
ONE-TO-ONE TEACHING AND ADVISING

In a perfect world professors would have the time to get to know every one of their students as individuals and would be able to tutor them when they had difficulties. Although this is seldom feasible, professors do have significant one-to-one contact with students. One-to-one contact occurs when a student asks a question and the professor makes eye contact while answering the question. It also occurs when a student asks a question after class or in the hall, and when a student comes to the professor's office to ask questions. Although brief, these encounters have a considerable impact on his or her rapport with students; thus one-to-one contact has a major effect on the professor's effectiveness as a teacher. Advising and counseling usually involve significant one-to-one contact with students. The area where many professors have the most contact with individual students is in serving as research advisers for graduate students.

The one ability which is common to all these examples is skill in listening. Actively listening to people and responding so that they know you understand is a necessary skill for excellent one-to-one teaching and advising. Unfortunately, this ability is often neglected. Listening skills will be discussed first, and then particular one-to-one teaching and advising situations will be considered.

10.1. LISTENING SKILLS

Everyone who writes about listening laments the lack of skill in this important communication area. Professors who take the time to listen to students will benefit, and their students will greatly appreciate the rare chance to be heard. This will increase the professor's effectiveness as a teacher significantly. However, learning to listen can be very difficult for

professors since many of them really do like to talk. Listening skills are also critical for effective advising and tutoring. If one of the goals of your department is to improve the communication skills of the engineering graduates, then it may be appropriate to teach students to improve their listening skills. Exercises that do this can easily be incorporated into laboratory and design courses.

Listening is a skill that can be learned, but practice is required. Listening skills are discussed in many counseling books (e.g., Bolton, 1979; Brammer, 1985; Edwards, 1979; Hackney and Nye, 1973), in many books on teaching (e.g., Eble, 1988; Lowman, 1985; McKeachie, 1986), and in articles in the engineering education literature (e.g., Katz, 1986; Miller, 1980; Root and Scott, 1975; Stegman, 1986; Wankat, 1979, 1980). Reading about listening skills can be a first step in improving these skills, but long-term gains require practice.

10.1.1. Setting the Climate

As the professor you must first create a climate so that listening can occur. To become known as someone who listens, you must be available, and the easiest time to be available for the largest number of students is before and after class. Students must come to class anyway, so the barrier to talking to the professor is significantly less than in coming to the professor's office. Make a point to come to class five or ten minutes early. Not only will this give you a chance to make sure that the room is ready for class, but it will send a subtle message that you are interested and looking forward to the class. It also gives students a chance to talk to you. Early in the semester it is useful to walk around the room with your class list, talking to students and learning their names. Later in the semester students will come up to you to talk.

Students often have questions after a class; by staying a few minutes you can further develop a rapport with them. To do this you may have to avoid scheduling a meeting immediately following the class. If the after-class period is too rushed, you might consider finishing class five minutes early. Since you don't want to delay the start of the next class, it helps to be available for short questions in the hall. Office hours are useful for longer discussions and for dealing with private concerns of students (see Section 10.2).

Professors and students are not equal. As the professor you have significantly more knowledge and experience in the subject area. In addition, you have power over the student. These inequalities in power and status inhibit some students (nothing inhibits other students). You can facilitate student interaction by making the environment more equal. Reduce barriers: Step from behind the podium and take a few steps toward the students. Wander in the audience to solicit interactions with students. Be relaxed and nonverbally encourage students to talk. Sitting down on the edge of a table or desk indicates that you are relaxed and have time to talk. Rearrange your office so that the desk is not a barrier between you and the students. (If you are new to academe and feel a bit insecure, you might want to have the desk between you and the students.)

A professor's attitude is important. Those who want to help students telegraph this attitude to them. Generally speaking, people who are classified as feeling types on the Myers-Briggs

Type Indicator (see Chapter 13) will have an easier time conveying to the students the impression that they want to listen. Thinking types need to think about the students' feelings. Perceptives tend to enjoy the uncontrolled give-and-take of discussions with students, while judging types need to schedule this time for students. By knowing yourself, you can adjust to be available and to listen to students. A note of caution: If you don't particularly like students but love the content, don't try to fake being the students' friend. They will see through your facade. Aloof professors who are content experts can be good teachers (see Table 1-1).

To encourage interaction with students, professors need to be nonjudgmental: There are no "dumb" questions. There are questions which show a lack of understanding, and there are questions you don't understand. The purpose of listening is to clarify your understanding of the questions so that you can help students understand the material. It is also helpful to avoid being defensive. This can be difficult when students are angry and are attacking a test, and may be attacking you. Although there are no dumb questions, there are hostile ones. Sometimes acknowledging a student's feelings (see Section 10.1.2) will calm her or him so that he or she can listen to facts. Sometimes humor is useful in deflecting the hostility. If no progress is made, offer to talk to the student privately after class. Discipline problems are discussed in detail in Chapter 12.

Being nonjudgmental does not mean "anything goes" or that there are no standards. Instead, it means that actions and behaviors are evaluated, not the inherent worth of the student. There are times "when a student is rationalizing about the difficulties and needs to be told bluntly to make an attitude adjustment and work harder (or more efficiently)" (Herrick and Giordano, 1991). When being blunt with a student, tell him or her the probable consequence of actions or inactions, but without a character analysis.

10.1.2. Focus

A professor's first focus should be on the student. Make eye contact, move or lean toward him or her, offering nonverbal encouragement. Listen to what the student says completely without trying to formulate your response before he or she is finished. Use your brain's "free time" to ask yourself questions about what the student is trying to say. What is the underlying message that may be hidden in the student's response? (Katz, 1986). A useful technique is to paraphrase the question briefly after the student is finished. This ensures that you have understood it, and in a classroom situation ensures that everyone has heard the question. Repeating the question also gives you a little more time to formulate an answer to the question.

Your focus should be on the student's problem being considered. The best atmosphere for a class is one where the professor is present to help the students master the objectives. Unfortunately, in many classes the professor is the enemy. Anything that you can do through one-to-one contact to help students feel that you are there to help them learn helps improve the atmosphere in the classroom. How much of the student's problem should be solved by the professor and how much by the student is a judgment decision which is discussed in Section 10.2. Another trick for focusing on a speaker's message is to take notes. This may help you

listen and pay attention at faculty and committee meetings, seminars, after-dinner speeches, and so forth. It is also appropriate to encourage both undergraduate and graduate students to take notes in meetings with you.

There should also be some focus on emotions. Emotions are always present, and if not dealt with directly may prevent communication and learning. This is particularly appropriate in private, but can also be appropriate in a classroom. In class, it is usually sufficient to acknowledge the emotion and then move to the content of the question. For example, “This appears to be an emotional issue for you. Let’s look at it from another angle”; or, “I see that you are upset about the grading of this test. Let me answer the question now and then we can discuss the grading after class.” In private, more time can be spent exploring the student’s emotions (see Section 10.3).

Although it is appropriate to focus on the student’s emotions, it is usually not appropriate to focus on your emotions as the professor. Try to remain rational and nondefensive. This is particularly true in class where an emotional outburst can do significant damage to your standing and credibility. Unwind later by talking to a friend.

10.1.3. Responses

Individuals make nonverbal, minimally verbal, and verbal responses to others. An additional response is silence. All these responses should be congruent. Students receive a confusing mixed message if your words do not agree with the nonverbal signals. This is one reason why most people cannot fake interest or caring for long periods.

Nonverbal messages include facial expressions, eye contact or lack of eye contact, interpersonal distance, hand gestures, and body language (Axtell, 1991; Miller, 1980). In Western cultures direct eye contact with occasional breaking and reforming of the contact is expected. Leaning forward is usually interpreted as a sign of interest, as are nods and encouraging hand gestures. An open stance or sitting position is interpreted as signifying openness, whereas crossing one’s arms suggests a closed position. Clenched fists are often interpreted as anger, as are angry facial expressions. These are powerful signals which most individuals raised in a Western culture transmit and receive unconsciously (Axtell, 1991). The signals are often so powerful that words are ignored if they are incongruent with the message.

An individual can change the nonverbal messages he or she is sending. Changing behavior often changes the individual’s feelings. For example, if you find that you have your arms tightly crossed and you are resisting listening to a message at a meeting, purposely opening your arms and relaxing will probably result in your being more open to listening. Since changing behavior often changes underlying emotions, it is useful to monitor and change the nonverbal clues you are sending to your students. One problem with nonverbal messages is that they have to be interpreted, and thus they may be misinterpreted. For example, the tightly crossed arms in the previous example may simply mean that the person is cold, while it is interpreted as being closed to an idea. In addition, the nonverbal messages of different societies are different (Axtell, 1991). In India shaking one’s head signifies agreement, not

disagreement as it does in Western society. The appropriate degree of eye contact and comfortable interpersonal differences are very different in different societies. If you are listening to one of your students and the nonverbal and verbal messages appear to be incongruent, it may be that you are misinterpreting her or his nonverbal messages. And he or she may be misinterpreting your nonverbal messages.

Minimal verbal messages are sounds like “uh” and “uh-huh” and words like “oh,” “yeah,” and “OK” which do not convey much meaning but encourage the person to keep talking. Minimal verbal messages sent by the listener usually imply that he or she is paying attention and understands the speaker. These messages are often used in private conversation, although they are also appropriate when a student is talking in class. If speakers often act as if they don’t know whether you are listening, you may need to increase your use of minimal verbal messages. However, faking minimal verbal messages when you aren’t listening will get you into trouble fairly quickly.

Verbal messages are an important part of the active listening process. Probes are questions or directives which ask the speaker to tell more. Probes can be nonspecific, “Elaborate on that” or “Tell me more”; or quite specific, “What would one observe if the weld was bad?” or “You are confused about the application of Kirchhoff’s laws in this situation.” Probes are often more effective if they are open-ended questions or directives which cannot be answered with a simple yes or no response. If you ask closed-ended questions and get yes or no responses, then change the questions to make them open-ended.

Paraphrasing what the person has said in your own words is a useful method for letting him or her know that you understand. With student questions it is useful to rephrase the question, and with both paraphrasing and rephrasing it is appropriate to ask if your interpretation is correct. Summarizing long statements in both classroom and private discussions is another useful active listening technique: “What I heard you say is” Again, it is important to check with the speaker that the summary is correct.

Silence is not golden if it does not encourage communication or becomes threatening. Use silence to encourage communication, not to punish students. Professors usually do not pause long enough after asking questions. A period of silence is necessary to allow students time to respond. In class this will be less threatening if you do something useful during the period of silence. For example, ask a question, clean off the blackboard, and then turn back to the students for an answer. Silence, perhaps punctuated with a nonverbal response, is also an appropriate response when a student is clearly processing information and is not ready for more communication.

Silence can also be very useful when students are trying to manipulate the professor. A common ploy is for a student to tell all the reasons why he or she will have trouble handing in an assignment on time or taking a test when it is scheduled, but never make a direct request for a postponement. Since no request has been made and no question has been asked, there is no need to respond. Silence is an effective counterploy since it forces the student to be honest about the request. An alternative response is to use a probe such as “Well, what are you going to do about it?” There is a final use for silence. When a student breaks down and starts crying in your office (yes, this can happen), one appropriate response is to offer a tissue and be silent until he or she has regained control.

TABLE 10-1 COMPARISON OF LISTENING AND NON-LISTENING BEHAVIORS (WANKAT, 1979)
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| | Non-listening behavior | Listening behavior |
|---------------------------|---|---|
| Time limitations | Does not mention time limitations, but shows in obvious ways he/she is busy | Honest about time limitations |
| Climate | Defensive— 1. Evaluates and judges 2. Tries to control speaker 3. Uses strategy 4. Is neutral and avoids feelings 5. Shows superiority 6. Is certain and dogmatic | Open and Supportive— 1. Non-evaluative and non-judgmental 2. Problem-oriented 3. Is honest and spontaneous 4. Accepts and shows feelings 5. Sets up an equal environment 6. Tentative about conclusions |
| Focus | 1. Internal – self-conscious 2. External – on other work 3. Other – does not watch speaker 4. Interaction – on mechanics of the conversation | 1. On speaker 2. On speaker's topic 3. Looks directly at speaker 4. On what is being communicated |
| Non-verbal behavior | Non-attending – closed posture, expressionless face, faces away from speaker | Attending – open posture, shows expression on face, looks at and leans toward speaker |
| Dialogue | No dialogue – either silent or monopolizes conversation | Dialogue – reflects and summarizes what speaker has been saying, clarifies unclear points, asks relevant questions |
| Overall attitude conveyed | Not interested | Interested |

10.1.4. Comparison Between Listening and Nonlistening Behavior

Table 10-1 presents a brief comparison of listening and non-listening behavior. This can serve as a useful checklist for monitoring your behavior or for helping students improve their listening skills.

10.2. TUTORING AND HELPING STUDENTS

We are using an inclusive definition of tutoring to include helping students before and after class, during office hours, in special help sessions, in the halls and on the telephone. We rejected the idea of calling this section “Office Hours” since only a fraction of the students in a class come to see a professor during office hours. A majority of students can receive

individual attention and at least minimal amounts of tutoring when the professor broadens her or his availability.

10.2.1. Tutoring Locations

Right before and right after class are the most efficient times for tutoring because many students ask questions then but are not tempted to visit with the professor. Coming to class early and staying late also shows accessibility and interest in the students. This technique is one of the few methods which is efficient and effective for both students and professors, and we strongly recommend that you try it. Since there are minimal barriers to the students, the hall can also be an effective place for informal student contacts. Professors who are open, and friendly and know the names of their students are often asked questions in the hall. Many of these questions can be answered immediately. For questions requiring more time or the use of a blackboard, you can make an appointment with the student or invite her or him into your office immediately. Taking a student with you into your office is one way to encourage students who otherwise would never come on their own.

Office hours are useful for the “regulars” who will use them. Unfortunately, many students, particularly introverts, who could benefit from help do not take advantage of a professor’s office hours. Encourage the whole class to visit both you and the TA during office hours. (Of course, be sure that both you and the TA keep office hours.) Private notes on returned homework and tests asking students to come in and see you or the TA can also be effective. In lower division courses it may be appropriate to tell struggling students that they must come in. This fits in with our general strategy of being more directive to beginning students. Some professors require all students to stop in early in the semester as a way of getting to know them. This also reduces the barrier to students’ coming to see you.

Telephones can also be used for long-distance tutoring. For television courses at remote sites, telephone contact with students is indispensable. Usually, a specified time is set aside when the professor will be available for phone calls about the course. Most students never use this service, but the existence of the service is important psychologically. Similarly, set-aside hours with the TA or the professor available to answer phone calls can be used for on-campus students. This service is particularly valuable for commuters who might find it difficult to come in for scheduled office hours.

Should you give your home telephone number to students and encourage them to call you at home? This is your decision. Some professors do this and some do not. If you do, it is appropriate to set limits on when they can call.

10.2.2. Advantages and Disadvantages of Tutoring

Tutoring and lecturing can fill complementary functions, as shown in Table 10-2, but they also differ in their ability to satisfy some of the basic learning principles listed in Section 1.4.

TABLE 10-2 COMPARISON OF LECTURING AND TUTORING

| Item | Lecture | Listening behavior |
|----------------------------------|--|--|
| Purpose | Transmit information | Troubleshooting |
| Where done | Lecture hall | Anywhere |
| Focus | Entire class | One student or small group of students |
| Coverage of material | Broad – Use of material may not be obvious to student | Narrow – immediately useful |
| Emotions | Not dealt with | Can be dealt with |
| Personal attention | Very little | Lots |
| Barriers to student use | None | Hesitant to bother professor Professor may not be receptive |
| Path | Linear/sequential | Branched/multiple |
| Information transfer | Mainly one-way | Interactive |
| Efficiency: Professor Student | High Low | Low High |
| Professor needs | Basic knowledge Ability to organize material Presentation Skills | Basic knowledge Listening skills Troubleshooting skills |
| Advantages | Good at transmitting information Efficient use of Prof's. time | Individualizes Can work on problem solving |

This comparison is shown in Table 10-3. A complete course package of lectures, tutoring, homework, and tests can satisfy all the learning principles; however, it is a good idea to try to satisfy as many of these as possible without the tutoring component since many students will not come in for tutoring.

10.2.3. Goals of Tutoring

The definition of good tutoring depends upon the goals of tutoring. The professor's goals are often to make a student a better problem solver who can become independent of the professor. Other possible goals include getting to know students better, receiving feedback about what they understand and do not understand, having an opportunity to interact more with them, motivating them to learn the material, stretching and challenging them, and minimizing the time spent tutoring.

TABLE 10-3 SATISFACTION OF LEARNING PRINCIPLES

| Learning Principles | Lecture | Tutoring |
|----------------------------------|-------------------------------|--|
| 1. Active learner | Often no | Usually yes |
| 2. Feedback | Usually no | Can include |
| 3. Knows objective | Can transmit in lecture | Could check on – but not usually done |
| 4. Motivate learner | Can happen – often doesn't | Reinforces motivation |
| 5. Individualize | Difficult | Yes |
| 6. Important types of learning: | | |
| Concepts | Yes | Can clarify |
| Apply principles | Sometimes | Yes |
| Illustrate problem solving | Can be | Can give practice |
| 7. Problem solving requirements: | | |
| Acquisition of knowledge | Yes | Can clarify |
| Practice | Usually no | Yes |
| 8. Structured hierarchy material | Yes | No |
| 9. Thought-provoking questions | Can do | Can do |
| 10. Professor enthusiastic | Can show | Can show |

Students often have a different perspective. Many want an answer to their current difficulty and are not concerned about overall development as a problem solver. However, there are students who are genuinely concerned about learning the course content and want to become better problem solvers. Some students use tutoring as a short-cut to finding information that they could clearly obtain on their own. Overly dependent students often want to check that they are doing everything correctly. They want reassurance. Students with a high need for affiliation may want to get to know the professor and use office hours for this purpose.

The dilemma for you is to satisfy your goals and at the same time satisfy enough of the student's goals. If none of the student's goals are satisfied, he or she will not return. This minimizes the time you spend tutoring but does not satisfy any learning objectives. Various methods can be used to improve tutoring.

10.2.4. Methods for Improving Tutoring

Tutoring is an art. A tutor must continually make decisions about what will be most helpful for a student at a particular time. Sometimes only a short answer or a pat on the back is needed.

In other cases significantly more time is required. Most of the suggestions in this section apply to these longer contacts.

One main advantage of tutoring is that a tutor can individualize the instruction for a particular student. Since different students want and need different things, vary your approach and responses. Observe and listen closely throughout the semester. When you meet these wants, the student will be happy and motivated. Unfortunately, this may not satisfy the student's needs. For example, someone who has trouble generalizing solution methods wants to see the solution method applied to all possible cases. What he or she needs is to learn to generalize. Good tutoring may consist of showing one additional case to satisfy his or her wants. Then the tutor can show how to generalize from the base case to the new case, and follow this by making the student generalize to another new case.

Students also require different emotional responses. One student may respond to a challenge, while another may require initial hand-holding and encouragement. Some students respond well to the Socratic approach; others become flustered and frustrated. What works best also varies from day to day. Right after a hard test is not the time to offer another challenge. By observing and listening to a student, you can get an idea of his or her emotional state. Then respond accordingly.

One important way to improve tutoring is by improving listening skills (Section 10.1). Remember to be nonjudgmental. It doesn't help a student when he or she is yelled at and called stupid. This requires patience. Without jumping to conclusions, try to find what the student's difficulties really are. Ask open-ended questions to help the student find her or his own mistake. Whenever the problem is nontrivial, encourage the student to talk. Some focus on emotions can be helpful. A very short comment such as "I see you're really frustrated" can have a remarkable effect. It frees up the student, helping her or him see you as human and to feel that you understand.

Listening is particularly important when a student has subtle misconceptions. Conceptualize what the student is thinking and compare his or her approach to possible correct approaches. Since words may be confusing, the student should write down equations or draw a figure. This can help you see what he or she is talking about.

Interest in helping students is another important ingredient in excellent tutoring. You have to want to help students, although the reason why you want to help is probably not very important. Interest is important because a student can sense it from many verbal and nonverbal clues. Interest is also important as a motivating force for the professor. Tutoring can be hard, frustrating work. Being interested in helping students provides the patience and energy needed to be an effective tutor.

When a student comes in for tutoring, the passive lecture approach has failed. Make the student do things. The student can explain an approach in detail, write equations on the board, or solve problems on paper. Involve the student in the process instead of giving another minilecture. After you explain something, don't accept the polite but often meaningless phrase, "I understand." For example,

Professor: Do you see it now?
 Student: Yeah, I understand.

Professor: Good, now finish this problem on the board.
 Student: You mean right now?

This forces the student to become actively involved. It also allows you to observe and correct mistakes as they occur. Give minor help, and allow the student to work the problem through to completion. This can provide confidence that he or she can solve the problems.

Another way to make the student be active is with probing questions which eventually lead her or him to the desired solution. Unfortunately, in our experience this does not work with all students. When it does work, it is a fine method for making the student reason his or her way through a problem.

Another method is to have the student explain your answer in her or his own words. Sometimes you'll answer one student's question and then have a second student come in and ask the same question. Ask the first student to explain the answer to the second student. This forces the first student to be active, gives you a chance to check on understanding, and fulfills the learning principle of having students teach.

Students often know concepts but are unable to use them to solve problems. Since problem solving is an art, the one-to-one contact of tutoring can help students improve their techniques. Many students have no idea how they or anyone solves problems. When tutoring, use the problem-solving strategy taught in your course. This may involve only one or two steps of the strategy or may involve going step by step through an entire problem.

For example, when a student is having trouble getting started, going over the define and explore steps is appropriate (See section 5.3).

Professor: O.K, Let's define the problem.
 Student: Well, it's written down here.
 Professor: Go to the board and draw me a figure.
 Good, now label all knowns.
 O.K., what are you asked to find?
 Good, that defines the problem. What's the next step?
 Student: It's to explore.
 Professor: What does explore mean.
 Student: Look for different possible approaches.
 Professor: Right. Give me five different ways you might be able to solve this problem.
 Student: Five?
 Professor: Uh huh, if you only have one you're not exploring.
 Student: Well I could
 Professor: Good, now let's go on and work on the most likely approach.
 Which approach is most likely to work?
 Student: I think that the
 Professor: Fine. Now let's plan how you would do that.

This approach does not produce an experienced problem solver immediately. However, it does guide the student toward improving.

When a student has put in considerable effort but is not converging on the right answer, troubleshooting is called for. Knowledge of typical student mistakes is helpful. For example, beginning students often have trouble with unit conversions or forget to convert units. A brief study of tests and homework will show you what these typical errors are in your subject.

If the difficulty is not a typical mistake, then more subtle errors must be searched for. This is where expert knowledge of the area becomes important. An expert can evaluate different approaches and find subtle errors. Excellent tutors must be subject matter experts, but not all subject matter experts are good tutors. How many times have you heard some variant of “He really knows the material, but he can’t get it down to our level.” The other ways to improve tutoring appear to be more important than becoming a subject matter expert. This is why students often make good tutors.

Several little tricks can help in tutoring. The first of these is humor. Professors with a good sense of humor are well liked even if they are hard taskmasters. Humor can aid the interaction by defusing anxiety and making learning fun. Groups of students can often be tutored at the same time. Since they often have similar difficulties, students can learn from others’ questions. The exception to this is the student who is totally lost and needs individual attention. A final suggestion is to talk to your colleagues. Find out what works for them with particular students.

10.2.5. Tutoring Problems

Time is the number-one problem. How do you find enough time to prepare lectures, tutor, do research, attend committee meetings, and do everything else which needs to be done? Tutoring does require time, and so it helps to be efficient (see Chapter 2). One method which can help you control your time is to set specific office hours for tutoring. Unfortunately, this solution can generate a new problem. What do you do about students who come in at times other than your office hours? One possibility is to respond, “I’ll help you this time, but in the future please come during office hours.” If a particular student keeps ignoring this request, he or she may be overly dependent.

The overly dependent student is another problem. To become an independent problem solver the student needs to be weaned from the professors. The student is probably getting what he or she wants, but not what he or she needs. One approach is to discuss dependence with the student. This needs to be done in a nonjudgmental fashion. For example, tell the student that employers expect their engineers to be relatively independent, and that you are worried that he or she is not learning this skill. If the dependent behavior persists, you may have to limit the student to a specified number of minutes per week. Fortunately, this extreme behavior is rare.

The opposite problem is the extremely shy student who may not ask for help even when he or she would benefit from it. Encourage the student. If this student does come in, force yourself to listen even if you are very busy. One interpersonal mistake may drive a shy or sensitive student away. For a shy student to go to a professor’s office is an act of courage. By being too busy or locking your door you may destroy this courage.

10.3. ADVISING AND COUNSELING

Probably the most neglected area in engineering education is advising, and certainly this is the area where students show the least satisfaction (Anonymous, 1986; Wankat, 1986). Inadequate advising is a commonly cited deficiency during ABET accreditation visits. Eble (1988) calls advising in college “a mess.” Hewitt and Seymour (1992) found that inadequate advising was a frequent complaint of students who left engineering. Although there has been an upsurge in interest in it, advising is still tremendously neglected as compared to teaching or research. In this section we will first discuss academic advising and then personal counseling. Professional counselors often draw a distinction between advising and counseling, but we will use these two terms interchangeably.

10.3.1. Academic Advising

Advisors need to be trained to do academic advising (Eble, 1988; Vines, 1986; Wankat, 1980, 1986). This is true for professors, peer counselors, administrative assistants, and professional counselors. Training is required for the specific information needed, in listening skills, and in specific counseling skills.

Recent studies (e.g., Light, 1990) have found that there are significant gender differences in what students want from their academic adviser. These differences are shown in Table 10-4. To some extent they may mirror differences in the percent of men and women who are feeling or thinking types according to the Myers-Briggs Type Indicator (see Chapter 13). The implication for advising is that procedures which have worked for men may not satisfy women. Tannen (1990) reports on the fascinating research on how men and women tend to differ in their conversations. In general, men communicate facts and try to maintain independence, whereas women search for rapport and connections. Within this general framework the pattern of answers in Table 10-4 makes sense.

TABLE 10-4 WHAT STUDENTS WANT FROM THEIR ACADEMIC ADVISOR.
Percent saying “very important” (Light, 1990).

| | Men | Women |
|---|-----|-------|
| 1. Will take the time to know me personally | 30 | 72 |
| 2. Shares my interests so we have something in common | 31 | 58 |
| 3. Knows where to send me to get information | 48 | 51 |
| 4. Knows the facts about courses | 64 | 43 |
| 5. Makes concrete and directive suggestions | 66 | 23 |

First, an adviser's information must be accurate and up-to-date as to the university's requirements for registration, prerequisites, dropping and adding courses, probation, transferring to a different school within the university, grade appeals, and so forth. The adviser needs to be able to tell a student the consequences of doing or not doing something. If the adviser does not know an answer, he or she needs to know whom to ask to find out. At large universities keeping up-to-date is a nontrivial task since courses, graduation requirements, and rules are continually changing. Advisers probably need to attend a meeting every semester to refresh their memories and to learn about changes.

Each school has a slightly different philosophy about advising. We believe that the responsibility for obtaining an education is the student's. The adviser is there to help, provide information, and explore alternatives with him or her, but the student must retain the ultimate responsibility. Thus, part of the function of an adviser is to help students gradually become more responsible in such things as checking for errors on a schedule, selecting a major and selecting electives, getting to know a few professors well, and eventually deciding upon graduate school or an industrial position.

Since we believe that the ultimate responsibility lies with the student, we recommend a relatively nondirective approach. Listen to the student and let her or him do most of the talking, empathize, probe, tell the student the probable consequences of a particular action, and then let the student make the decision. Of course, there are certain actions such as taking a course without the prerequisites which are not allowed, but if the action is allowed, the student should make the final decision. The adviser's expertise is important in explaining the consequences of a particular action. For example, many students are unaware of the consequences of being dropped from the university. Or, a student may not realize that dropping a particular required course will delay graduation by one year.

Many lower-division students are not ready for the responsibility of conducting their own affairs. A fairly proactive stance is appropriate for lower division students when there are signs of problems, such as excessive absences, D and F grades, probation, failure to register on time, and so forth. Phone calls, letters, and personal visits can help prevent a student from getting into serious trouble. Students often just let things go because they do not understand the probable consequences of their actions. A formal written contract with the student may be appropriate (e.g., to get a tutor). Since such students are often irresponsible, it is important for the adviser to keep notes on what has happened and what agreements have been made.

With freshmen and sophomores it is appropriate to discuss academic skills if students are having problems. Engineering professors often assume that students know how to study and understand the tricks of taking tests. Many students have not learned these skills. Study methods, problem solving, test taking tricks, relaxation methods, and methods for budgeting time can all be useful to such students. These academic survival skills can be covered informally in small groups, and students can be encouraged to form study teams. Many universities have these types of programs available through a counseling office or the psychology department.

Upper-division students should be more mature, and with them a more laissez-faire approach is appropriate. There are skills which these students probably have not learned which will be useful. In particular, being interviewed and decision making are of considerable interest to seniors. These can be taught in seminars or small groups. Individual attention with

a professor who is familiar with a given industry or with several graduate schools can be extremely helpful to students. Although students want to hear the professor's opinions, it is still important to listen to them and let them make the decision.

Advisers often have to communicate with students. At large universities it is surprisingly difficult to be sure that all or even most students understand what they are supposed to do for registration, dropping classes, company interviews, and other official tasks. Try a variety of different modes of communication. Seminars, announcements in class, bulletin board announcements, letters, catalogs, advertisements in the student newspaper, and individual discussions are different modes each of which will reach a few students that the others won't. The failure of a student to know the rules is not an excuse, but try to reach as many students as possible. Since this problem reoccurs every year, you must patiently keep trying to communicate.

Advisers can spend a great deal of time on routine matters such as registration. There are ways to make this and other routine matters more efficient. Records should be computerized to remove this burden from the advisers. Registration can be handled efficiently by the combination of a group seminar to provide information and individual sessions with the counselor for final course selection. Individual sessions are important to avoid losing students and to give the adviser an opportunity to question the student's course selections (Grites, 1980). Some students sign up for completely inappropriate courses for a variety of reasons. The adviser can catch this by asking questions.

Hiring a professional counselor, empathic administrative assistant, or peer adviser (an upper-division student) can be a cost-effective way of reducing the burden on engineering professors while simultaneously increasing the effectiveness of advising. The routine bookkeeping, processing of forms, and enforcing of discipline do not have to be done by professors. They can better spend their time advising students on professional decisions involving the choice of electives, graduate school, or industrial jobs.

At large universities many students seldom have the opportunity to speak individually with a professor—with the lone exception of engineering professors who serve as advisers. It is important for advisers to be open and take advantage of this opportunity. Use of listening skills and empathy may lead the conversation from a rather mundane presenting problem to more serious concerns. The term “presenting problem” refers to a problem which is raised by the student but which may conceal another problem—the one needing to be addressed. Oftentimes an adviser is the only official person at the university who has really taken the time to listen to the student. This illustration of caring can make a major difference in the student's career, and many times is what keeps a student in school. Doing this requires interest, time, and counseling skills which are the subject of the next section.

10.3.2. Counseling Skills for Personal Problems

Advising students on personal problems is not a major role of engineering professors, but it is sometimes required. The procedures used for dealing with personal problems are often useful for academic and career counseling. A simple crisis intervention model useful for short-

term interventions will be presented (Edwards, 1979; Wankat, 1980). Professors should always aim for short-term intervention with students with one or at most two sessions. If the professor has a student in class, then great care should be taken in counseling him or her on personal problems. The roles of teacher and personal counselor are in many ways incompatible (Lowman, 1985). All professors should be aware of the resources on campus so that they can refer students to additional help.

An ABCF model can be used to help students deal with a crisis (Edwards, 1979; Wankat, 1980). The four steps in this crisis intervention model are:

A. Acquire information and rapport. Students who come in to talk to an adviser very often have a presenting problem which is the first thing they talk about. The presenting problem is real and often is the only problem. However, there may be other problems hiding behind the problem which the student would like to talk about if given the opportunity. Advisers who are open and use listening skills give students the opportunity to discuss these deeper problems. In addition, there are often other signs of serious problems which can sometimes be noticed by casual observation: excessive absences, sudden plummeting of the quality and quantity of work, the smell of alcohol on the person, slurred speech, and so forth (Civiello, 1989).

Once it is clear that there is probably a problem, the adviser uses active listening skills to acquire information and establish rapport with the student. Empathy, which may be crucial for gaining rapport, involves knowing what it is like to walk in that person's shoes. It can be obtained by focusing on feelings since the feelings of sadness, anger, fear, happiness, and so forth are universal. The adviser may not have been in a situation similar to the student's, but he or she will have felt similar feelings. With this focus on feelings some students may become quite emotional and start crying. Signify that this is OK, give the student a tissue, and let him or her cry. The short book by Mayeroff (1971) is useful for insights into empathy and caring.

Individuals often skirt subjects that are taboo, but they probably want to talk about these issues. It is permissible to bring up issues such as death, AIDS, suicide, poverty, and broken relationships. (Note that this can be difficult for the teacher because he or she usually has to evaluate performance in class.) If you bring up a topic which is not the problem, the student will correct you. Probe, but encourage the student to do 90 percent of the talking.

Often counseling should stop at the acquiring step. People, particularly women, may want a confirmation of feelings, not problem solving (Tannen, 1990). This behavior is more likely to occur with peers who are of equal status than with students who are in a subordinate position.

B. Boil the problem down. Sometimes the student knows what the problem is and sometimes he or she has not accepted what the problem is. If it seems clear to you that the student knows what the problem is, it is OK to ask, "What's going on here?" Follow this with silence to give the student time to collect her or his thoughts. When the problem is unclear, an important function of a counselor is to help the student clearly state the problem. While in the acquiring stage you can hypothesize about the problem. Then explore if this is a possible problem by probing with open-ended questions. When there is sufficient evidence, you can formulate a problem statement and check it with the student. Do this in a tentative fashion. "It seems that the underlying problem is . . ." If the student agrees or modifies the statement

slightly, then you are ready to move on to step C. If not, return to step A.

C. Coping—help the student cope. If we think of working with students on personal problems as problem solving, then steps A and B are the define stage. Step C consists of the explore and plan stages. The adviser helps the student devise a plan to cope with the problem. Since it is the student’s problem, it is not helpful to give advice. Explore alternatives and try to get the student to set up an action plan. This may be difficult.

There are problems in which the situation cannot be changed but must be accepted. For example, a death in the family or a parent who is dying of cancer are not problems which are amenable to action. However, there are actions which may help the student, such as joining a support group, seeing a professional counselor, or taking incompletes in a few classes. These possible actions can be all be explored.

As a counselor you can serve as a resource person during the coping step. Students often do not know what resources are available on campus or in the community. They can be referred to the university counseling center, the office of the dean of students, the student hospital, the financial aid office, the local crisis center, or whatever else is appropriate. It may be helpful to call the referral office and make an appointment for the student with her or his permission.

F. Follow-up. The student needs to go out and actually carry out the action plan. It is sometimes appropriate to schedule one follow-up session to check on his or her progress and offer encouragement. This follow-up can be suggested informally (“Stop in and see me when you’ve gotten this resolved”) or formally (“Can you come in and see me at this time in two weeks?”) Whether or not a follow-up is appropriate depends on your judgment.

One paradox of helping is that the more severe the crisis, the less training the adviser needs. Natural caring and empathy are often sufficient for acute problems. Students with long-term chronic problems and dysfunctional students require trained professional counselors, social workers, or psychologists. Refer these students to the appropriate professionals.

10.4. RESEARCH ADVISERS

An extremely important type of one-to-one teaching involves being a research adviser. This role is closer to the tutoring role than that of an academic adviser or personal counselor, although it has elements of all these roles. Research advisers have two major objectives: to help students develop and become competent researchers, and to do research and publish the results. Although usually complementary, there can be conflicts between these two objectives. The resolution of these conflicts depends upon the relative importance each adviser places on the two objectives.

10.4.1. Undergraduate Research

A research experience can be extremely valuable for undergraduates, and strong arguments can be made that a senior thesis should be required (Prud'homme, 1981); or if classes are large and resources limited, undergraduate research should be an encouraged option (Fricke, 1981). Research can give students the opportunity to explore a particular topic in greater depth than would be possible in class. The student can receive individual attention from one professor and get to know this professor, “try out” research to see if graduate school should be considered, or improve his or her efficiency, time management skills, and ability to schedule complex projects. If teams are used, the student will learn how to function in a team.

Most undergraduate engineering students in the United States have little experience in working independently on a large project. Thus, initial supervision needs to be fairly structured. An undergraduate may need to be taught laboratory skills which professors normally assume graduate students know. Ideally, the professor will have time to teach the undergraduates the appropriate skills. If the professor is busy, an advanced graduate student can be assigned the duty of helping them get started. Making a graduate student the supervisor of an undergraduate provides for much of the day-by-day assistance to the undergraduate. In addition, the experience at supervision is useful for the graduate student. With this arrangement professors can meet with the team once a week and review progress and provide ideas.

The selection of projects for undergraduate research is critical. Real problems which push the knowledge level of the student are appropriate. However, the project must be doable in a finite amount of time. Team projects can be significantly more complex than individual projects (Masih, 1989). Reporting of results in both written and oral form should be part of the project requirements. If possible, it is very motivating to list the undergraduate as a coauthor of any papers resulting from the research.

10.4.2. Graduate Student Research

In most schools the major goal of research programs, particularly the Ph.D. program, is a research project and the thesis which results. Then the role of the research adviser becomes critical. This role really has no equivalent in undergraduate education, and in many ways it is essentially unchanged from that of medieval tutors. At some schools the research adviser essentially controls when the graduate student graduates, how long the graduate student is funded, what the project is, whether or not the student goes to conferences and so forth. Once the student signs on for a given project, he or she may lose many rights. Since there will always be a few professors who will abuse such a powerful relationship, the department needs to consider formal institutional controls. Since disgruntled students always know how other students are being treated, it is helpful to have uniform policies which research advisers must follow. New professors need mentoring in becoming research advisers since they have probably had only their own adviser as a role model.

In engineering most graduate students doing research receive support. Policies on how long the student will be supported to the M.S. and to the Ph.D. are useful to ensure uniformity.

Such policies also help prevent advisers from keeping students too long and prevent students from abusing the system because they enjoy graduate school. Some leniency in the cutoff date is useful for exceptional cases, but the extra period of support should be limited.

The selection of a research adviser is probably the most important decision an individual makes as a graduate student. Unfortunately, the process is often random and the student does not ask the right questions (Amundson, 1987). A better approach would be to train students in selection processes before they listen to faculty presentations and interview faculty members. Such training could include a discussion of differences in personality type (see the description of the Myers-Briggs Type Indicator in Chapter 13). In addition, students could be shown various decision methods and perhaps a list of generic questions considered important by the faculty. Since mistakes are made in the selection of a research adviser, a uniform policy on allowing students to switch advisers should be followed. Some schools require all students to interview other potential advisers at some specified point such as on completion of the M.S. Students who are satisfied with their current advisers attend these interviews in a cursory fashion. This policy protects the students and removes any stigma from switching advisers.

Palmer (1983) lists the philosophical needs of students as *openness*, *boundaries*, and an *air of hospitality*. Openness is a sense that there are few barriers to learning. Admit students to the community of scholars and expect them to learn. Firm boundaries help create an open space where students can choose interesting, meaningful research, but not so open that they run wild. Research and learning can be very painful processes since they do not represent linear paths. Therefore, the learning space must be hospitable. Both new ideas and failures must be treated gently so that the student has permission to keep trying.

10.4.3. Masters' Research

Masters students following a thesis option do research projects which in some ways are longer versions of undergraduate research. The project must be doable in a finite amount of time, which means that the professor probably needs to define most of the problem for the student. Most masters students have just made the transition from being undergraduates. Graduation does not suddenly make them mature, self-starting individuals. Many of these students need the same initial structure as undergraduates; however, graduate students should be made more independent fairly quickly. Thus, it is appropriate to define the problem for the student but require her or him to control the execution of the project. Asking a senior graduate student to train new graduate students in laboratory skills and safety practices is still a good idea. But it is probably not a good idea to use an advanced graduate student as a research supervisor. New graduate students deserve the attention of the professor.

New graduate students may not be very efficient, may not know how to do a scientific literature survey, and probably do not know how to schedule a long project. All these things need to be taught. Thus, there is a strong tutoring aspect to starting new graduate students. At the beginning of the graduate student's tenure as a student, it is useful to have regularly scheduled meetings. Even though there may be no research as yet, there are many other things to talk about. Shortly after being assigned an adviser, the student should be asked to develop

a project plan for when he or she wants to graduate. This makes the student think about what must be done to graduate. The plan can be revised on a regular basis as the student learns more about the time demands of the project. The student also needs to learn to balance the work on courses where there are immediate demands and research where there may be no immediate demands. Research also requires accepting delayed gratification.

Some discussion with the student about background and goals is appropriate. This will help develop rapport with the student. It is also useful to know where the student has come from (figuratively speaking) and where he or she is going to help design methods to motivate the student. Use active listening skills to get the student to talk about her or himself.

Regular meetings of the graduate and undergraduate students in a research group can help foster a sense of belonging. A senior graduate student can be assigned to organize the meetings. The presentation of research results to the group is a useful practice on a regular basis and makes students more polished when they make formal presentations. New students can be asked to make presentations on papers from the literature. Discussion of the presentations should be critical yet friendly. The professor can ensure that this happens. New ideas should be greeted with the PMI or another positive approach (see Section 5.6.3).

10.4.4. Ph.D. Research

When they graduate, Ph.D.'s in engineering are expected to be independent researchers. This means that they should be able to analyze a situation, define the problem, outline a plan of attack, and then conduct the research. Many companies assume that a new Ph.D. can supervise the work of technicians. In academia the new Ph.D. will be expected to generate new research ideas, supervise the research of graduate students, write proposals, review papers, teach, serve on committees, and publish. If the Ph.D. is to be able to do all these at graduation, then he or she needs guided practice in doing these or similar things while a graduate student. This need for practice guides our advising of Ph.D. students.

Since the professor usually has research money for a specific area, the general area for the Ph.D. student's research is usually set. However, within this broad area the student needs to define the problem he or she will work on. This is a nontrivial task. The easy part involves doing a literature search to see what others have done. The professor can help the student by steering her or him to the appropriate tools in the library including computer searches. During this period, attendance at a professional meeting can help the student see what the current hot areas are.

The hard part for most students is the intellectual development often required to be in charge of the research. Determining what is important and what research should be done requires that he or she be relatively mature (see Chapter 14). Most students have always been told what to do, and they find the freedom of Ph.D. research frustrating. The period of frustration can easily last a year while they work to determine "What they want." Duda (1984) notes that many students have misconceptions about graduate research, not realizing that research is a problem-solving method and that a straight, linear path seldom works. The backtracking, deadends, and lack of obvious progress can be frustrating.

Amundson (1987) suggests meeting with students on a regular basis until it becomes necessary to turn them loose. Then they need to be told to work on their own until they come up with something that is new or surprising. It must be made clear to the student that the value of a coefficient is not a surprise even if it is new, especially at the Ph.D. level. Most students respond amazingly well to this ploy and develop independent ideas. A few start their graduate programs already independent and appreciate and use the freedom to develop research on their own. A few are unable to cope and probably should be encouraged to look outside the Ph.D. program for career opportunities.

When a student does present a new idea, it needs to be accepted but with the challenge that it be further developed. Ask the student to develop the idea and then prove it theoretically or experimentally. Suggest that he or she develop twenty or fifty alternatives to the idea. Refuse to judge the idea since the student needs to learn how to do this.

While conducting research, a student needs to learn to do a host of other tasks. These can be paced over a long period so that he or she is not overwhelmed at any one time. And the student needs plenty of freedom to learn to think; otherwise, he or she may escape from thinking into mindless work on other tasks. Foremost among these tasks is learning to communicate. Encourage the student to review the literature and then write a review article with you. This is efficient since it accomplishes the necessary review process, helps the student learn how to write, and earns the student a publication early in her or his graduate student career. The review article can be completed before the student is challenged to become independent. Communication includes oral presentations. Students can be required to make oral presentations in group meetings and later at professional society meetings. These presentations need to be evaluated to help the student improve. Videotaping some of the group presentations is a good way to encourage growth. Students should be given the opportunity to review papers and proposals. This should first be a supervised activity where the professor also reviews the paper or proposal and the reviews are compared and contrasted. Then, the student can review papers and proposals independently.

After a student has learned to conduct research independently, he or she can help to supervise other students. This supervision itself should initially be supervised. That is, have meetings with the Ph.D. student, both individually and with the undergraduate student, to discuss the progress of the undergraduate student's research. Your supervision can then be slowly reduced.

After a graduate student has completed some research, he or she will want to write a research paper. Ideally, the first paper should be written after the student's M.S. thesis. Take an active role in outlining this paper and in the necessary revisions to the paper. When the reviews arrive, show them to the student. The reviews often provide for reality testing. The student should then help with revisions of the paper on the basis of the reviewer's comments. Once the student has started doing independent research, he or she needs to become independent in writing papers. After experiencing the first flush of success in publishing a paper, the student may suddenly write several papers. If these are not well done, return them with a note indicating that they are not up to professional standards, but do not provide detailed comments. Rewriting is a necessary part of writing, and the student needs to master this art.

Although it may not be appropriate to place a student completely in charge of writing proposals, he or she can certainly help prepare them. Let the student share the joys or

frustrations of submitting research proposals. Discuss with her or him the strategy you use for obtaining research support.

Students who intend to follow an academic career need additional teaching experience beyond being a TA. A course or self-study on teaching methods is useful. The chance to do supervised teaching of a class or seminar is also an excellent experience which far too few students receive.

10.5. CHAPTER COMMENTS

The ways that a professor interacts with students in one-to-one situations obviously depend heavily on the professor's personality. Some suggestions have been provided which have been found to be useful.

The section on being a research adviser is likely to be controversial. Many professors use very different procedures as research advisers. Obviously, there is no one best way to advise research students. We have clearly stated our value judgments and then suggested an advising procedure which follows these value judgments. If readers do the same, then Section 10.4. will have achieved its purpose.

10.6. SUMMARY AND OBJECTIVES

After reading this chapter, you should be able to:

- Explain and use methods to improve listening.
- Improve tutoring of students and become more effective in helping them learn.
- Improve both academic and personal advising skills.
- Outline your personal value structure for advising research students, and then develop procedures to improve your advising of these individuals.

HOMEWORK

1 Set up a role play to practice listening skills. This requires that you have a partner to take the role of a student, and a facilitator to observe the interactions and record both their positive and negative aspects. The observer needs to watch the climate, the focus, and the responses (nonverbal, minimal verbal, and verbal). Several role plays should be done. They can include the following situations.

- a** A student needing help after class.
- b** A student needing help during office hours.

- c A student needing academic advising.
 - d A student with a personal problem which is causing academic difficulty.
 - e A Ph.D. student who is having difficulty getting started on research.
- 2 List the rules and regulations for undergraduate students at your university as far as registration for classes is concerned.
 - 3 What is the purpose of Ph.D. education in your engineering field? Based on this purpose discuss what the ideal thesis adviser would do. Then develop a program to make your own advising more closely approach the techniques of your ideal adviser.

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