing this audience? Is the length and scope appropriate for the audience?
  - What image do I have of you as a mentor? What is it like to be your mentee based on your written statement?
  - Do you draw on your own experience as a mentor and/or mentee?
- If I were on a review/hiring committee, how would I respond to this statement? Would it stand out (positively or negatively) among the 20, or 200, I've already read?
- Follow the teaching philosophy practice: articulate core beliefs and then support them with evidence from personal experience and/or research. Follow a rubric similar to that for a teaching philosophy[*]:
  - Definitions of mentor and learning.
  - View of the mentee.
  - View of the mentor.
  - Goals and expectations of the mentor/mentee relationship.
    What are the goals you have for your student this summer? These may include project specific milestones and/or goals derived from the elements of a good research experience and project which you wrote down for week 1.
  - Mentoring methods and evaluation.
    What is your strategy for achieving these goals? Consider whether you want a general strategy or would like something as specific as a week-by-week plan. Or, based on your own experiences as a mentee, what do you plan to discuss explicitly with your mentee, what will you make implicit, and what will you address only if it comes up?
  - Professional development as a mentor.
  - Personal context of mentoring.

[*] The list was adapted from Christine Pribbenow's teaching philosophy rubric published in Sarah Miller, Christine Pfund, Christine Maidl Pribbenow, Jo Handelsman. *Science, 322,* 1329-1330.

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 2
Establishing Expectations

Core themes and Objectives

Expectations

One critical element of an effective mentor-mentee relationship is a shared understanding of what each person expects from the relationship. Problems between mentors and mentees often arise from misunderstandings about expectations. Importantly, expectations change over time, so frequent reflection and clear communication about expectations are needed on a regular basis.

Learning Objectives for Expectations

Mentors will have the knowledge and skill to:

- Establish expectations and clearly communicate them to the mentee
- Design and communicate clear goals for the mentoring relationship
- Listen to and consider the expectations of their mentee in the mentoring relationship
- Assess the mentee's knowledge and skill level and adjust the project design accordingly
- Consider how differences may affect the relationship

SESSION OUTLINE

Activities

Introductions
Review seminar logistics
Share research project descriptions
Case Studies: Expectations

Participant Materials

Table tents and markers (or table tents from previous week)
Copies of description and learning objectives for Expectations
Copies of *Expectations* case studies

Assignments for Next Session

Discuss expectations with your mentee (or another young researcher in your group or department) and write a paragraph about the discussion. Alternatively, draft a contract to use with your mentee. For an example, see https://www.aamc.org/download/49868/data/gradcompact.pdf.pdf.

FACILITATOR NOTES

- Introductions (10 minutes)
  - ASK: Please remind everyone who you are and share one thing you learned from the reading "What is a Mentor?".
  - See Appendix: Session 2 for typical responses from participants about the reading.

- Review of the Seminar and Logistics (5 minutes)
  - TELL: Briefly review the basic logistics and process for the seminar.
    - Expectations for attendance and participation in weekly meetings
    - How readings and assignments will be distributed and collected for the course
    - Confidentiality is important to the seminar and everything discussed in seminar or on the course website will remain confidential.
    - How to enroll in seminar if participants are taking the seminar for credit
    - The seminar is designed for mentors actively working with a mentee. If that is not the case, participants can use their past experience in the discussions and adapt the assignments to plan for future mentoring relationships.

- Sharing research project descriptions in pairs and with the whole group (10 minutes)
  - ACTIVITY (5 minutes): Have participants pair up and read one another's project descriptions (or verbally share the projects if they did not do the assignment).
    - TELL: Direct the pairs to discuss what the descriptions tell the reader about what physics research is like. Ask them to consider what an undergraduate researcher's perception of physics research might be if they heard this description. Ask mentors to consider what their mentee's paragraph would say if he/she wrote a description of the research project? Would it align?
  - DISCUSS (5 minutes): Have each pair share what they learned in their conversation with the whole group.

- Case Study: *Expectations*: *In over his head* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute the case study. Let participants read the case individually.
  - DISCUSS (12-13 minutes): Have the participants discuss their reactions to the case study. Some possible guiding questions:
    - How do you design goals and projects for a mentee?
    - When choosing a project for your mentee, how do you weigh the mentee's interest with the immediate needs of the research PI or group?
    - As an advisor or mentor, what should you do if a mentee does not like the project?
    - How do you assess your mentee's skills so you can choose an appropriate project?
    - How can you make sure your expectations take into account a mentee's individual work style and learning style (e.g., lots of interaction vs. very little interaction, lots of independent reading/research vs. lots of one-on-one learning)?
    - How can you make sure your expectations take into account a mentee's individual background and abilities (e.g., what basic lab skills, programming skills, mathematics skills, and fundamental physics knowledge do they have/need)?
  - See Appendix: Session 2 for typical responses from participants.

- Case Study: *Expectations*: *Mismatched Priorities* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute the case study. Let participants read the case individually.
  - DISCUSS (12-13 minutes): Have the participants pair up and discuss the case study for 7-8 minutes. Then ask the pairs to share one salient point from their pair-wise discussions. Some possible guiding questions:
    - What can you do as a mentor to avoid this kind of situation?
    - How do you establish and communicate your expectations to your mentee?
    - How do you find out what expectations your mentee has of you and of his or her research experience?
    - Do you think the mentor in this case has been clear about his/her expectations? How could the expectations have been more clearly articulated?
    - What is the responsibility of the mentee to find out what the expectations are in the relationship?
  - See Appendix: Session 2 for typical responses from participants.

- REVIEW: Assignment for next session (5 minutes)
  Discuss expectations with your mentee (or another young researcher in your group or department) and write a paragraph about the discussion. Alternatively, draft a contract to use with your mentee. For an example, see https://www.aamc.org/download/49868/data/gradcompact.pdf.pdf.
  - The Mentoring Philosophy/Strategy is an evolving document, so while participants are not formally given the assignment to revise their philosophy each week, they may find it beneficial to review and update as the seminar progresses. See Appendix: Session 2 for additional ideas and questions to share with the participants that will help them think about how to incorporate what they've discussed about expectations into their mentoring philosophy.

Space for Reflection and Notes

Case Study
Expectations: In Over His Head

Tom arrives as a Research Experience for Undergraduates (REU) student, excited by the new research opportunities in front of him. After talking with him, Tom's mentor, Alice, learns that he is a junior at a small college where there are only two physics professors, one of whom knows a bit of astronomy. He has not had any astronomy or astrophysics courses, although he helped set up a new undergraduate observatory on the campus. He has had no experience with scientific computing. As Tom seems like a sharp student, Alice decides to engage him in an astrophysics research project that includes some computing elements.

Tom is enthusiastic about the numerical simulation project that he has been given. He is attentive during the first weeks as he receives a lot of preparatory information covering a wide array of subjects. His first steps in actually doing the project are slow and a bit tentative, which Alice chalks up to a steep learning curve. He puts in full days and asks a lot of questions, albeit rather elementary ones.

But by the fifth week, Alice begins to wonder if Tom may be in over his head. He isn't progressing with either the computing or the astrophysics as fast as she had expected. He has become quiet at team meetings now that the conversations have shifted toward ongoing research, and when questions are directed to him about his research, Tom answers curtly and without much content. He doesn't talk with the other REU students about his work, especially an REU student in the same research team who is making great progress.

Alice is concerned that the summer may be turning into a negative experience for Tom. But when she asks Tom how things are going, Tom says everything “is fine.” He still puts in many hours each day, although Alice is not sure what he is doing.

Alice wonders what to do now, if anything.

Case Study
Expectations: Mismatched Priorities

Jo was helping me collect data for a paper we hoped to submit for publication at the end of the semester. One of the last, key experiments we needed to run was a study of the temperature dependence of the sample's conductivity that required continuous data acquisition over about six hours. In order to have a long block of time available to us, I scheduled the experiment for a Saturday. Jo helped me get everything ready on Friday: we prepared all of our thin-film samples, soldered probes to the substrates, made certain we had a full liquid helium tank, calibrated the instrument, and gathered all of the other equipment we would need to conduct the experiment.

On Saturday morning I waited for several hours for Jo to show up but she never did. Finally I started the experiment myself. It wasn't a huge problem to have to do the experiment myself, but I was disappointed that Jo didn't show up. The next Monday, I expressed my disappointment, and her reply was, "The Pitchfork Music Festival was starting in Chicago, and I really wanted to go see this band playing there." I didn't know what to say.

Physics Research Mentor Training Seminar
Session 3
Effective Communication

Core themes and Objectives

Communication

Good communication is a key element of any relationship and a mentoring relationship is no exception. As mentors, it is not enough to say that we know good communication when we see it. Rather, it is critical that mentors reflect upon and identify the specific characteristics of effective communication and take time to practice communication skills.

Learning Objectives for Communication

Mentors will have the knowledge and skill to:

- Foster open communication with the mentee
- Address how differences in communication styles, background, position of power, etc. can alter the intent and the perception of what is said and heard
- Use multiple strategies for improving communication
- Provide and get feedback on progress and expectations regularly

SESSION OUTLINE

Activities

Discuss mentoring philosophies
Case Studies: Communication
Communication Worksheet (Optional)

Participant Materials

Table tents and markers (or table tents from previous week)
Copies of description and learning objectives for Communication
Copies of *Communication* case studies
Communication Worksheet (Optional)

Assignments for Next Session

Interview your mentee and write a paragraph describing him or her.

FACILITATOR NOTES

- Establishing relationships with mentees (15 minutes)
  - DISCUSS: Explore participants' experiences doing the assignment for this week, which involved discussing expectations with their mentee. Some questions to guide your discussion:
    - How did you initiate the conversation with your mentee? Was it uncomfortable?
    - Did you use a mentoring compact?
    - Did any of your mentee's expectations surprise you?

- Discussion of Mentoring Philosophies (15 minutes)
  - ACTIVITY (3 minutes): Have participants exchange their written philosophy with someone else in the seminar. Have participants reflect and write for 3 minutes on what struck them about the mentoring philosophy they read.
  - DISCUSS (10-12 minutes): Participants discuss their reactions to the mentoring philosophies with the whole group. Some possible guiding questions:
    - What struck you about the mentoring philosophy you read?
    - Where (on the scale of visionary to detailed) should a philosophy be?
      - Where is yours?
    - How will you use your mentoring philosophy?
  - NOTE: As part of the discussion or to wrap it up, be sure to stress the following points:
    - A mentoring philosophy is a work in progress and mentors need to think about revising it as they go through the training and beyond.
    - The mentoring philosophy could be included as part of a teaching philosophy
    - Mentors might consider using the philosophy as a basis for a statement to hand out to mentees to help establish and communicate expectations
    - Alternatively, mentors might draft a contract to use with their mentee or use elements from a contract and embed them in their philosophy. For an example, see https://www.aamc.org/download/49868/data/gradcompact.pdf.pdf

- Case Study: *Communication: Putting in Enough Time* and *The Slob* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute the case studies. Have the participants review the cases and choose one to discuss.
  - DISCUSS (12-13 minutes): Have the group as a whole discuss reactions to the case study. Some possible guiding questions:
    - If you were the mentee, how would you feel?
    - If you were the mentor, how would you feel?
    - If you were the faculty advisor, how would you feel (in the case of "The Slob")?
    - How does a mentee learn the social dynamics/structure of a research group and the sense of hierarchy (if it exists) of personnel and projects?
      - How can a mentor communicate these concepts?
    - What can you do as a mentor to avoid this kind of situation?
    - How do you communicate your expectations to your mentee?
    - How can you create an opportunity for your mentee to communicate his or her expectations?
  - See Appendix: Session 3 for typical responses from participants.

- Awareness of communication (5 minutes)
  - DISCUSS: Explore mentors attention to and awareness of their communication with their mentees. Some possible questions to use:
    - How would you characterize the communication between you and your student? Does your communication differ when you talk about the research project versus other topics?
    - What would your mentee's paragraph say if he or she wrote a description of the research project? Would it align with yours?
    - Does your mentee have a similar style of communication to your own? If so, how are they similar? How are they different?
    - What is active listening? How can you be a better active listener in your mentoring relationship?

- Optional activity (10 minutes): If time allows, have workshop participants complete 2 rows of the "Communication Worksheet" (page 33) and then discuss it in pairs.
  - The major goal of this activity is to raise mentors' awareness about how statements are intended and how they are heard. Because participants will all have different backgrounds, it is likely that there will be different reactions (positive and negative) to some of these statements. By discussing these differences in the seminar, it will help to broaden everyone's awareness of the communication challenges that mentors and mentees can face.
  - Some points to make with the participants:
    - Mentors are in a position of power and their seemingly simple statements can be heard very differently than they are intended.
    - It is important to keep the mentor's powerful position in mind when phrasing feedback to a mentee.
    - It is also helpful for participants to realize that they should give their own mentors and peers the benefit of the doubt and not assume a statement is ill-intended.
    - Lastly, it is critical to empower mentees to ask for clarification when they hear something that they interpret to be critical or unfair.

- REVIEW: Assignment for next session (5 minutes)
  - Interview your mentee (or another young researcher in your research group or department) and write a paragraph that describes your mentee.

Space for Reflection and Notes

Case Study
Communication: Putting in Enough Time

Joan, an undergraduate, was working hard at her first semester of research, but nobody seemed to notice. Her mentor, Dr. Simms, said Joan could come in whenever she had time available. Joan mentioned to Dr. Simms that she might come in at unusual hours as she tried to fit her part-time job and the research activities around her class and homework schedule. Joan discovered that most of the other undergraduates in the lab did not have part-time jobs to juggle.

At the start of the semester Joan was spending about ten hours per week in the lab, but after a few weeks of solo work with little feedback, her motivation declined and she started to cut her weekly hours progressively shorter. Nobody commented to her about the change, so she assumed that everything was going okay.

One day toward the end of the semester, another undergraduate approached Joan to tell her about a conversation she'd overheard at lunch between Dr. Simms and another professor in the group. According to the student, Dr. Simms was complaining that nothing seemed to have gotten done in the lab this semester. “Dr. Simms made a really snide comment about part-time jobs getting in the way of research,” the other mentee said. “I think you'd better start trying to look busy.”

Case Study
Communication: The Slob

Nervis, a graduate student mentor, was frustrated because her undergraduate student, Sam, was not running successful experiments. While Sam had great enthusiasm for the project, each experiment failed because of some sloppy error—forgetting to rinse the sample with ethanol, forgetting to close a valve, or forgetting to turn down the voltage on a power supply.

After a month of discussions, and careful attempts to teach Sam habits that would compensate for his forgetfulness, Nervis was ready to give up. Nervis spoke with her adviser, Dr. Dortmund, and asked for advice, hoping that she could fix the problem and start getting useful data from Sam. Dr. Dortmund offered to work with Sam. When Sam walked into his office, Dr. Dortmund said, "I hear you're a slob in the lab. You gotta clean up your act if we're going to get any data out of you." Seeing the crushed and humiliated look on Sam's face, he quickly added, "I'm a slob too—that's why I'm in here pushing papers around and not in the lab doing the hard stuff like you guys!"

Communication Worksheet*

In pairs, discuss the following questions as they relate to two of the statements below:

a. What was the likely intent of this statement or question?
b. How might the statement or question be heard?
c. How else could you say these questions or statements?

Statement or Questions	What was the intent?	How might it be heard?	How else could you say it?
"Be on time to our group meetings from now on"			
"How much longer do you think it will take you to finish that project?			
"You will never get anywhere in this field if you don't dig in and stick with problems until you solve them."			
"I am not sure the work you are doing in that area is really valuable."			
"Clean up your work area"			
"I haven't seen you around the building much. Are you taking time off?"			
"I am not sure you have your priorities in order."			
"What's it like to be a minority student in this program, anyway?"			
"It seems you might be better suited for an 'alternative' career"			

* Fine, E., & Handelsman, J. (2005). Benefits and Challenges of Diversity in Entering Mentoring: A Seminar to Train a New Generation of Scientists, (pp. 71-81). Madison, WI: University of Wisconsin Press.

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 4
Assessing Understanding

Core Themes and Objectives

Understanding
Determining if someone understands you is not easy, yet knowing if your mentee understands you is critical to a productive mentor-mentee relationship. Developing strategies to assess understanding is an important part of becoming an effective mentor.

Learning Objectives for Understanding
Mentors will have the knowledge and skill to:

- Assess their mentees' prior knowledge of the research field
- Assess/determine their mentees' understanding of core concepts and procedures in the research field
- Consider diverse strategies for enhancing mentee understanding
- Explain and/or model the practice of science and research in their discipline
- Assess their mentees' ability to develop and conduct a research project, analyze data and present results

SESSION OUTLINE

Activities

Debrief mentee interview assigned last week
Case Studies: Understanding

Student Materials

Table tents and markers (or table tents from previous week)
Copies of *Understanding* case studies

Assignments for Next Session

Thoughts on what to do if you don't get along with your mentee.

FACILITATOR NOTES

- Establishing relationships with mentees (15 minutes)
  - DISCUSS: Explore participants' experiences doing the assignment for this week, which involved interviewing their mentees. Some questions to guide your discussion:
    - How did you initiate the conversation with your mentee? Was it uncomfortable?
    - Did you learn anything you did not know?
    - Did you share anything about yourself that you would not have thought to share before the assignment?

- *Understanding* Case Study: *It Seemed So Clear When You Explained It* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute copies of the case study and let participants read it individually.
  - DISCUSS (12-13 minutes for each case): Review reactions to the case study as a whole group. Some possible guiding questions:
    - Has this ever happened to you as a mentor? As a mentee?
    - How can you know if your mentee understands something?
    - What can you do in the future to make sure your mentee understands what you are saying? Generate a list of ideas from the discussion.
    - How can you get mentees to assess their own understanding?
    - How can you identify the difference between an undergraduate researcher who is "not getting" something vs. an undergraduate researcher who is not trying?
  - NOTE: The following points can help mentors be more mindful about their communication with their mentees.
    - Remind mentors that everyone unconsciously makes assumptions on ability based on other cues/factors such as race, ethnicity, gender, ability to speak English, prior experience and background, kinds of questions someone asks, etc. How can mentors address those assumptions?
    - Ask mentors to consider the difference between an expert perspective and novice perspective. As an expert, there are many steps in an explanation you may leave out as they are second nature or it is hard to remember what it was like to be a novice. For example, when you see a master chef cooking, it looks easy; but when you try it on your own you realize it is not as clear as you thought and that many steps have been left out of the explanation.
  - See Appendix: Session 4 for typical responses from participants.

- *Understanding* Case Studies: *Resourceful Mentee* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute copies of the case study and let participants read it individually.
  - DISCUSS (12-13 minutes for each case): Review reactions to the case study as a whole group. Some possible guiding questions:
    - What responsibility does the mentee have to communicate his/her lack of understanding? What if they do not realize that they do not understand?
    - How can you effectively explain protocols to mentees without sounding condescending toward them?
    - How do you balance independence with understanding?

- What role do you think might have been played by a language barrier? What about a cultural barrier?
- What strategies could you use in the future to make sure your mentee understands the substance of your research, and not just the mechanics?

➢ See Appendix: Session 4 for typical responses from participants.

❖ REVIEW: Assignment for next session (5 minutes)

➢ Reading: "Mentoring Learned, Not Taught"

➢ What if you don't get along? The next session will begin with a discussion of the following two questions. Think about how you would respond if you were in this situation.

- What if you don't resonate with your REU (Research Experience for Undergraduates) student or another mentee? What if you find that the two of you don't like each other?

NOTE: When teaching a class, the answer is clear -- you have a responsibility to teach every student who is in your class. When taking on a graduate student for many years, possibly the answer is still clear -- it is not wise to go down that path with such a relationship.

However, what about an REU student whom you have selected, or who has been assigned to you? At what point do you suggest that the mentee seeks to work with another person for the benefit of both of you? Do you have an ethical responsibility as mentor to ensure that the student achieves the goals of a good REU experience which we discussed in the second session? What do you say to the REU student? Can the REU program director play a role in helping to resolve this situation?

Space for Reflections and Notes

Case Study
Understanding: It Seemed So Clear when you Explained It…

You have recently explained a complicated computational technique to Josh, your mentee. As you were explaining, Josh nodded the entire time as if he understood every word you were saying. When you were finished with your explanation, you asked Josh if he had any questions. He said no. Just to make sure, you asked Josh if everything was clear. He said yes. Three days later you asked Josh how his work using this technique was going and he told you he hasn't started because he does not understand the technique.

What can you do in the future to make sure your mentee understands what you are saying?

Case Study
Understanding: A "Resourceful" Mentee

Your mentee, Sascha, is enthusiastic about your research project and seems confident in his ability to be resourceful. Every day when he gets back from the instrument room, you ask him how it went, and he says "Good," without giving much detail. You occasionally check his log book and everything seems to be going well, and so it doesn't occur to you to question Sascha about the nitty-gritty details of his day.

After several weeks pass, you realize that your data were collected not exactly the way you wanted. After some probing, you realize that the instrument was not taking data over the full range of operation. You asked Sascha why he didn't record data over the full range and he said the power supply fuse blew every time he tried to take data at the higher ranges. "I looked for a different power supply, but I couldn't find one," he told you, "And so I just stopped taking data a point just below the one that caused the fuse to blow." You're frustrated because you could have had the instrument repaired if you had only known.

Physics Research Mentor Training Seminar
Session 5
Fostering Independence

Core Themes and Objectives

Independence
An important goal in any mentoring relationship is helping the mentee become independent; yet defining what an independent mentee knows and can do is not often articulated by either the mentor or the mentee. Defining what independence looks like and developing skills to foster independence are keys to becoming an effective mentor.

Learning Objectives for Independence
Mentors will have the knowledge and skill to:

- Consider the important roles they play in the academic, professional, and personal development of their mentees
- Employ various strategies to build their mentees' confidence
- Implement varied approaches to foster their mentees' independence in scientific research
- Establish trust between themselves and their mentees
- Create an environment where mentees can achieve goals
- Stimulate creativity

SESSION OUTLINE

Activities

Debrief assignment on getting along
Provide mid-point feedback on the seminar process
Case Studies: Independence
Defining Knowledge and Skill Development

Student Materials

Table tents and markers (or table tents from previous week)
Process Check-in worksheet
Copies of *Independence* case studies

Assignments for Next Session

Bring in copies of your own case study to share with the class (or be prepared to present one verbally)
Reading "Mentoring Learned, Not Taught"

FACILITATOR NOTES

- Getting Along (10 minutes)
  - DISCUSS: Explore participants' thoughts on the assignment for this week, "What if you don't get along." Some questions to guide your discussion:
    - How do you know when you are not getting along with a mentee? What are the warning signs?
    - What might you do if you are not getting along with your mentee?

- Process Check (10 minutes)
  - ACTIVITY: Have participants fill in the mid-point process check-in ("Seminar Process Check" worksheet, page 45) and turn it in. The results will be anonymous.
  - TELL: Share with participants that you will read these and reflect on them at the next meeting.

- *Independence* Case Study: (15 minutes)
  - **NOTE:** The relevant case studies in this section seem to depend upon the academic level of the mentee with whom the participants typically work. Some case studies (*The Hands-on Mentor* and *The Slow Writer*) are more relevant for participants that serve as mentors to graduate students while other studies (*Too Much Free Rein?* and *Forced Guidance*) are more relevant for participants that work primarily with undergraduates. If the participant pool is mixed, let them select based on which pair of cases they wish to discuss and then conduct two parallel small group discussions. By this point in the seminar, they should be able to engage in a slightly independent discussion about independence.
  - ACTIVITY (3-5 minutes): Distribute copies of the case studies, select two to discuss, and let participants read them individually.
  - DISCUSS (10-12 minutes): Discuss reactions to the case studies as a whole group. Some possible guiding questions:
    - How do you foster independence?
    - How do you determine how much independence a mentee is ready for?
    - How do you convey to your mentee that it is it okay to make some mistakes?
      - How do you judge which and how many mistakes are acceptable?
      - How important is it for a mentee to make mistakes to become independent?
    - How do you convey your expectations about the independence?
    - How do you question the details of a mentee's work without making them feel like you do not trust them?
    - How can you determine if you are making assumptions about an undergraduate researcher's ability to do research based on his or her background, ethnicity, gender, or some other factor?
  - See Appendix: Session 5 for typical responses from participants.

- Determining Knowledge and Skill Development (15 minutes)
  - ACTIVITY (5 minutes) Ask mentors to make a list of the knowledge and skills they expect their mentee to have at certain stages of the mentoring relationship (e.g.,

beginning researcher, senior undergraduate working on senior thesis, mid-level graduate student).

- DISCUSS (10 minutes) Explore how mentors see their mentee's skills and knowledge developing. Some possible questions to use:
  - What does independence look like after a summer, after a year, etc.?
  - How do you help your mentee develop these skills?
  - How do you help your mentee assess his or her own level of independence?
- See Appendix: Session 5 for examples of skill and knowledge development.

❖ REVIEW: Assignment for next session (5 minutes)

- Bring in copies of your own case study to share with the class (or be prepared to present one verbally)
- Reading: "Mentoring Learned, Not Taught"

Space for Reflections and Notes

Seminar Process Check

1. What is going well in this seminar?

2. What is not going so well in this seminar?

3. How do you feel about the structure, activities, and format of the seminar?

4. How do you feel about the topics we've discussed? What topics have we not considered that you would like to explore?

5. Additional comments:

Space for Reflection and Notes

Case Study (Grad student mentee)

Independence: Too Independent?

Natalie, a graduate student, is excited about the new data she just obtained from a recent observing run at a telescope. She's a good independent worker, so her supervisor, Dr. Green, happily lets her tear into the manuals on how to reduce data and read papers by people who have dealt with similar data. Knowing that it's much better and easier to get it right the first time, Natalie spends a long time studying and then taking careful limited steps with her own data. However, she faces numerous decisions. For many steps, she reads that some people take one approach, while others do something different. She has no a priori reason to choose one step over another, so she tries both and compares the results. The results are different, so she ponders whether the differences are statistically significant. Then she realizes that the details of her observing setup deviate in some ways from those assumed in the manuals or used by the people who wrote the papers she's reading.

Now she's really worried and resolves to be extra thorough and careful. Enough time passes that Dr. Green gets a little worried and checks up on Natalie. Natalie says, "Oh, thank you, I was wondering whether I should come to you with this, but I just wanted to try a couple extra things." Natalie launches into a long and detailed description of all the worries, decisions, things she's tried, etc. Dr. Green says that careful attention to detail is commendable but it's taking way too much time. Natalie asks Dr. Green for answers to her detailed questions so she can move on, but Dr. Green replies, "Oh, it's been far too many years since I reduced that kind of data. I don't remember the details, but I remember it only took a few weeks. You'll have to find someone else in the department who's done that more recently."

Case Study (Grad student mentee)
Independence: The Slow Writer

Jaxson, the most senior graduate student in your group, is adept at performing experiments but is a very slow writer. Last fall, you set multiple deadlines that Jaxson missed, while Drew, another student in the group, wrote his entire masters thesis, submitted a paper, and did experiments. Over winter break, Jaxson had a breakthrough and produced a fairly reasonable draft of a preliminary proposal. However, because Jaxson produced it so close to the (planned) prelim date, and he did not have the presentation ready, you delayed the exam. To avoid delays in publications, you have taken the lead in writing the manuscripts based on Jaxson's work. However, in order to graduate with a PhD, you realize Jaxson must write the dissertation as well as the next manuscript. Setting deadlines for detailed outlines, manuscript/thesis sections, figures, etc. hasn't worked. Communicating the importance of manuscripts to the scientific endeavor hasn't worked. Encouragement hasn't worked. Veiled threats don't seem professional. Other than being patient, what should you do?

Case Study (Undergraduate mentee)
Independence: Too Much Free Rein?

Ian, an undergraduate student, is excited about the new data he just obtained from a recent observing run at a telescope. These are his first data, and he wants to reduce and analyze them himself. His mentor respects his desire to do the work independently, and so decides not to interfere unless asked. Four weeks go by without a word from Ian, and the mentor decides to check in. Ian says that everything is going fine, and he'll have results to show the mentor shortly. A week later he proudly asks to set up an appointment to show his mentor the results. After only five minutes the mentor knows that Ian has not reduced the data correctly, and in fact will have to do most of the work again. The mentor points out the mistakes. As Ian leaves it is clear that he is crestfallen. After a week, the mentor hasn't heard a word from him. The mentor wonders if Ian was given too much freedom and ponders what to do now.

Case Study (Undergraduate mentee)
Independence: Forced Guidance

I started working with Amy on her senior thesis this semester, and I just can't seem to get along with her! I told her at the beginning of the semester that I thought we should have weekly meetings to talk about her progress, and she agreed. At our next meeting, I asked Amy to run through a list of the things she'd accomplished that week. She had no notes and seemed pretty unprepared for talking about her work in the level of detail that I expected. She's been canceling most of our meetings at the last minute—either she doesn't feel well, or she suddenly remembers an assignment for another class that's due the next day! I know that she's doing the work, because at the few meetings she keeps, she has a lot to say—but her progress on this project is very uneven, both in time taken and in quality, and I'm often forced to suggest that she redo crucial pieces. I fear these critical meetings leave Amy demoralized and less interested in accepting guidance from me, but I don't know how else to get her to understand that she needs my help.

Physics Research Mentor Training Seminar
Session 6
Mentoring Challenges

Core Themes and Objectives

Sharing Mentoring Challenges and Solutions
Discussing mentoring challenges and posing solutions with your peers is an effective means of reflecting on mentoring and considering diverse approaches. The collective experience of a group of mentors can expand your own mentoring toolbox for handling challenges when they arise.

Learning Objectives
Mentors will:

- Explore the dynamics of the mentor-mentee relationship
- Consider diverse mentee's perspectives when addressing mentoring challenges and solutions

SESSION OUTLINE

Activities

Review and discuss the seminar process based on feedback from last session
Discuss mentoring challenges and strategies for addressing those challenges

Participant Materials

Table tents
Copies of compiled responses from Process Check-in
Index cards (optional)

Assignments for Next Session

Write a brief description of how you and your mentee(s) are different
Write a brief solution to a mentoring challenge
Reading: “Benefits and Challenges of Diversity” and “Mentoring Across Cultures”

FACILITATOR NOTES

- Discussion of Process Check-in (10 minutes)
  - DISCUSS: Review the feedback from the process check-in and how the seminar can be improved.

- "Mentoring Learned, Not Taught" (10 minutes)
  - DISCUSS: Ask participants if they want to discuss the reading assignment "Mentoring Learned, Not Taught". If so, here are some questions which might help guide the discussion:
    - What were key points of the article for you?
    - What do you think of some of the principles of mentoring listed?
  - See Appendix: Session 6 for typical responses from participants.

- Mentoring Challenges Discussion (25 minutes)
  - ACTIVITY: Have participants share copies of their biggest mentoring challenges from last week's assignment (if participants do not arrive in class with a written challenge, have them take 3-5 minutes to write their mentoring challenge down on an index card).
    - Write the challenges on the board.
    - Have the group to choose one or two of the challenges for discussion.
  - DISCUSS: Explore issues and dynamics that inform the challenges as a whole group. Have the group generate several specific approaches (at least 2-3) to address the selected mentoring challenge or challenges. Some general questions to get the conversation started include:
    - How many of you have experienced this particular challenge as a mentor or as a mentee?
    - What are the possible consequences of not dealing with the challenge that has been posed?
    - What is the likelihood of you experiencing this challenge as a mentor at some point in our career?

  If the discussion does not seem productive using the participants' challenges, you can discuss one or two of the case studies found in the reading "Mentoring Learned, Not Taught".

- How do you know if there is a problem with your mentee? (10 minutes)
  - ACTIVITY: Have participants brainstorm about how they will know if their mentee is struggling.
    - Write their ideas on a white board or flip chart for reference in the discussion that follows.
  - DISCUSS: Explore the fact that just because a mentee does not complain, it does not mean he or she is not struggling. Possible discussion questions:
    - How do you know if something is wrong?
    - How often should you check in on your mentoring relationship?
    - Can a mentee, over whom you have power, be truly honest with you about problems he or she is having in the mentoring relationship?
  - See Appendix: Session 6 for typical responses from participants.

- REVIEW: Assignment for next session (5 minutes)
  - Write a brief description of how you and your mentee(s) are different. If you don't have a mentee, give a brief description of a past academic or work experience in which differences between individuals played a major role. Don't take the easy way out and talk about mere differences of opinion. Look deeper into relationships and backgrounds and how these differences might affect your mentoring relationship.
  - We have considered many mentoring challenges so far in case studies, readings, and actual situations faced by members of the group. Please pick a challenge, one of these or one of your own that we haven't discussed, and describe a brief response or solution. Consider if the solution is the optimal solution for the mentee, the mentor, or a compromise.
  - Reading: "Benefits and Challenges of Diversity" and "Mentoring Across Cultures"

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 7
Addressing Diversity

Core Theme and Objectives

Diversity
Diversity along a range of dimensions offers both challenges and opportunities to any mentor-mentee relationship. Learning to identify, reflect upon, and engage with diversity is critical to forming and maintaining an effective mentoring relationship.

Learning Objectives for Diversity
Mentors will have the knowledge and skill to:

- Recognize some of the biases and prejudices they bring to the mentor-mentee relationship
- Implement concrete strategies for addressing issues of diversity
- Engage in conversations about diversity with their mentees
- Recognize how they can influence their mentees' decisions to commit to careers in science
- Improve their multicultural competency

SESSION OUTLINE

Activities

Discuss readings on diversity
Research Results on Bias
Case Studies: Diversity

Participant Materials

Table tents
Copies of Research Results on Bias
Copies of the *Diversity* case studies

Assignments for Next Session

The American Physical Society (APS) has an ethics statement, APS Guidelines for Professional Conduct, and additional resources at http://www.aps.org/policy/statements/02_2.cfm. Be prepared to talk about how they apply to you and your work. Bring a copy of these guidelines to the session.

Reading "*Nature's* Guide for Mentors"

FACILITATOR NOTES

- Discussion of Process Check-in (10 minutes)
  - DISCUSS: Review the feedback from the process check-in and how the seminar can be improved.

- Discussion of readings on diversity (15 minutes)
  - DISCUSS: Explore participants' reactions to the readings "Benefits and Challenges of Diversity" and "Mentoring Across Cultures," as well as the assignment on differences. Some possible guiding questions:
    - What were your initial reactions to the readings?
    - Are there aspects of the readings you agreed or disagreed with?
    - What did you learn from the reading that you did not already know?
    - List the aspects of diversity you wrote about for your assignment.
    - How does diversity enhance your mentoring relationship? How does it challenge the relationship?

- *Research Results on Bias* (15 minutes)
  - ACTIVITY (5 minutes): Several studies have been conducted to identify types of bias that can exist in mentor/mentee or other similar relationships. Ask participants to break into pairs of smaller groups and review the study findings listed on the "Bias and Stereotypes Worksheet" (page 59). Ask mentors to consider how bias or stereotype threat might impact a mentoring relationship.
  - DISCUSS (10 minutes): As a whole group, discuss reactions to the study results. Some possible guiding questions:
    - Do you believe everyone has biases?
    - How might a mentor's biases impact interactions with his or her mentee? How might a mentee's biases impact the relationship with his or her mentor?
    - How can you minimize the impact of bias?
  - See Appendix: Session 7 for typical responses from participants.

- *Diversity* Case Study: *Is It Okay to Ask?* (15 minutes)
  - ACTIVITY (2-3 minutes): Distribute the case study to participants and have them read it individually.
  - DISCUSS (12-13 minutes): Explore participants' reactions to the case study. Some possible guiding questions:
    - Do you think this is a common question/reaction?
    - If you were the mentor in this case, would you feel comfortable asking a mentee about his or her race, ethnicity, gender, disability, etc.?
    - Do you think someone's race, ethnicity, gender, disability or other background characteristics that may place him or her in a minority group affect his or her experiences as a mentee?
    - Specifically, how would you go about engaging someone in a discussion about his or her race, ethnicity, gender, disability, or other background characteristics?
    - What is your approach to addressing diversity with the people you work with?

- What are some ways you can learn to better understand your mentee's attitudes and experiences?
- How do you deal with a mentee's emotional needs? Is this the same or different from addressing his or her background in that both impact the experience in research?
- Do you think everyone should be treated the same? Does treating everyone the same mean that everyone is being treated equally?

➢ See Appendix: Session 7 for typical responses from participants to some of these questions.

❖ REVIEW: Assignment for next session (5 minutes)

➢ Ethics Assignments: Look up the aforementioned APS Guidelines for Professional Conduct. Think about how they apply to you and your work. Bring a copy of them to class. In the next session, we will discuss how we teach (or fail to teach) ethics to our mentees.

➢ Reading: "*Nature's* Guide for Mentors"

Space for Reflection and Notes

Bias and Stereotypes Worksheet*

In pairs or smaller groups, discuss the following questions as they relate to the findings below:

1. What bias or stereotype threat does the result highlight?
2. Do you feel you have this bias or have you seen this bias enacted upon?
3. How can this bias impact a mentoring relationship?

Study 1. If African American or female students are asked to identify their race or gender, respectively, at the start of an exam, they will do statistically worse on that exam.†

Study 2. Blind, randomized trial: When asked to rate the quality of verbal skills indicated by a short text, evaluators rated the skills as lower if they were told an African American wrote the text than if a they were told a white person wrote it, and gave lower ratings when told a man wrote it than when told a woman wrote it.‡

Study 3. Blind, randomized trial: Evaluators rated the same job performance lower if told it was performed by a woman. This difference was substantially greater when evaluator was busy or distracted.§

Study 4. Real life study: CVs of real women were assigned a male or female name, randomly, and sent to 238 academic psychologists to review either 1) at the time of job application or 2) at the time of review for an early tenure decision. Respondents were more likely to hire the applicant if a male name was found on the CV at the time of job application. Gender of applicant had no effect on respondents' likelihood of granting tenure when their CV was reviewed as part of an early tenure decision. However, there were four times more "cautionary comments" in the margins of the tenure packages with female names such as "We would have to see her job talk."**

Study 5. Real life study: Parents' estimates of math ability are higher for sons than for daughters, despite no gender differences in grades or test scores.††

Study 6. Real life study: Letters of recommendation for successful applicants for medical school faculty positions were analyzed based on gender of applicant. Letters for male applicants were longer and referred to research ability more often. Recommendations for females were shorter and referred to skill as a student/teacher more than a researcher. Females were more likely to be described using "grindstone" adjectives implying success due to hard work and persistence rather than skill.‡‡

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* Adapted from a workshop presented by Christine Pfund, Jo Handelsman and Jim Stith at the National Academies Summer Institute on Undergraduate Education in Biology (http://www.academiessummerinstitute.org).

† Steele, Claude M., & Aronson, J. (1995). "Stereotype threat and the intellectual test performance of African Americans." *Journal of personality and social psychology, 69,* 797-811.

‡ Biernat, M., & Manis. M. (1994). Shifting Standards and Stereotype-Based Judgments. *Journal of Personality and Social Psychology, 66,* 5-20.

§ Dovidio, J. F., & Gaertner, S. L. (2000). Aversive racism and selection decisions: 1989 and 1999. *Psychological Science, 11,* 319–323 and Martell, R. F. (1991). Sex bias at work: The affects of attentional and memory demands on performance ratings for men and women. *Journal of Applied Social Psychology, 21,* 1936-1960.

** Steinpreis, R. E., Anders, K. A., & Ritzke, D. (1999). The impact of gender on the review of the curricula vitae of job applicants and tenure candidates: A national empirical study. *Sex Roles, 41,* 509-527

†† Yee, D. K. & Eccles, J. S. (1988). Parent perceptions and attributions for children's math achievement. *Sex Roles, 19,* 371-333.

‡‡ Trix, F. & Psendka, C. (2003). Exploring the color of glass: Letters of recommendation for female and male medical faculty. *Discourse & Society, 14*(2), 191–220.

Space for Reflection and Notes

Case Study
Diversity: Is It Okay to Ask?

Last summer I worked with a fantastic undergraduate mentee. Shirley was very intelligent and generated a fair amount of data directly relevant to my thesis project. I think that she had a positive summer research experience, but there are a few questions that still linger in my mind. This particular mentee was an African-American woman from a small town. I always wondered how she felt on a big urban campus. I also wondered how Shirley felt about being the only African-American woman in our lab. In fact, she was the only African-American woman in our entire department that summer. I wanted to ask Shirley how she felt, but I worried that it might be insensitive or politically incorrect to do so. I never asked. I still wonder how she felt and how those feelings may have affected her experience.

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 8
Ethics

Core Theme and Objectives

Ethics
Mentors play an important role in both teaching mentees about ethical behavior and modeling ethical behavior. Moreover, there are many ethical issues to consider when entering a relationship with a mentee based on the power dynamic that exists between mentors and mentees. Reflecting upon and discussing ethical behavior is an important part of becoming an effective mentor.

Learning Objectives for Ethics
Mentors will have the knowledge and skill to:

- Articulate the issues of ethics they need to discuss with their mentees
- Clarify the roles they play, both as teachers and role models, in educating mentees about ethics
- Apply APS Guidelines for Professional Conduct

SESSION OUTLINE

Activities

Discuss ethics guidelines from professional societies
Case Studies: Research Ethics
Assignment: Summary paragraph of discussion about mentoring challenge with advisor or colleague

Participant Materials

Table tents
Copies of *Ethics* case studies

Assignment for Next Session

Present a mentoring challenge to your own adviser/research mentor or another faculty member whom you respect and discuss possible solutions. Write a summary of the discussion.

FACILITATOR NOTES

- Discussion of APS' ethics guidelines (20 minutes)
  - ASK: Some possible guiding questions:
    - Did you know that APS had ethics guidelines before this assignment?
    - How do these guidelines apply to your work?
    - How do or can mentors teach these ethics to mentees?
    - What are good resources for teaching about ethics?

- *Ethics* case studies (35 minutes) *We suggest doing this activity as a jig-saw, which means having participants break into smaller groups (two or three per group) and assigning one case study to each sub-group. After the members of each sub-group read the case study, they should discuss in their small group for 15 minutes. Then each group should report out to the whole group by describing the case to the larger group and summarizing their discussion (15 minutes).*
  - ACTIVITY (5 minutes): Distribute copies of the case studies and have participants read the one they are assigned.
  - DISCUSS (15 minutes): In small groups, the participants should consider the following questions:
    - Who are the stakeholders in this case (individuals, institutions, public)?
    - What are the facts? What assumptions are you making about the situation?
    - What are the consequences of the proposed course of action?
    - What other courses of action are possible? Which ones are preferable and why?
    - What, if anything, could have been done to prevent the situation?
  - DISCUSS (15 minutes): In the larger group, ask mentors to consider some of the following questions:
    - How can a mentor's reaction to unexpected news motivate or influence a mentee to make good or bad ethical choices?
    - How can you teach a mentee good ethical behavior?
    - How do new researchers learn ethical practices in physics?
      - What is general and what is specific to the discipline?
    - Are there certain "red-flag" issues when working with new REU students?
    - Are there special issues for learning ethical practices in physics research? If so, what are they?
    - What ethical issues can arise due to the power dynamic between a mentor and mentee?
  - See Appendix: Session 8 for typical responses from participants to some of these questions.

- REVIEW: Assignment for next session (5 minutes)
  - Present a mentoring challenge to your own adviser/research mentor or another faculty member whom you respect and discuss possible solutions. Write a summary of the discussion.

Space for Reflection and Notes

Case Study
Ethics: Throwing Out Data

During the process of showing an undergraduate how to reduce and analyze neutron data from nuclear collisions, Professor Stone notices that the student is getting more and more uncomfortable and withdrawn. Professor Stone is mystified and wonders what is going wrong, but the student is evasive when asked. Eventually the undergraduate mentions that they've been taught that selectively throwing out data you don't like is unsavory and possibly even fraudulent. Shocked, Professor Stone says, "depending on what you're doing, yes, that's true. We haven't done that." The undergraduate responds, "yes we have. You used an algorithm to remove some of the background and other false signals from the data set, which also throws out some real data. Then you cover this up by correcting your spectra with 'detector acceptance' factors."

Case Study
Ethics: Tweaking the Data

You are mentoring an undergraduate in your lab, and have asked her to collect data for one of the experiments you plan to include in your next publication. When the dataset is complete, you sit down to analyze it and find your predictions completely disconfirmed. Dismayed, you call her into you office and ask her to describe, in great detail, what she did when collecting the data. You want to make sure that these anomalous results can't be more easily explained by mistakes in the lab. The conversation lasts quite a while, but at the end you are still frustrated and puzzled by the data, and you send her home so you can think about it some more.

Later, you are eating lunch in the cafeteria when you overhear the undergraduate talking to a friend of hers. “I think my mentor is mad at me,” she tells her friend, visibly upset, and describes their recent meeting. You are surprised to realize that she took your questioning very personally. When she finishes venting, her friend replies, “If your mentor is so mad, you probably did make a mistake somewhere. After all, who’s the expert on this subject? Maybe you should tweak the data a little next time to keep your mentor happy.”

Case Study
Ethics: Authorship

Three of my graduate students work collaboratively on closely related projects. Cynthia conducted a synthesis of several of our studies, and wrote it up as a separate paper. On the first draft of the manuscript she did not put her lab-mates' names on the paper. I asked Cynthia why she didn't, and she said she felt strongly that they did not deserve authorship because the data were already published as separate projects, and that she had done the hard work of synthesizing their findings into a new story. Rather than arguing further, I gave her permission to circulate the draft to the rest of the lab for feedback.

The next day, John and Marie, the other two students on the project, came to my office complaining that they felt they deserved authorship on the paper. I told them that I agreed, and that I would put them on the paper. When I told Cynthia to add their names, she was very upset and started pointing out other instances in which she thought she should have been on their papers, but wasn't. Finally, I said "I am the PI on this project, and I make the final decisions. All three of you should be on this paper. No more discussion." Cynthia stormed out of my office and would not reply to my emails for a week. Our relationship is still strained. How do I repair it?

Case Study
Ethics: Free Labor

I was thrilled when Rongying, my undergraduate mentee, won a fellowship for an independent summer research project. Her small fellowship project was directly related to my thesis project, and so I was optimistic about getting great data from her, as well as being able to complete my project because I had an extra pair of helping hands. My advisor did not have funds to pay for any assistance for my project, and so if Rongying had not gotten a fellowship, I would have had to split my project between two summer field seasons because the workload was not possible with only me working on it.

One day, Rongying asked why she wasn't paid extra for the hours she worked on my project outside of her fellowship research. I told her that most undergraduates who receive fellowships are expected to work on both their mentor's and their own projects as part of the training, which was true in my department. Rongying said that her fellowship requirements state that her stipend was only to be used for work on her own project. I didn't know what to say or how to handle issues of money, and so I just told her to talk to my advisor about it.

Case Study
Ethics: Big Strong Guy

You are the graduate student mentor to a team of students working on a research project that occasionally requires some serious manual labor. Dr. Sanford, the PI for the project visits the research site often. When he is there and needs some physical work done, he always asks for "a big strong guy" to volunteer to help him. Today, Jane, a female student on your team, volunteers after one of these requests, and Dr. Sanford says, "Are you a big strong guy? No!" He then turns away, still looking for someone to assist him. What do you do?

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 9
Elements of Good Mentoring

Core Themes and Objectives

Elements of Good Mentoring
From their own experiences and from discussions throughout the research mentor training seminar, mentors will hear about and reflect upon a wide variety of mentoring challenges and approaches. Reflecting upon these diverse approaches and developing a set of approaches that align with the needs of their mentees as well as their personal style is an important part of becoming a more reflective and intentional mentor.

Learning Objectives for Good Mentoring
Mentors will:

- Explore and compare different approaches to mentoring
- Identify specific elements of their own approach to mentoring

SESSION OUTLINE

Activities

Discussion of assignment
Creating a mentoring toolbox
Discussion of job scenario

Participant Materials

Table tents

Assignment for Next Session

Bring two copies of the revised draft of your mentoring philosophy to the next seminar session.

FACILITATOR NOTES

- Exploring approaches to mentoring (15 minutes)
  - ASK: Have each participant answer the following questions for the whole group regarding the assignment:
    - What case did you present to your advisor/research mentor or other faculty member?
    - How did that person respond to the case?
  - DISCUSS: Explore more broadly what participants' answers show about the collective experience of mentoring. Some questions to guide your discussion:
    - What can we learn from other mentors?
    - Do you think other mentors are intentional about their approach to mentoring?
    - What effective mentoring practices have you observed from your own or other research mentors?
    - Are the general issues in research mentoring the same across disciplines or are there discipline-specific issues?

- Roles of the mentor beyond research mentoring (10 minutes)
  - ASK: Clearly, the role of mentor extends beyond the research environment. What is the role of the mentor in:
    - Academic advising?
    - Career advising?
    - Life advising?
  - DISCUSS: Explore participants' answers. Some guiding questions include:
    - When does the mentor's responsibility end?
    - Where/how does one learn how to be a better mentor in these other arenas?
    - Do others in the institution share responsibilities in these areas?

- Creating a mentor toolbox–applying what we have learned (15 minutes)
  - ACTIVITY: Have participants brainstorm answers to the following questions:
    - If you were giving advice to a new mentor on how to be effective, what would you tell that person? Make a list.
    - If the new mentor asked how to do each thing listed, what would you say?

- Job scenario (10 minutes)
  - TELL: Provide the following scenario to participants:
    - You are applying for a position—your dream job.
    - You are told that mentoring students will be an important part of the job.
    - You are asked to describe your approach to mentoring and give a specific example of effective mentoring.
  - ACTIVITY: Have participants write down their thoughts about how they would answer and share their responses with the group.

- REVIEW: Assignment for next session (5 minutes)
  - Revise the draft of your mentoring philosophy. Bring two copies to the next seminar session.

Space for Reflection and Notes

Physics Research Mentor Training Seminar
Session 10
Developing a Mentoring Philosophy

Core Theme and Objectives

Mentoring Philosophy
While every mentoring relationship is unique and may require different approaches to each specific situation, it is important for mentors to work from a core philosophy. Mentors should be able to articulate this philosophy to themselves, their peers, and perhaps most importantly, to their mentees.

Learning Objectives for Ethics
Mentors will have the knowledge and skill to:

- Critically and constructively review their approaches to and experiences of mentoring relationships
- Articulate a core mentoring philosophy

SESSION OUTLINE

Activities

Review mentoring philosophies
Discuss opportunities to provide research mentor training to other researchers
Evaluate research mentor training seminar

Participant materials

Table tents
Copies of the Reflecting on Mentoring Worksheet

FACILITATOR NOTES

- Mentoring Philosophies (25 minutes)
  - ACTIVITY: Have participants swap mentoring philosophies with each other and provide comments both in writing and verbally.
  - DISCUSS: Have participants share their feedback and reactions with the whole group.

- Reflecting on Mentoring Discussion (20 minutes)
  - ACTIVITY: Have participants answer the questions on the "Reflecting on Mentoring Worksheet" (page 81).
  - DISCUSS: Explore participants' responses to the questions from the worksheet. The questions from the worksheet are:
    - Are there things that you learned in research mentor training that did not make it into your philosophy?
      - What are they?
    - What are you going to use your mentoring philosophy for, if anything? (See notes from session 1 on developing a mentoring philosophy to help guide this discussion.)
    - What will you do, specifically, the next time you mentor?
    - Reflect on your relationship with your mentor. How has this seminar affected your perception of that relationship?

- Application of the Research Mentor Training Seminar (10 minutes)
  - TELL: Be sure to share with participants that they are now qualified to provide research mentor training and can offer it at their institutions if they so choose. They can obtain curriculum material at www.researchmentortraining.org.
  - TELL: Encourage participants to use this training to their advantage in their professional careers. They should refer to this training, both their participation in it and their ability to teach it to others, in future job applications and grant proposals.

- Evaluation (5 minutes)
  - TELL: Let participants know they will be receiving a follow-up evaluation. A template evaluation instrument can be found in *Entering Mentoring: A Seminar to Train a New Generation of Scientists* available at www.hhmi.org/grants/pdf/labmanagement/entering_mentoring.pdf.

Space for Reflection and Notes

Space for Reflection and Notes

Reflecting on Mentoring Worksheet

1) For your revised mentoring philosophy: Identify two or three things that you changed in your mentoring philosophy based on your experiences in this class.

2) Are there things that you learned in research mentor training that did not make it into your philosophy? If so, what are they?

3) Specifically, how are you going to use your mentoring philosophy?

4) What will you do differently from now on when you mentor?

5) Reflect on your relationship with your mentor. How has this class affected your perception of that relationship?

Space for Reflection and Notes

APPENDIX: SESSION NOTES

The following sections include typical responses from past seminar participants to many of the discussion questions and case studies. These notes are by no means exhaustive; however, they are a summary of several sessions. They are presented here to give facilitators ideas about what to expect in their seminars. If a session is moving slowly, these may provide prompts for the facilitator to spark conversations. It is unlikely that any single seminar session will "cover" every idea presented in these session notes.

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Session 1: Project Design

- Alternate Introductory Activities to Visual Explorer:
  - Activity: Constructive/Destructive Group behaviors. (5 minutes)
    - Pass out the list of characteristics (page 9). Ask each participant to review the list of constructive/destructive group behaviors and choose their most constructive and destructive group behavior and write them on the back of a table tent.
    - Ask each participant to share their choices with the larger group.
  - Activity: New Undergraduate Research Student Perspective (15 minutes)
    - Ask participants to think back to when they were an undergraduate and consider the following questions:
      - How did you approach coming to a summer research program? What were you thinking? What are your hopes? Plans?
      - During your undergraduate physics research, did you feel like there were many others like you or that you could relate to?
      - Do you expect the same to be true for your mentee in your departments this summer?
      - Based on your answer to the previous question, how will you change how you approach/interact with your mentee?

- Typical responses to the question: "What are the elements of a good research project in physics for an undergraduate?":
  - Projects should have a reasonable scope.
  - Projects should be feasible.
  - Projects should generate some results that a student can present.
  - Projects should not simply include cookbook experiments or repeating standard calculations/computations.
  - Projects should be designed to give the mentee a good chance of some early success.
  - Projects should be meaningful to the research group; don't just give a side project to a mentee that no one else in the group cares about.
  - Projects should have some built-in challenges that can be faced once the student gains some confidence.

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Session 2: Expectations

- Typical responses to the article "What is a Mentor?":
  - Mentoring should be a "personal" relationship.
    However, it is difficult to develop a concrete definition of what "personal" means. What most people had in mind is the antithesis of the old academic stereotype: Professor Smith removes his lab coat, dons his tweed blazer, and says to his grad student as he heads to the door, "See you in the morning, Jones, and do see if you can get to a stable proto-flubber this evening".
  - Defining level of authority is often a challenge.
    How much authority should mentors have over their undergraduate mentee? How does a mentor balance authority with having a personal relationship with the mentee?
  - Titles are important and interesting.
    Is calling a professor by his or her first name acceptable? Are formal titles "doctor" or "professor" preferred? Sometimes using formal titles are part of someone's culture. For situations like this, consider whether the mentor's or the mentee's (who perhaps grew up using honorifics and does not feel right abandoning them) comfort is more important.
  - The challenge of multiple mentors is often discussed.
  - Diversity issues are often discussed.
    Some participants note that they have to work to treat male and female mentees similarly. For some, the natural inclination is to pay more attention to female mentees, since they think the women "need" more guidance than men. In terms of defining success as a researcher, they also recognize that they may inadvertently set higher standards for women than for men.
  - Defining good record-keeping is important.
    How are records kept in participants' research groups? Are standard paper notebooks kept? Are group notebooks kept or individual research notebooks? Are electronic records kept?

- Typical responses to the case study: *In Over His Head*
  - When deciding on the goals and projects for a mentee, consider developing two project ideas and letting the student choose one based on his or her interests.
  - It is important to clearly communicate how the project integrates into the larger goals of the research group and the importance of the project results to the research team. If a mentee feels that the project is meaningful and contributes to the larger research group's success, they are much more likely to embrace it, even if it does not align with their original interests.
  - Break the research project into manageable chunks so the mentee can master one aspect at a time. Lay out a timeline and list of expectations across all of the steps. Be sure to assess understanding and progress at each step.
  - One means of assessing a mentee's skills is to ask them to read a journal article or method paper about the research project and then complete a worksheet on the article which asks them to articulate their understanding as well as note elements that they do not yet understand.

- To elucidate a mentee's preferred working and learning styles, ask them about their past jobs and have them describe their most and least favorite ones. This will give you a sense of what motivates them and what hinders them.
- Call the mentee's previous mentor or instructor to ask about the mentee's background and abilities.

❖ Typical responses to case study: *Mismatched Priorities*
- Mentors need to communicate orally and in writing their explicit expectations to each mentee. Do not assume that a mentee understands the culture of research and the unspoken expectations about work hours, procedures and work ethic.
- Ask a mentee about their expectations for the research experience and of their mentor.
- Talk to mentees about expectations and consider:
  - When should the discussion occur? Will the PI be in this discussion?
  - What should the mentor tell the mentee? What should the mentor ask the mentee?
  - How can a mentor determine whether the mentee is overambitious for the summer and hence may be heading for disappointment, or whether the mentee lacks confidence and may not get as much out of the experience as he or she could?
- Discuss with each mentee his or her responsibility for asking about expectations if they are not certain so as to avoid miscommunications and frustration.
- Mentors should write a list of expectations for the relationship and ask their mentee to do the same, then compare the lists. It is important to revisit these lists at the end of the summer or each semester, if the mentoring relationship continues beyond the summer.

❖ Integrating Expectations into your Mentoring Philosophy/ Strategy

If time allows, ask participants to ponder the following questions until the next session:
- Did you include something about setting and communicating expectations in your mentoring strategy?
- Do you want to add/modify expectations in your strategy?
- What do you have in your strategy/plan to make sure the REU and everyone else is clear on expectations?
- Do you have anything in your strategy to deal with dissatisfaction/jealousy on the part of your REU student? Do you think that's necessary at this point?

Session 3: Communication

- Typical Responses to the communication case studies: *Putting in Enough Time* and *The Slob*
  - Mentors need to engage in effective communication practices which include active listening, maintaining eye contact and allowing adequate time for conversation.
  - The mentee in both of these cases is likely to feel embarrassed, demoralized, and guilty when they are called out on their action(s).
    The mentor may need to address these feelings in a follow-up conversation.
  - The situations described may have been avoidable.
    If a direct conversation about expectations had occurred earlier in the relationship, this could have been averted. Strategies for initiating such conversations can be reviewed from the previous session on expectations.
  - Mentees may not know the social dynamics/structure of a research group and the sense of hierarchy of personnel and projects.
    It is important for mentors and mentees to have a conversation about these topics. Such a conversation may be initiated by asking the mentee to draw a diagram of everyone in the research group and how they relate to one another and then discussing it with the mentor.
  - Comments from a person in power can be intended one way, but heard differently by the mentee.
    Mentors should acknowledge this power dynamic and keep it in mind when they communicate.
  - Cultural differences may impact a mentee's willingness to ask about expectations.

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Session 4: Understanding

- Typical responses to understanding case studies: *It Seemed So Clear* and *Resourceful Mentee*
  - This situation has happened to most mentors.
    Most mentors immediately resonate with students who have this problem. Many mentors believe the behavior stems from claims of understanding to cover insecurity. Mentors must be very careful to not make students feel even more insecure with attempts to probe their level of understanding.
  - Explicit discussions between mentors and mentees about expectations for understanding can open the door for mentees to ask more questions.
    Mentors can emphasize that they do not get upset when a mentee asks questions, but do get frustrated if the mentee claims to understand something which they do not actually understand.
  - Mentees may believe there is a limit to the number of times they can ask the same questions.
    This is an assumption the mentor may want to address in a discussion about asking questions.
  - Mentees often know less than mentors expect.
    Mentors need to be prepared to spend the necessary time explaining concepts and details.
  - It is partially the responsibility of the mentee to admit a lack of understanding.
    Mentors must be willing to help once the mentee admits his or her need for assistance.
  - It is important to recognize the difference between an expert perspective and a novice perspective.
    Mentors should realize they might leave out steps in an explanation that are necessary for a mentee to hear.
  - Some ways to assess a mentee's understanding include:
    - Have the mentee explain a concept or method back to you.
      The mentor should be careful to avoid sounding condescending when asking the student to explain something back.
    - Have the mentee diagram the concept or method.
    - Have the mentee teach the concept or method to another member of the research group.
    - Have the mentee watch you do the procedure once, then do it together, and then try it alone.
    - Review the mentee's lab notebook daily until he or she is able to do the experiment independently.
    - Ask the mentee to figure something out on their own and then come back to the mentor with questions.
      This may help to foster independence.

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Session 5: Independence

- Typical responses to the independence case studies:
  - Independence can be fostered by
    - Letting the mentee try something on his or her own first
    - Getting a mentee started on an experiment and then asking him or her to finish it.
    - Helping the mentee in the beginning to build confidence and then challenging him or her to come up with ideas and complete experiments independently
    - Letting the mentee demonstrate the procedure and asking that he or she explain it, rather than telling or showing the mentee what to do
  - It is important to determine how much independence a mentee is ready for by:
    - Asking what they are comfortable doing
    - Requiring him or her to write protocols before starting a procedure
    - Having the mentee talk through their ideas and steps before starting
  - Mistakes are a part of the process of doing research:
    - Allowing a mentee to struggle and fail *for a while* can be an important part of the process of developing as an independent researcher.
    - Struggling is important but a mentor should not wait too long to correct mistakes.
    - Mentees often don't realize that they don't fully understand something and it's up to the mentor to probe for this without coddling an independent-minded student.
    - There is value in making mistakes.

      The acceptable timescale over which the mistakes are allowed to run depends upon the situation. Summer undergraduate research students may require more frequent attention and possible intervention from the mentor, compared to a year-long research experience or graduate student.
    - Mentees may not recognize that mistakes can be great learning opportunities.

      A frank discussion about the pros and cons of making mistakes can help them recognize that they can learn from mistakes. Asking the mentee how he or she would handle it if his or her own mentee made a mistake may help open communication avenues between mentor and mentee.
  - Expectations about independence can be communicated explicitly:
    - Write the expectations out for the mentee, perhaps a part of a compact or agreement
    - Ask the mentee to review a job description or a graduate school application and then discuss the level of independence needed to get the position.
    - Be transparent and clear about the fact that one role of a research mentor is to help mentees to become independent. An important skill for the young researcher to develop is that of communicating clearly what they are doing and why they are doing it. Asking them to explain what they are doing and why they are doing it is not indicative of a lack of trust, but a necessary part of the process of becoming an independent researcher.
  - Expectations can be affected by biases:
    - To expose potential biases, imagine what mentors might assume, or how they might react, if the mentee were from a different background.
    - Give concrete measures of success and apply them equally to every mentee.

- Example Knowledge and Skill Development across Career Stage (for 5 selected knowledge and skill areas; please note this is not a comprehensive table)

Beginning Undergraduate (at end of one semester of research)	***Senior Undergraduate with several semesters of research experience***	***Mid-career Graduate Student***	***Post-Doc***
Introductory knowledge of physics	Intermediate knowledge of physics (1-2 courses)	Advanced knowledge of physics	Advanced knowledge of physics, including expertise in their sub-area
Ability to read the introductory and review literature and ask questions	Ability to read the literature and find answers to questions through additional literature searches	Ability to critically read the literature and find answers to questions through extended literature searches and consulting experts	Ability to critically read the literature and find answers to questions through extended literature searches and consulting experts
Ability to write a hypothesis	Ability to predict the next hypothesis	Ability to outline an entire research project with hypotheses and to design experiments	Ability to write a grant proposal for an entire research project
Ability to talk about their project to others	Ability to explain their project to peers and through presentation	Ability to give a poster or presentation on their work	Ability to design and give an oral presentation on their work at a national meeting
Ability to do an experiment once shown how	Ability to do an experiment from a protocol and design an experiment	Ability to design experiments for an entire research project and conduct them	Ability to design experiments for an entire grant proposal and conduct them

Session 6: Mentoring Challenges

- Typical topics that arise during discussion of the "Mentoring Learned, Not Taught" article
  - Key points of the article include:
    - Good mentors try to put the mentee's needs first, perhaps exclusively so.
    - Good mentoring takes practice and reflection.
    - There is no formula to "perfect" mentoring but there are some guiding principles.
    - Mentors cannot measure every mentee against the mentors own strengths.
    - Mentors needs to consider how their comments are heard and realize they may be heard differently from how they were intended.
    - Every mentoring relationship is different.
    - Not every mentoring relationship will work out positively.
  - Key mentoring principles include:
    - A good match between mentor and mentee is important.
    - Communicate directly.
    - Develop a mentoring style and philosophy.
    - Be fair.
    - Consider words and action carefully.
    - Be a role model.

- Typical responses to "How do you know if there are problems with your mentee?
    - Mentee may act withdrawn.
    - Mentee may stop asking questions.
    - Mentee may respond defensively to your questions.
    - Mentee may stop showing up for work.
    - Mentee may appear grumpy or upset.
    - Mentee may stop coming to you for advice.
    - Mentee may change the topic when you ask a question about their work.

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Session 7: Addressing Diversity

- Typical responses to Discussion of Bias:
  - Most mentors believe they have biases, though few are willing or able to verbalize what biases they believe they have.

    It is important to mention that everyone has biases and the purpose of the discussion is not to make them feel guilty about having them, but rather to help them recognize their biases so they can reflect upon them in the future.
  - Biases can impact the mentor/mentee relationship in a number of ways, including:
    - First impressions of a person
    - Assessment of a person's ability
    - Assumptions about the reasons for a person's actions
    - The way mentors and mentees talk to each other
    - Willingness to give someone the benefit of the doubt
    - The ability to truly hear the other person and understand their perspective
  - The impact of biases may be minimized by:
    - Recognizing personal biases and reflecting on them
    - Reflecting on personal biases before having a discussion with someone
    - Taking time when reviewing the work of another person; rushing can exacerbate the impact of bias.
    - Talking through an issue with an independent colleague before having a discussion with your mentor or mentee
    - Considering how a personal response would change if the mentee/mentor was a different gender, race, ability level, etc.

- Typical responses to the diversity case study: *Is It Okay to Ask?*
  - In some groups, mentors can be fairly quiet and reluctant to speak first in this discussion, but just give them a few minutes. Once mentors get going with the discussion, it is often rich and engaging.
  - Views of the impact of race, gender, ethnicity, and background (RGEB) on the research experience mentors vary widely: Example responses include:
    - RGEB have nothing to do with a research experience because the experience should solely focus on research and not on personal issues.
    - RGEB have everything to do with a research experience and permeate every aspect of the experience, impacting perceptions, confidence, and motivation.
    - Ignoring the impact of RGEB sends a message that those aspects of a person have no role in ones work, which may turn students off to science.
    - The level of impact will vary across the relationship. At times it may be invisible. At other times, it may be the most important factor.
  - Individuals want to be assessed for their ability, independent of RGEB.

    The trick is deciding how to balance acknowledging someone's background and taking it into consideration when deciding how to work with that person but not letting a person's background bias your interaction with them.
  - There is no consensus on if and when it is "ok to ask".

    Some feel it is important to ask early, others feel it is never ok to ask, and others

still feel there are special situations when it is necessary to ask.

- Establishing a sufficiently personal relationship with ALL mentees allows mentors to learn about RGEB-related issues from mentees without directly asking questions about their RGEB:

  Regular conversations with ALL mentees in the lab to check on how they are doing and whether they are happy in their overall environment are important. This will build relations that allow mentees to be comfortable sharing concerns AND allow mentors to notice if RGEB are issues in the lab.

Session 8: Ethics

- Typical responses to Guiding Questions on Ethics
  - The power dynamic of a mentoring relationship can cause mentees to make unethical choices.
    - It is critical that mentors tell each mentee to be honest about his or her results no matter what they anticipate the mentor's reaction will be. Novice mentees want to please their mentor. If a mentee perceives that a mentor is unhappy with their results, the mentee may feel pressure to change the result or not share future "undesirable results" to make the mentor happy. Novices may not recognize the ethical issues with that decision.
    - Mentors must separate their emotional reaction to results from the scientific response so that the mentee can feel comfortable with sharing unexpected or conflicting data with the mentor.
  - Lab notebooks can be a good first step in the discussion of ethics.
    - Ask mentees why keeping a good notebook is important.
    - Ask them who owns the notebook and its contents.
  - Mentors can teach good ethical behavior by:
    - Being an ethical role model
    - Talking about issues of ethics with your mentee
    - Pointing out situations in which a mentor or mentee might be in an ethical dilemma (without even recognizing it).
    - Asking mentees what they understand about ethics
    - Giving mentees reading material about ethics and discussing it with them
  - New researchers learn ethical practices in a variety of ways
    - Watching their peers and superiors
    - Hearing about stories of misconduct
    - Required seminars or workshops on ethics
    - Taking online ethic courses
    - Word of mouth
  - The ethics case studies at the American Physical Society website may provide additional physics-specific resources to facilitate discussions of ethics amongst the mentees and mentors in a research group.
  - Common ethical issues for young researchers
    - Omissions of coauthors (mentors and fellow researchers) on papers/posters.
    - Forgetting to acknowledge funding sources and others on papers/posters.
    - Lack of citation of references in posters and presentations
  - Ethical issues for mentors of young researchers
    - How much writing should the mentor do with respect to the mentee's end-of-summer paper or poster? Where is the line between author/coauthor/editor?

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