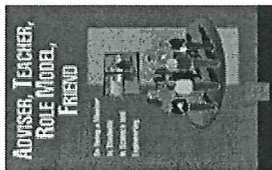


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Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering

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THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

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WHAT IS A MENTOR?

1

WHAT IS A MENTOR?

The notion of mentoring is ancient. The original Mentor was described by Homer as the “wise and trusted counselor” whom Odysseus left in charge of his household during his travels. Athena, in the guise of Mentor, became the guardian and teacher of Odysseus son Telemachus.

In modern times, the concept of mentoring has found application in virtually every forum of learning. In academics, *mentor* is often used synonymously with *faculty adviser*. A fundamental difference between mentoring and advising is more than advising: mentoring is a personal, as well as, professional relationship. An adviser might or might not be a mentor, depending on the quality of the relationship. A mentoring relationship develops over an extended period, during which a student’s needs and the nature of the relationship tend to change. A mentor will try to be aware of these changes and vary the degree and type of attention, help, advice, information, and encouragement that he or she provides.

In the broad sense intended here, a mentor is someone who takes a special interest in helping another person de

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WHAT IS A MENTOR?

2

velop into a successful professional. Some students, particularly those working in large laboratories and institutions, find it difficult to develop a close relationship with their faculty adviser or laboratory director. They might have to find their mentor elsewhere—perhaps a fellow student, another faculty member, a wise friend, or another person with experience who offers continuing guidance and support.

In the realm of science and engineering, we might say that a good mentor seeks to help a student optimize an educational experience, to assist the student's socialization into a disciplinary culture, and to help the student find suitable employment. These obligations can extend well beyond formal schooling and continue into or through the student's career.

The Council of Graduate Schools (1995) cites Morris Zelditch's useful summary of a mentor's multiple roles: "Mentors are advisors, people with career experience willing to share their knowledge; supporters, people who give emotional and moral encouragement; tutors, people who give specific feedback on one's performance; masters, in the sense of employers to whom one is apprenticed; sponsors, sources of information about and aid in obtaining opportunities; models, of identity, of the kind of person one should be to be an academic."

In general, an effective mentoring relationship is characterized by mutual respect, trust, understanding, and empathy. Good mentors are able to share life experiences and wisdom, as well as technical expertise. They are *good listeners*, *good observers*, and *good problem-solvers*. They make an effort to know, accept, and respect the goals and interests of a student. In the end, they establish an environment in which the student's accomplishment is limited only by the extent of his or her talent.

WHAT IS A MENTOR?

3

WHY BE A GOOD MENTOR?

The primary motivation to be a mentor was well understood by Homer: the natural human desire to share knowledge and experience. Some other reasons for being a good mentor:

Achieve satisfaction. For some mentors, having a student succeed and eventually become a friend and colleague is their greatest joy.

Attract good students. The best mentors are most likely to be able to recruit—and keep—students of high caliber who can help produce better research, papers, and grant proposals.

Stay on top of your field. There is no better way to keep sharp professionally than to coach junior colleagues.

Develop your professional network. In making contacts for students, you strengthen your own contacts and make new ones.

Extend your contribution. The results of good mentoring live after you, as former students continue to contribute even after you have retired.

FACTS

THE MENTORING RELATIONSHIP

The nature of a mentoring relationship varies with the level and activities of both student and mentor. In general, however, each relationship must be based on a common goal: to advance the educational and personal growth of the student. You as mentor can also benefit enormously. There is no single formula for good mentoring:

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mentoring styles and activities are as varied as human relationships. Different students will require different amounts and kinds of attention, advice, information, and encouragement. Some students will feel comfortable approaching their mentors; others will be shy, intimidated, or reluctant to seek help. A good mentor is approachable and available.

Often students will not know what questions to ask, what information they need, or what their options are (especially when applying to graduate programs). A good mentor can lessen such confusion by getting to know students and being familiar with the kinds of suggestions and information that can be useful.

In long-term relationships, friendships form naturally; students can gradually become colleagues. At the same time, strive as a mentor to be aware of the distinction between friendship and favoritism. You might need to remind a student-and yourself-that you need a degree of objectivity in giving fair grades and evaluations. If you are unsure whether a relationship is "too personal," you are probably not alone. Consult with the department chair, your own mentor, or others you trust. You might have to increase the mentor-student distance.

Students, for their part, need to understand the professional pressures and time constraints faced by their mentors and not view them as merely a means-or impediment-to their goal. For many faculty, mentoring is not their primary responsibility; in fact, time spent with students can be time taken from their own research. Students are obliged to recognize the multiple demands on a mentor's time.

At the same time, effective mentoring need not always require large amounts of time. An experienced, perceptive mentor can provide great help in just a few minutes by mak

ing the right suggestion or asking the right question. This section seeks to describe the mentoring relationship by listing several aspects of good mentoring practice.

Careful listening. A good mentor is a good listener. Hear exactly what the student is trying to tell you-without first interpreting or judging. Pay attention to the "subtext" and undertones of the student's words, including tone, attitude, and body language. When you think you have understood a point, it might be helpful to repeat it to the student and ask whether you have understood correctly. Through careful listening, you convey your empathy for the student and your understanding of a student's challenges. When a student feels this empathy, the way is open for clear communication and more-effective mentoring.

Keeping in touch. The amount of attention that a mentor gives will vary widely. A student who is doing well might require only "check-ins" or brief meetings. Another student might have continuing difficulties and require several formal meetings a week; one or two students might occupy most of an adviser's mentoring time. Try through regular contact-daily, if possible-to keep all your students on the "radar screen" to anticipate problems before they become serious. Don't assume that the only students who need help are those who ask for it. Even a student who is doing well could need an occasional, serious conversation. One way to increase your awareness of important student issues and develop rapport is to work with student organizations and initiatives. This will also increase your accessibility to students.

Multiple mentors. No mentor can know everything a given student might need to learn in order to succeed. *Everyone benefits from multiple mentors* of diverse talents, ages, and personalities. No one benefits when a mentor is too "possessive" of a student.

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GOOD MENTORING: SEEKING HELP

A white male professor is approached by a black female undergraduate about working in his lab. She is highly motivated, but she worries about academic weaknesses, tells him she is the first member of her family to attend college, and asks for his help. He introduces her to a black male colleague and a white female graduate student in related fields who offer to supplement his advice on course work, planning, and study habits. He also seeks information about fellowships and training programs and forwards this information to the student.

Comment: This student already has an essential quality for academic success—motivation. By taking a few well-planned steps, an alert mentor can help a motivated student initiate a network of contacts, build self-esteem, and fill academic gaps.

STYLES

Sometimes a mentoring team works best. For example, if you are a faculty member advising a physics student who would like to work in the private sector, you might encourage him or her to find mentors in industry as well. A non-Hispanic faculty member advising a Hispanic student might form an advising team that includes a Hispanic faculty member in a related discipline. Other appropriate mentors could include other students, more-advanced postdoctoral associates, and other faculty in the same or other fields. A good place to find additional mentors is in the disciplinary societies, where students can meet scientists, engineers, and students from their own or other institutions at different stages of development.

Coordinate activities with other mentors. For example, a group of mentors might be able to hire an outside speaker or consultant whom you could not afford on your own.

Building networks. You can be a powerful ally for students by helping them build their network of contacts and potential mentors. Advise them to begin with you, other faculty acquaintances, and off-campus people met through jobs, internships, or chapter meetings of professional societies. Building a professional network is a lifelong process that can be crucial in finding a satisfying position and career.

PROFESSIONAL ETHICS

Be alert for ways to illustrate ethical issues and choices. The earlier that students are exposed to the notion of scientific integrity, the better prepared they will be to deal with ethical questions that arise in their own work.

Discuss your policies on grades, conflicts of interest, authorship credits, and who goes to meetings. Use real-life questions to help the student understand what is meant by scientific misconduct: What would you do if I asked you to cut corners in your work? What would you do if you had a boss who was unethical?

Most of all, *show by your own example what you mean by ethical conduct.* You might find useful the COSEPUP publication *On Being a Scientist: Responsible Conduct in Research* (1995), also available on line.

POPULATION-DIVERSITY ISSUES

In years to come, female students and students of minority groups might make up the majority of the population

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ADVICE FOR NEW MENTORS

For most people, good mentoring, like good teaching, is a skill that is developed over time. Here are a few tips for beginners:

- Listen patiently.** Give the student time to get to issues they find sensitive or embarrassing.
- Build a relationship.** Simple joint activities—walks across campus, informal conversations over coffee, attending a lecture together—will help to develop rapport. Take cues from the student as to how close they wish this relationship to be. (See “Sexual Harassment” in section on Population-diversity issues.)
- Don't abuse your authority.** Don't ask students to do personal work, such as mowing lawns, baby-sitting, and typing.
- Nurture self-sufficiency.** Your goal is not to “clone” yourself but to encourage confidence and independent thinking.
- Establish “protected time” together.** Try to minimize interruptions by telephone calls or visitors.
- Share yourself.** Invite students to see what you do, both on and off the job. Tell of your own successes and failures. Let the student see your human side and encourage the student to reciprocate.
- Provide introductions.** Help the student develop a professional network and build a community of mentors.
- Be constructive.** Critical feedback is essential to spur improvement, but do it kindly and temper criticism with praise when deserved.
- Don't be overbearing.** Avoid dictating choices or controlling a student's behavior.
- Find your own mentors.** New advisers, like new students, benefit from guidance by those with more experience.

TIPS

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from which scientists and engineers will emerge. Every mentor is challenged to adapt to the growing sex, ethnic, and cultural diversity of both student and faculty populations.

Minority issues. Blacks, Hispanics, and American Indians as a group make up about 23% of the US population, but only about 6% of the science and engineering labor force. Many minority-group students are deterred from careers in science and engineering by inadequate preparation, a scarcity of role models, low expectations on the part of others, and unfamiliarity with the culture and idioms of science. Mentors can often be effective through a style that not only welcomes, nurtures, and encourages questions, but also challenges students to develop critical thinking, self-discipline, and good study habits. Expectations for minority-group students in science have traditionally been too low, and this can have an adverse effect on achievement. A clear statement that you expect the same high performance from all students might prove helpful. Be aware of minority support groups on your campus and of appropriate role models. Link minority-group students with such national support organizations as the National Action Council for Minorities in Engineering (see “Resources”).

Cultural issues. You could find yourself advising students of different cultural backgrounds (including those with disabilities) who have different communication and learning styles. Such students might hail from discrete rural or urban cultures in the United States or from abroad; in many programs, foreign-born students are in the majority. If you are not familiar with a particular culture, it is of great importance to demonstrate your willingness to communicate with and to understand each student as a unique individual. Are you baffled by a student's behavior? Remember

that a cultural difference could be the reason. Don't hesitate to ask colleagues and the students themselves for help. Finding role models is especially important for students from a culture other than yours. Examine yourself for cultural biases or stereotypical thinking.

POOR MENTORING: CULTURAL BIAS (1)

A foreign-born engineering student is reluctant to question his adviser. As a result, the adviser thinks the student lacks a grasp of engineering. The adviser tries to draw out the student through persistent questioning, which the student finds humiliating. Only the student's determination to succeed prevents him from quitting the program.

Comment: The student grew up in a country where he learned not to question or disagree with a person in authority. Had the adviser suspected that a cultural difference was at the root of the problem, he might have learned quickly why the student was reluctant to question him. When communication is poor, try to share yourself, listen patiently, and ask the students themselves for help.

STYLES

Female representation. In some fields—namely psychology, the social sciences, and the life sciences—females are well represented as students but underrepresented in the professoriate and are not always appointed to assistant professor positions at a rate that one would expect on the basis of PhD and postdoctoral student representation. In other fields—such as mathematics, physics, computer science, and engineering—females are underrepresented at all levels. In all fields, the confidence of female students might be low, especially where they are isolated and have few female role

models. If you advise female students in one of these fields, be aware that they could need extra support. Wait for cues from students, however, to avoid singling out anyone for special treatment. Be familiar with campus support groups and of female role models on and off campus.

POOR MENTORING: CULTURAL BIAS (2)

An American Indian student was having great difficulty in a course, despite genuine effort. A senior professor tutored the student for an entire semester without success. The student failed the course and left for another, less-demanding university. The professor was frustrated at having devoted many hours from his busy schedule and gotten no result.

Comment: Another faculty member decided to seek out the student to see what had happened. The student explained: "In my culture, you would never tell an older person of high authority that you did not understand what he was saying. This would be very disrespectful of his age and wisdom. So I told him I understood, but really I never understood anything he said."

In other words, the student never had told the professor directly that he could not understand him. This information had to be discovered by a third party. If the cultural tradition had been understood, the department might have tried to find a tutor closer to the student's age; the professor could have taken an oversight role to indicate his concern for the student. The student could have been helped, and the professor would have saved time.

STYLES

Family issues. Both women and men can face challenging family issues; mentors should be alert to students who need extra support when having a child, raising a child alone, returning to school after child-rearing, caring for a

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parent, suffering marital problems, or juggling the challenges of a two-career family. You might want to send a student to a colleague or counselor with special competence in family issues.

POOR MENTORING: INAPPROPRIATE BEHAVIOR

The male adviser of a female graduate student has not seen her for several months. Passing her in the hall, he squeezes her shoulder as he describes concerns about her research. He sends her an e-mail message, inviting her to discuss the project over dinner. She declines the invitation. He learns that she has redirected her work in a way he does not approve of, and he asks her to return to her original plan. He is astonished when she accuses him of sexual harassment and files a complaint with the dean's office.

Comment: In this case, the adviser erred in touching the student and extending a dinner invitation that could easily be misconstrued.

STYLES

Sexual harassment. If you mentor a student of the opposite sex, extra sensitivity is required to avoid the appearance of sexual harassment. Inappropriate closeness between mentors and students will produce personal, ethical, and legal consequences not only for the persons involved but also for the programs or institutions of which they are part.

Be guided by common sense and a knowledge of your own circumstances. Is it appropriate to invite the student to discussions at your home? During meetings, should you keep the office door closed (for privacy) or open (to avoid

the appearance of intimacy)? Make an effort to forestall misunderstandings by practicing clear communication. If you do have a close friendship with a student, special restrictions or self-imposed behavior changes might be called for.

But do not restrict students' opportunities to interact with you because of sex differences. In a respectful relationship, mutual affection can be an appropriate response to shared inquiry and can enhance the learning process; this kind of affection, however, is neither exclusive nor romantic. For additional guidance, talk with your department chair, your own mentor, or other faculty.

Disability issues. Students with physical, mental, emotional, or learning disabilities constitute about 9% of first-year students with planned majors in science and engineering. Be careful not to underestimate the potential of a student who has a disability. Persons with disabilities who enter the science and engineering workforce perform the same kinds of jobs, in the same fields, as others in the workforce. You should also keep in mind that persons with disabilities might have their own cultural background based on their particular disability, which cuts across ethnic lines.

As a mentor, you might be unsure how to help a student with a disability. Persons with disabilities can function at the same level as other students, but they might need assistance to do so. You can play a pivotal role in finding that assistance, assuring students that they are entitled to the assistance, and confirming they are able to secure assistance. Another very important role of the mentor is in making colleagues comfortable with students who have disabilities.

Many campuses offer programs and aids such as special counseling, special equipment (adaptive computer hardware, talking calculators, and communication devices).

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adapted physical education, learning disability programs, and academic support. Further, your institution's specialist in Americans with Disabilities Act (ADA) issues might provide help (for example, in securing funding from the National Institutes of Health [NIH], the National Science Foundation [NSF], and other sources). However, keep in mind that this person might know less than you do about the needs of a student in your field—for example, in the use of particular equipment.

Remember that the student who lives with the disability is the expert and that you can ask this expert for help.

Summary Points

In a broad sense, a mentor is someone who takes a special interest in helping another develop into a successful professional.

In science and engineering, a good mentor seeks to help a student optimize an educational experience, to assist the student's socialization into a disciplinary culture, and to aid the student in finding suitable employment.

A fundamental difference between a mentor and an adviser is that mentoring is more than advising; mentoring is a personal as well as a professional relationship. An adviser might or might not be a mentor, depending on the quality of the relationship.

An effective mentoring relationship is characterized by mutual trust, understanding, and empathy.

The goal of a mentoring relationship is to advance the educational and personal growth of students.

A good mentor is a good listener.

Everyone benefits from having multiple mentors of diverse talents, ages, and personalities.

A successful mentor is prepared to deal with population-diversity issues, including those peculiar to ethnicity, culture, sex, and disability.

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