

# EFFICIENCY

Professors are more effective if they learn to be efficient. Ideally, this learning would be done in school (it is helpful to be an efficient student). Most new professors work long hours and still feel they don't have time to do everything they want or need to do. By being more efficient they could do more research and do a better job of teaching in less time. Being efficient requires both an attitude and a bag of tricks. This chapter draws upon Lakein (1973, 1997), Griessman (1994), Morgenstern (2004), and Covey (1989, 2004, 2013) for many of the basic ideas. Reis (1997), Boice (2000), and Deneef and Goodwin (2007) have written guides for increasing the performance of new professors while Wankat (2002) and Robinson (2013) consider all professors.

## 2.1. SUMMARY AND OBJECTIVES

After reading this chapter, you should be able to:

- Set goals and develop activities to meet those goals.
- Prioritize the activities and use to-do lists.
- Improve your work habits with respect to people interactions and other activities.
- Analyze your travel patterns and improve your time use during travel.
- Explain how time spent preparing to teach affects course effectiveness, and use methods to improve your teaching efficiency.
- Improve your research efficiency and apply approximate cost-benefit analyses.
- Use methods to control stress.
- Discuss situations when a strict application of efficiency principles may not be the most efficient in a global sense.

## 2.2. GOALS AND ACTIVITIES

Clarifying your motivation for being more efficient will help provide the energy and drive to become more efficient (Covey, 2004; Morgenstern, 2004). Often, you know what you should

do, but summoning the energy to do it is difficult. For example, you know that exercising at least three days a week is good for your health, but you often skip because . . . well, you can always find an excuse. A vision or mission for your life will help provide the energy to do what should be done (Covey, 2004, 2013; Morgenstern, 2004; Wankat, 2002). For example, some engineers want to find a cure for cancer. Yes, they know that cancer consists of multiple diseases that will require multiple cures, but their mission is crystallized in the shorthand version—find a cure for cancer. Most people who have life missions developed them slowly through working on what they believe is important and then reflecting on the results. This development probably cannot be rushed although people can prepare so that when their life mission becomes clear they are ready to focus on it.

Even in the absence of a life mission, most people know many of the things they want. To achieve what they want, they can set goals, both short- and long-term, for both work and leisure. To illustrate, a young professor's lifetime goals may include the following:

- Be promoted to associate professor and then to professor
- Become a recognized technical expert
- Be recognized as an outstanding teacher
- Develop a happy personal relationship
- Provide for children's education
- Spend a sabbatical in Europe
- Remain in good health

This is a reasonable but certainly not all-inclusive list. Your goals may be different, of course, because only you can develop your list.

A lifetime is, one would hope, a long time. Action plans are easier to develop for shorter-term goals, so a two- or three-year list of goals such as the following may be useful.

- Remain in good health
- Publish five papers in refereed journals
- Be promoted to associate professor
- Take a Caribbean cruise

Even shorter term lists such as semester lists are useful. Achieving just one or two major goals in a semester requires an unusual level of persistent effort. For this chapter to be useful you need to write down your own goals and then work to determine smaller goals that will help you achieve your major goals.

Lists of goals have the advantage of keeping you focused on the big picture, but they often include items that are difficult, which just encourages procrastination. Consider the goal "remain in good health," listed above. We can list the following smaller goals that will help one attain the goal of good health (Agus, 2014):

- Stop smoking
- Lose weight
- Be more physically active

This list is still pretty daunting and is probably too much to tackle at one time. In addition, the goals don't tell what you need to *do*. For this you need *activities*. For example, the following list will probably help someone get started on the goal of stopping smoking:

- Make an appointment to see a physician for a prescription for nicotine withdrawal
- Clean out all the ash trays and discard them

- Throw away all the cigarettes in the house
- Purchase the prescription and start taking it

Some people find it helpful to publically announce their goal so that others can be supportive while others prefer to work on the goals quietly. Do whatever works.

Activity lists should be developed for each goal. A certain amount of ingenuity may be required to develop a list of appropriate activities. For example, writing a proposal may eventually help you achieve the goal of being recognized as a technical expert. If the desired goal requires a decision by others, such as being promoted, it is helpful to determine what their requirements are for achieving this goal. Of course, requirements for promotion are often moving targets, and it may be impossible to get a firm commitment on what is required. For instance, the criteria for promotion (see Section 17.2) usually do not list the number of papers required. However, by asking several full professors you should be able to get an approximate idea of the number and type required. This gives you information to plan the right activities for reaching your goal.

Goals, whether we choose them or they are assigned to us, are extremely important, since to a large extent they control our daily work. As professors we control a significant portion of our time, but routinely fill this time with goals for teaching, research and service. Even when tasks are assigned, faculty often can negotiate what tasks they will do. For example, in many departments teaching assignments are, up to a point, negotiable. Negotiate for assignments that will help you be efficient. For example, if you will be teaching a new course, ask to be assigned it for the next three offerings so that you can reuse the material you prepare for the course. Service assignments are also negotiable. If there is a task you would like to do, make this clear by asking for it. Remember, there is a big difference between one-off and continuing tasks. A task that can be done in half a day probably just delays completing other tasks, while a continuing task often means that something else cannot be done. Department heads often need to be reminded, "If I do this task, which of my current activities do you want me to stop doing?" The same reasoning applies when other professors offer us the opportunity to work on research or other projects

### 2.3. PRIORITIES AND TO-DO LISTS

After goals and activities, set *priorities*. This involves juggling the order of the goals until you find an order which satisfies you now. Don't try to set priorities for all time. Goals are made to be changed. A professor desiring promotion may give that goal a higher priority than taking a long vacation. The long vacation can be seen as a reward for accomplishing the first goal. Professors usually must work on several goals at once. Choosing "maintain good health" first makes achieving the other goals easier, but maintaining good health requires a steady commitment. At the same time, courses must be well taught, research must be done, committee meetings must be attended, and so forth.

Meeting goals requires a day-by-day commitment. *To-do lists* and *calendars* help ensure that high-priority items are worked on. A to-do list delineates the activities that you want to work on within a given time period. Good choices are daily, weekly, and semester to-do lists. A semester to-do list includes only major projects such as papers, proposals, and books. This list is glanced at when weekly lists are prepared. A weekly to-do list includes the activities you want to do that week. Many of the activities may be assigned duties that are indirectly related to your lifetime goals, since doing them well will help you keep your job and perhaps be promoted.

Include some discretionary activities related to your high-priority goals. Also include non-work activities that are important to reaching your goals, such as swimming three times a week to be physically more active. The type of calendar used is unimportant so long as you use it. When we get busy, external memory (the calendar) is much more reliable than our own internal memory.

An ABC system can be used to set priorities (Lakeln, 1973, 1997). List on your to-do list the important items to do in the near future as A's. Include work items that have to be done, such as writing a series of lectures or a proposal. Also include activities that will help you achieve your lifetime goals and which you chose to work on this week. Include on the A list large, long-term projects such as writing a book. A mix of things that you have to do and things that you want to do makes work more pleasurable. The A jobs should be worked on during periods of peak efficiency. Putting an item on the A list does not mean that you will finish it today or this week or even this year. Instead, it is a commitment to spend a minimum of five or fifteen minutes on the activity. The purpose of this is to break down overwhelming tasks into little pieces to prevent procrastination. The five to fifteen minutes may grow into several hours of effort once you get started.

Lakeln (1973) suggests listing the A activities in order of priority, A1, A2, and so forth. B items are either less important or less urgent. If there is time, you can work on them this week. If not, the B's and perhaps some of the A's will wait for next week. C items are even less important and are held in reserve. Sometimes these items take care of themselves and there is no need to work on them. Priorities change. A paper due August 15th may be a C in June, a B in July, an A in August, and an A1 on August 14th.

Begin the week by listing the highest priority activities on daily to-do lists. If you don't get to an activity on Monday, work on it on Tuesday. On Friday, check to see which A's haven't been worked on. Either work on them then, or move them to next week's list. We found that there was no reason to continue to list B or C items since we always had more A items than we could finish. You may want to omit routine meetings and class meetings from the list since they are recorded in your calendar. If you can, arrange your schedule so that you have a chance to work on items on the to-do list early in the week and a chance to clean up at the end of the week.

It is useful to realize that most of the time urgent does not equal important. Keeping up with the literature in your specialty is important but rarely urgent. Priorities help you to be sure that important but not urgent things are done. There are urgent but less important chores such as committee work, writing thank-you notes, and preparing expense reports that must be done. Do these all at one time when your energy is running low and you need a break from important activities.

In setting up priorities it is useful to think about *critical paths* for large projects. Think about what needs to be done in what sequence so that the whole project can be completed quickly. This is illustrated in Figure 2-1 for an experimental research project. It is important to do the preliminary design quickly so that equipment can be ordered. New graduate students often do not realize that it may take from one month to more than a year for equipment to arrive. If ordered early, the equipment may be available when the experimenter is ready for it.

Ideally, researchers will follow the straight path through the entire process; however, this seldom occurs. Usually, there is significantly recycling back to one of the earlier steps. After recycle some of the intermediate steps may be skipped (for example, when a close look at the system as actually constructed helps to explain unexpected experimental results). Note that we recommend that the parts of the paper should be written throughout the research project.

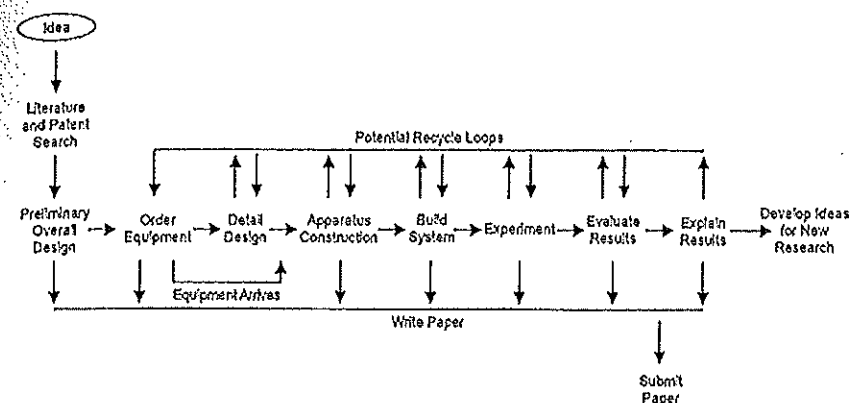


Figure 2-1. Critical Path and Potential Recycle Loops for Experimental Research Project

A major problem with planning, to do lists and schedules is that people routinely overestimate how efficient they will be and underestimate the time required to complete tasks (Dunning et al., 2004). As an example, we did not graduate with our PhDs when we thought we would and we have never had an MS thesis student or a PhD student graduate on time following their schedule. This *planning fallacy* occurs even for worst-case scenarios.

A second problem with priorities and to-do lists is becoming too work-oriented and forgetting to "stop and smell the roses." Loosening up on the rigidity of the list will probably help. Consider most items on the list as a guide and don't worry if you don't work on a particular task. Try to be productive without being rigid about following a schedule. Saturated with one project? Switch to something else. This is often a good time to initiate people contact either face-to-face or electronically. Alternatively do non-urgent but important chores.

## 2.4. WORK HABITS

Goals set? Activity lists developed? It's time to consider our work habits. Work habits have a major effect on how efficiently we satisfy our goals and thus are the subject of many books on time management and efficiency (e.g., Covey, 1989; Grlessman, 1994; Morgenstern, 2004; Lakein, 1973, 1997; Mackenzie and Nickerson, 2009).

### 2.4.1. Interactions with Coworkers

Visiting. Much of a professor's time is spent interacting with various people, so your work habits involving people are important. Determine when and where you work most efficiently by yourself and with others. Some prefer blocks of time in the morning to work alone, while others prefer the afternoon. For some an hour at a time is sufficient, while others need much longer periods. In working with others, do you prefer a formal schedule or an informal drop-in policy? Only you can determine these individual preferences. A useful

way of looking at these individual preferences is with the Myers-Briggs Type Indicator (MBTI), discussed in Chapter 13.

Once you have discovered the most efficient way to work, arrange your schedule and control interruptions and visitors. Listed office hours are very useful. If a student comes in at another time when you are busy, say, "I only have a couple of minutes now, but I'd be happy to spend more time with you during my office hours." This approach is most acceptable to the student if you have office hours four or five days a week and you have the reputation of being in your office for your office hours. Of course, students prefer an open door policy. A second method to control interruptions is to say *no*, but this is only acceptable to students if you share a good reason, such as preparing for a class in one hour, and if you can offer an alternate time.

Controlling the length of visits is also important. Perhaps surprisingly, the worst offenders are often colleagues. When the visit has lasted long enough, stand up and say, "It's been nice talking to you, but I have to get back to work." With more senior professors you can joke that the work of assistant professors is never done. Escort your visitor to the door and invite them to visit again. Controlling the length of visits can be done politely but firmly.

Another method for controlling interruptions is to hide. A second office or an office at home or a table at a local coffeehouse can be a good place for work requiring solitude. Most students do not become upset if they can't find a professor, although they become very upset if they find the professor and he or she does not have time to talk.

Secretaries. Some universities do not provide secretarial assistance to professors because of budgetary constraints. This short-sighted view squanders the much more valuable professional resource. Unless you have had industrial experience, you probably have never worked extensively with a secretary. The situation is complicated since you are undoubtedly not the only boss and are probably one of the less important bosses from the viewpoint of your secretary. If you are lucky enough to have the services of a secretary, how can you best use her or his capabilities to help both of you do your jobs better?

Peters and Waterman (2004) note that outstanding companies obtain productivity through people. A productive professor treats secretaries, teaching assistants (TA) and undergraduate assistants (UGA) with respect. Realize that they have other responsibilities besides your jobs. Plan ahead and help them plan ahead. Develop a "win/win" atmosphere where both you and your office or research staff can work efficiently (Covey, 1989). If you have a number of assistants working with you (e.g., as TA and UGA for a large course) it is important to communicate clearly so that everyone understands what you want. Try to make your staff partners with you even though they only work part time with you. Short weekly meetings allow you to go over what needs to be done that week and it gives everyone a chance to determine how the work will be accomplished. Since students all have other duties, encourage them to trade off tasks when necessary. But be sure that the trades are written down so that everyone has a clear to do list. If there is not a close deadline, ask if one time is better for getting a project done than another. Give a warning when there is a big project such as a proposal coming up. If something is not needed quickly, provide a due date. If you consistently give materials on time, then when there really is a big rush, your fairness will be rewarded with an all-out effort. When someone has really gone out of the way to help you with a big project, reward him or her appropriately—candy, flowers and gift certificates are always appreciated. Praise never goes out of style. Finally, your mother was right—"please" and "thank-you" are magic words.

Teaching Assistants. Both undergraduate and graduate teaching assistants can be extremely helpful, particularly in large classes. However, new teaching assistants often have no experience in grading and need to be trained. Your goal is to make the TA a partner in teaching the course. Discuss the following before the semester starts.

1. *Your expectations.* TA duties usually start before the semester starts and continue until grades are due. The TA may not realize that he or she has contracted for this time.
2. *Attendance and note taking at your lectures.* Otherwise, the TA will be very rusty in grading and helping students.
3. *Proctoring tests.* In large classes extra help is always useful.
4. *Office hours.* Help the TA set required office hours at times convenient to both the students and the TA. Adjusting office hours weekly to meet student needs will significantly increase student attendance at office hours (DeVilbiss, 2015). Expect the TA to be available during office hours but protect him or her from excessive demands from students at other times.
5. *Scoring.* Explain in detail how you want scoring done (see also Section 11.3). Remember this is probably a learning experience for the TA or UGA also. For the first few assignments grade a few problems to serve as examples. Check over the scoring and give feedback so that the TA or UGA can improve as a grader. Expect a reasonable turnaround on grading, but tell graders in advance when a heavy grading assignment will be coming. If students ask for regrades, work with the grader. Listen to the TA's rationale for assigning grades. Try to balance consistency in grading with fairness.
6. *Recording grades.* One TA can be responsible for the online gradebook.
7. *Student interaction.* If laboratory or recitation sections are involved, encourage the TA to prepare ahead of time and to learn the names of students. Laboratory TAs should know how to operate all the equipment and they should be aware of any safety hazards.
8. *Efficiency.* Arrange the TA's workload so that it can be done in the amount of time the person is being paid for.
9. *Professional expectations.* Clearly explain your and the school's expectations for professional behavior.
10. *Training programs.* If one is available, encourage or insist that your TA enrolls. TA training programs that include multiple components such as practical pedagogy, practice teaching, and opportunities for discussion increase the performance of TAs (Richards et al., 2012).
11. *Reflection.* TAs will gain more from the experience if they reflect on both the positive and negative aspects of being a TA (Wiedert et al., 2012).
12. *Mentoring.* TAs who are interested in becoming professors should be mentored so that the TA position also serves as a professional internship.
13. *International TAs.* TAs from other countries will often benefit from contact with American undergraduates and the undergraduates often gain a better understanding of other cultures from international TAs. However, international TAs, particularly those who were not undergraduates in the USA, often have difficulty adjusting to American customs. Student-teacher interactions may be different than in their home country, and American students may appear rude or overly informal. You may need to explain clearly to international TAs that US standards of behavior in many pro-

essional areas, such as behavior towards women, are different from those in many other countries. Students lacking fluency in English should not be used in positions where they will have extensive contact with students.

**Other Support Personnel.** There are always other personnel in the department who do important work but are often ignored. They include janitors, shop personnel, laboratory instructors, instrumentation specialists, storeroom clerks, business office personnel, information technology people, and so forth. Treat them and their work with respect. Many of the support personnel are interesting people with a long history in the department. Be friendly and listen when they talk. Since their viewpoints are different from professors', you can learn things you will never learn if you only talk to professors. If you feel comfortable with it, ask them to call you by your first name. In some departments they have significant student contact, and they may know the students better than most of the professors. If so, they can be very helpful if you have any problems with particular students.

A professor must be honorable and honest in all dealings with secretaries, TAs, and other support staff. Thus, do not ask them to do personal favors or anything illegal or unethical. Respect their privacy and what little personal space they have. Ask permission before you borrow any equipment or use any of their equipment such as personal computers. Finally, be sure that your TAs and research assistants also treat the support staff appropriately.

### 2.4.2. Miscellaneous Efficiency Methods

Covey (1989), Lakein (1973, 1997), Mackenzie and Nickerson (2009), Robinson (2013), and Wankat (2002) suggest a variety of methods for improving the use of time.

**Avoid perfectionism.** Manuscripts can be revised endlessly, and yet the reader will never think they are perfect. At some point you have to let go and put out a less-than-perfect, but not sloppy, manuscript. This same reasoning is applicable to other work such as lectures.

**Reward yourself and take breaks.** Most of us become very inefficient if we try to work all the time. You might recommend to your graduate students that they take at least one day a week off and do no work on that day. This will pay off in terms of long-term efficiency, and overall work production will actually increase despite working fewer hours. Most people also need vacations (even assistant professors). Over a five- or six-year period an assistant professor will probably enjoy life more and get more done if he or she takes at least one week of vacation every year.

**Use the same work several times.** The most obvious application of this is teaching the same course several times. Then the work spent in setting up the course is reused when you teach it the second and third times. Teach courses in your research area. Time spent on research will help you present a more up-to-date course, and time spent on the course will help you better understand your research area. Another example is the preparation of a literature review. This work can be published, serve as the literature review of a proposal, be presented as a paper, or serve as the basis for several lectures.

**Bogged down?** Change your work environment or your task. Carrying work to the library, college union, or local hangout can provide just the change you need. Switching tasks can provide a needed break. If proofreading has you down, read a technical journal for half an hour.

**Use odd moments to do useful work.** Can you do useful work while you commute on public transportation to work? (Note that relaxation may be the most useful thing to do.) Plan

work for trips (see Section 2.4). Take a book or papers to grade to the doctor's office. Figure out what works for you for those ten- or fifteen-minute periods that are not long enough for a "serious" project.

**Do not multi-task.** Although many people, particularly students, think they are good at multi-tasking, they have not compared how much they accomplish compared to focusing their attention on a single task. Scientific studies show that no one is good at multi-tasking (Chew, 2011). This is particularly true if the task requires concentrated effort such as studying.

**Handle mail and e-mail more efficiently.** The general rule is to minimize the number of times you handle it. There is no law that says that you must open junk mail or junk e-mail. If you *do* open a piece of mail or an e-mail, try to respond immediately or at least be sure that you do something to move it forward each time you pick it up. You can help your correspondents by including your telephone number and e-mail address in your messages.

The advent of e-mail brought on a host of problems that seldom occurred with regular (snail) mail. Regular mail normally was safe and did not carry viruses. Even with virus protection opening unknown files is dangerous. Ironically, e-mail and Twitter go out too quickly. With regular mail there would be a wait while a secretary prepared a corrected, neat copy of the letter. During this wait people could calm down and decide that sending the letter was not wise. E-mail and tweets can be sent immediately and cannot be recalled. So, never send an e-mail or tweet when you are mad. Proofread all e-mails. Many readers will dismiss your e-mail if it is poorly written. Recipients are more likely to read your e-mail if the subject line is specific about the topic. E-mail and tweets also have the annoying habit of showing up at inconvenient times. There is no law that says you have to open it or respond immediately. If you do not have time for a detailed response, send a short e-mail stating that their e-mail has arrived and will be answered in a day or two when you have time to provide the measured response it deserves.

**Carry a small notebook, pocket calendar, smart phone, or other scheduling device at all times.** Then you can record appointments and, if necessary, transfer them to another calendar later. This helps you to avoid missing meetings. The notebook or device can also be used to jot down ideas, record references, list names of people you meet, and so forth.

## 2.5. TRAVEL

Travel can be exhilarating and broadening, but also exhausting. The interest and energy generated is very high when you seldom travel (say, once or twice a semester). As you travel more often, the interest in each trip decreases. The first trip is very exciting; the fifth trip in the same year is a lot less so. Every trip involves a certain amount of hassle in developing plans, buying tickets, arranging for colleagues to teach your classes while you are gone, and so forth. In addition, when you return you have to catch up on the work you missed while you were gone. These hassles and the work you have to make up lead to a tiredness factor. Cumulatively, tiredness increases as you make more and more trips. The combination of interest and energy generated by the trip and energy drained by the trip is the efficiency curve shown in Figure 2-2. This curve goes through a maximum at a certain number of trips per semester. An additional factor is the effect of your travels on your spouse or significant other. (Even pets don't like to be left alone.) However, a partner who travels with you may be more positive about traveling, and a partner can help reduce the tensions of traveling.

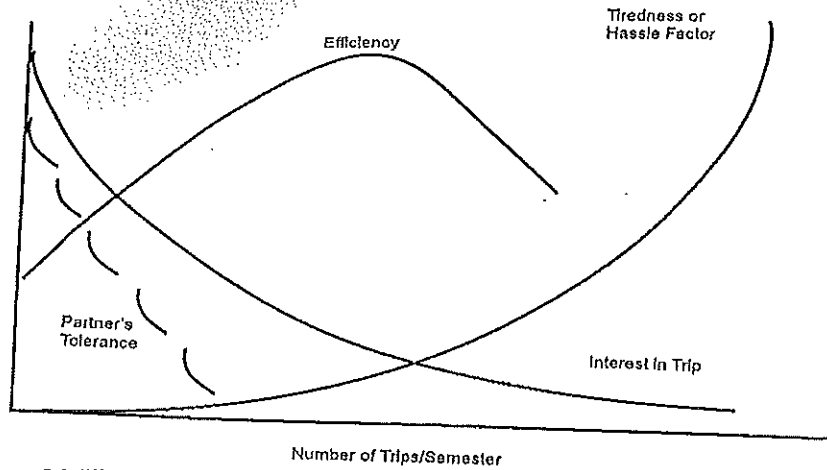


Figure 2-2. Effects of Travel

There are no numbers on Figure 2-2 since the values depend upon individual circumstances. If you're not feeling well, one trip may be too many. Extroverts tend to like traveling more than introverts do, probably because the hassles are not as draining for extroverts. The point of Figure 2-2 is that there is an optimum amount of travel for you.

Not traveling may lead to stagnation, parochialism, and a lack of name recognition. There are several dangers in traveling too much. Certain responsibilities such as office hours, committee meetings, and academic advising really cannot be made up. Being gone too much risks the danger that classroom effectiveness may plummet (see Section 2.6). It will probably take one day to catch up for each day you are gone. If you are gone a week, it will take a week to catch up, and that will be two weeks you do only routine and urgent tasks and don't get a chance to work on important goals. Ask, "Does this travel help me reach my long-term goals?" Sometimes travel helps you reach some goals, such as increasing your name recognition but hinders reaching other goals such as writing a book. If you decide that you are traveling too much, then say no to less important trips and develop a standard e-mail for declining invitations.

When you do travel, a good secretary who understands travel is very important. For a very complicated trip, such as three weeks covering five universities in Australia and three in New Zealand, it will be worth the expense to work with a good travel agent. Shop around until you find an agent who will work with you, and then stay with that person. Currently, planning ahead, getting your tickets early, and being flexible as to the dates you travel can save money. An extra day to be a tourist or just relax can be the difference between an enjoyable trip and an exhausting one. Registration fees at conferences are lower if you register early.

Use the time spent on airplanes to get some work done. A long flight may represent the longest period of uninterrupted time that you'll have in months. Bring a combination of writing projects and reading, such as a book or some articles to review. If possible, also bring some light technical reading. When the flight is at night after a busy day, you may decide that a review of the day and sleep are more important than doing more work.

## 2.6. TEACHING EFFICIENCY

Courses can be organized so that they are efficient for everyone involved. First, ask colleagues who have taught the course previously if they will share course materials with you. If asked, many senior colleagues are happy to share materials and discuss teaching. Either adopt the course goals and objectives used previously or develop new ones. If the course has never been taught at your institution, search the web for similar courses to provide ideas. Then decide upon the course organization and teaching method. The lecture method is most commonly used since it is widely believed to be the most efficient use of a professor's time. This may be true the first time a course is taught, but other methods can be equally efficient the second and subsequent times the course is taught. Active learning methods are usually more efficient for students since they learn and remember more material. Develop a tentative course schedule including exam dates before the semester starts, and hand it out to the students and the TA at the first class session. This allows them to plan for tests and projects. Calling it a "tentative" course schedule gives you flexibility you may need if it becomes necessary to adjust the schedule.

Homework and tests can be developed efficiently. Solving problems before they are used practically eliminates using problems that either cannot be solved or are too easy. As a rule of thumb, you should be able to do the test in approximately half the time graduate students will require, one-third the time junior and seniors will need and one-quarter of the time sophomores will take. Occasionally using a homework problem or lecture example on a test emphasizes the importance of doing homework and paying attention during lecture (Christenson, 1991). Ask TAs to solve some of the homework problems, but check their solutions. On tests we have the TAs solve the problems they will grade and compare answers with our answers. Solving problems before grading improves the grading. If you award partial credit, give the TA your solution plus a scheme for awarding partial credit. Check your grading scheme by grading half a dozen tests. Be particularly mindful that there may be alternate correct solution paths. Requiring written requests for regrades drastically reduces the number of arguments you have to confront. For unusual assignments such as an essay, provide the students with a couple of exemplars in advance so that they have a better idea of what you want. Use a rubric (see the Chapter 4 Appendix) when grading speeches or essays.

Preparing for a lecture immediately before the period it will be given ensures that you are fresh. When presenting a lecture given previously, learn to revise and prepare the lecture in one-half to three-quarters of an hour. For totally new lectures or major revisions develop the ability to prepare a fifty-minute lecture in two hours or less. These time limits prevent Parkinson's law (work expands to fill the time available) from controlling your time. Of course, if you don't understand the material, much more time may be required. Time can be saved in lecture preparation by using examples from other textbooks. This is preferable to repeating an example from the assigned textbook. Most new faculty members drastically over-prepare and spend much more time than we have suggested here (Boice, 2000). In some engineering disciplines screencasts are readily available and can be used to provide students examples on their own time (see Chapter 8).

You may be tempted to use someone else's lecture slides or the slide set that is bundled with the textbook. Use of a few graphs, figures, or images can be helpful, but adopting more is a false economy. It is difficult for most professors to present material they have not prepared

spontaneously and convincingly. Lectures presented from another professor's materials are likely to be very flat and uninspiring.

How much time needs to be spent on a course before it deteriorates? The answer depends upon your skill and experience as a teacher and upon your knowledge of the content. For new professors and for professors teaching a subject for the first time, more time and effort are required to do a good job (see Figure 2-3A). Our observations indicate this is generally an S-shaped curve. Effectiveness increases rather slowly at first and then speeds up as more time is put into the course. As more and more time is spent on the course, effectiveness approaches an asymptotic limit and may actually decrease slightly. As the professor gains experience in teaching and becomes more familiar with the material, the curve sharpens and moves upward and to the left to higher effectiveness with less effort.

The hypothetical curve for an experienced professor is shown in Figure 2-3B. There is a very broad range of professorial effort where course effectiveness is quite satisfactory. However, at critical point C there is a discontinuous drop in course effectiveness and the course drops below acceptable levels. This drop occurs because teaching, unlike research, is always a "what have you done for me lately" activity. All the rapport and good feeling developed one semester has to be rebuilt the next semester. A professor with a good reputation will have an easier time doing this than one with a bad reputation. However, if the "good" professor does not put in enough time or is gone too often, the course effectiveness will crash. Experienced professors can hover in the flat plateau above point C and adjust their efforts if they feel the class is slipping. This is somewhat dangerous, particularly if the class is slipping because of too much travel. Note in Figure 2-3B that experienced professors are more likely to have a maximum, point M, beyond which extra effort actually decreases class effectiveness.

Students also appear to follow the curves in Figure 2-3. Figure 2-3A refers to students who are not experienced learners in a particular area, and Figure 2-3B to those who are very experienced in a given area.

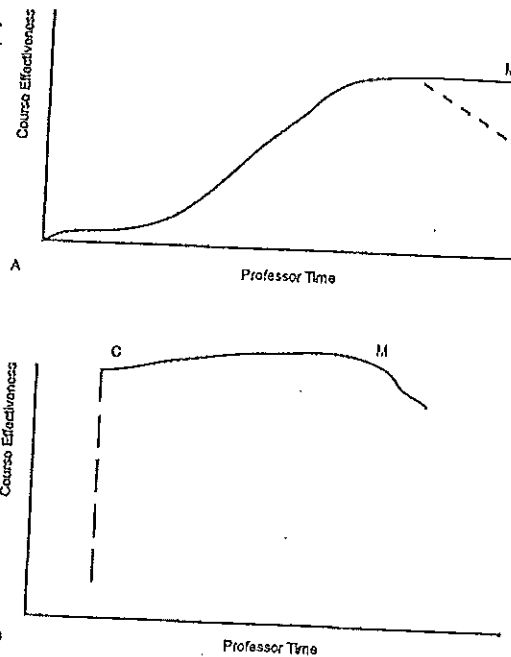


Figure 2-3. Effects of Professor's Time and Effort on Course Effectiveness: A. New Professors or New Courses, B. Experienced Professor with Established Material

## 2.7. RESEARCH EFFICIENCY

At research universities, even professors who are dedicated to teaching need to conduct research if they expect to be promoted and tenured. Barker (2010), Reis (1997), and Wankat (2002) focus considerable attention on research. Reichert et al. (2002) consider the start-up process for new professors at research universities.

An excellent, efficient research program will follow many of the same basic principles as a well-run company. The following principles are adapted from Peters and Waterman (2004) and Wankat (2002).

1. Be action-oriented. This is Covey's (1989) first habit of effective people.
2. Pay attention to the customer. For research the customers are the company, foundation, or government agency supporting the research and the readers of articles from the research.
3. Supervision of graduate students should aim for a happy medium between too little and too much as discussed in Section 10.5. Within broad guidelines, give graduate students control and responsibility. Do not spell out the nitty-gritty details. Regularly scheduled meetings can prevent excessive procrastination.
4. Show respect for each research student. One way to do this is to listen more and talk less.
5. Be hands on and driven by values. Visit the graduate student's laboratory or office. Continually remind them of the basic value of the research group (e.g., "innovation" or "careful experimentation").
6. Develop a balance between doing research in your area of expertise and working on creative ideas. You don't want to develop the reputation of continually repeating the same research, but there needs to be some coherence in the research projects. Before starting a new project ask, "Do I have the skills, time, and energy to do a good job?"
7. Develop an energized atmosphere with the expectation of regular contributions from every group member.
8. Finish the research and publish.
9. Unfortunately, professors are in a business where rejection and professional snubs are not uncommon. This is a secret we keep from graduate students interested in academic careers. Find a way to constructively deal with rejection such as the REBT method in the appendix to this chapter.
10. Do research that excites you.
11. No proposal, no money.

It is easiest to get results and write publications when you work on new ideas instead of following the well-beaten research track. Thus, time spent on generating new research ideas usually pays off. Many articles and books have been written on creativity (see Section 5.7). Application of these creativity methods can lead to more impactful research.

Many universities want to see proof that assistant professors can obtain research funds both on their own and as part of a collaborative team. Proposals written by a team of researchers with complementary skills usually take more time to write, but are often more likely to be successful than individual investigator proposals. If approached about joining a team to write a proposal, you need to consider several different facets. Is your part of the proposed research within your area of expertise and does it fit into your long-term research plan? Do you have time? What will you not do if you work on the proposal and if the proposal is funded? If

working on the proposal will make you give up something very valuable, saying no may be the best option. Do you want to work with your colleagues on the proposal team? Follow your instincts when determining the answer. Saying no to senior colleagues can be tricky. Develop a reason for saying no that has no negative connotations about the research team or the quality of the research. For example, a new baby in the family or the need to finish writing a textbook are almost always acceptable.

A useful method to determine semi-quantitatively if a particular project is worth doing is a *cost-benefit analysis*. Cost-benefit analyses can be done for projects other than research, but they are easy to illustrate for comparison of proposals since monetary value is involved. The benefit-to-cost ratio in dollars per hour for writing a proposal can be estimated as

$$\frac{\text{Benefit, \$}}{\text{Cost, hours}} = \frac{(\text{Money received}) \times (\text{Probability of funding})}{(\text{Hours writing proposal})} \quad (1)$$

where the number of hours required writing the proposal is approximately

$$\text{Hours of writing} = k \times (\text{number of pages}) \quad (2)$$

The value of the proportionality factor  $k$  depends on your speed and that of your collaborators. The probability of funding is harder to estimate, particularly initially when you have no experience. Some idea of this value can be determined by talking to experienced professors or by talking to the agency.

Consider two sources of funds: one offers a small amount of money but has a high probability of success, and another offers significantly more money but has a lower probability of success. The following approximate comparison can be done.

Source A, \$25,000, requires a ten-page proposal, and has a 50% chance of funding:

$$\text{Benefit/cost}(\$/\text{hour}) = \frac{\$25,000}{10k} \times 0.5 = \frac{1250}{k}$$

Source B, \$500,000 (for 3 years), requires a twenty-page proposal, and has a 10% chance of funding:

$$\text{Benefit/cost}(\$/\text{hour}) = \frac{\$500,000}{20k} \times 0.10 = \frac{2500}{k}$$

On the basis of the cost-benefit ratio alone, source B looks more advantageous. However, there may be other reasons for trying source A first:

1. Need to quickly show success in obtaining funding.
2. Grant is small but prestigious.
3. Grant is for a proof of concept and could easily lead to much more money later.

It may be possible to send very similar proposals to both organizations, but this is ethical only if you inform the agencies of your intention.

A final comment on writing proposals and papers: *always check your references.*

## 2.8. HANDLING STRESS

Professors and students often feel significant stress. Modest stress may increase efficiency and not be harmful to health. But after some point stress can decrease efficiency and become

harmful. Some people can thrive in an environment that is very stressful for others. Three approaches to handling stress are: change of environment, change of perception, and relaxation methods (Wankat, 2002).

Changing the environment is a very effective way to reduce stress. Sometimes all that is needed is the realization that there are alternatives. For example, professors who find lecturing to be very stressful can use other teaching methods once they realize they exist. A professor who finds the noise from a student lounge to be annoying can ask to be assigned another office. Professors may find that parts of their lifestyles are increasing their stress levels, and this stress can be reduced by changing lifestyles. Even excessive caffeine intake may increase stress. People with certain medical conditions may find that some weather patterns cause them physical stress. Alleviation of this problem may require moving to another university in another section of the country. Some people find all aspects of a professor's life stressful. Their only solution may be to find a job in industry or in a government laboratory. Often a stressful part of the environment can be changed only by a major move, and other aspects of the position make such a move undesirable. In cases such as this it is important to learn to manage the stress.

An effective method for managing stress is to change your perception—how you feel and react to incidents (Ellis and Harper, 1997). Everyone has a surprisingly large degree of control over how they feel and react to situations. Some professors feel that they have to be perfect and thus become very upset if a class does not go well or a research paper is harshly criticized. As a result they may be unable to function. Individuals with a need to be perfect will be happier and more efficient if they learn to accept some imperfection (see Chapter 2 Appendix). A similar problem arises with those who feel responsible for the actions of others. For example, most professors do not enjoy flunking students, but some find doing so to be extremely stressful. They feel that the F is their responsibility instead of the student's. It is much less stressful and fairer to assign this responsibility to the student where it belongs. Alleviating the problem of assigning yourself too much responsibility is possible by the same methods which work for over perfection. A related problem is the *catastrophe syndrome*—believing that a catastrophe will occur if something happens or does not happen. The something can be rejection of a paper, low teaching ratings, denial of tenure, or whatever the professor wants to name. Admittedly, none of these are pleasant, but they are catastrophes only if perceived that way.

Many psychological methods can, with the help of a counselor or psychologist, be used to overcome perception problems that increase stress. Rational emotive behavioral therapy (REBT) can be learned and applied to oneself (Ellis and Harper, 1997; Ellis, 2006). Essentially, REBT postulates that we think irrational, unhealthy thoughts and it is these thoughts that make us feel bad. The solution proposed by REBT is to rationally attack the irrational thoughts and change our thinking patterns. REBT is particularly appropriate for engineers who are trained to think rationally. The REBT approach is briefly outlined in the Chapter 2 Appendix.

The perception of stress can also be reduced by desensitization procedures (Humphrey, 1988) that involve repeated exposure to the stress-causing stimulus, but in a relatively supporting and nonthreatening environment. In a clinical setting the exposure is usually obtained by imagining the stress-causing event. In classical applications of desensitization the stimulus is first present at a very low level, and then gradually the level is increased. This may sound complicated, but it is not uncommon for professors or department heads to apply a similar procedure. For example, a new professor may first be assigned to teach a graduate class with ten stu-



dents, then an elective class with thirty students, and finally a required sophomore course with 150 students. This individual will become somewhat desensitized to the stress of presenting a lecture to a large audience. A professor who gives many quizzes in class is in effect desensitizing students who have problems with test anxiety. This method is most effective if the first quizzes are worth a smaller proportion of the course grade than later quizzes, or if a practice test is given.

Relaxation techniques are useful for reducing excessive stress while it is occurring (Humphrey, 1988; Whitman et al., 1986). Methods useful in helping one to relax include physical activities such as jogging, tennis, swimming, or walking. Regular weekend activities, particularly those that get you outside and involve physical activity, help to keep stress from building up.

Activities that result in *flow* are particularly good for taking your mind off of daily stressors (Csikszentmihalyi, 1990). Flow, which occurs when one is totally immersed in the activity, is more likely to occur when one has control, can set feasible goals, plays according to rules, obtains feedback on achieving goals, focuses attention, has a balance between challenge and skills, and can increase challenge/skills to avoid boredom. Examples of flow activities are cooking, fishing, wood working, playing a musical instrument, golf, and other sports.

It is important to *get away* and not carry work with you. Professors used to have the advantage that they did not regularly carry paging devices with them. Now that professors carry their cell phones or smart phones everywhere, stress levels and burnout appear to have increased. The ability of computers to convert work from being done mainly in the office to a 24/7 activity is a good example of the increase in stress caused by not controlling technology.

There are other useful relaxation methods. Although less popular now, transcendental meditation (TM) or repeating a mantra works for many people (Humphrey, 1988). A westernized version of TM is given by Benson and Klipper (2000). Various breathing exercises can be as simple as taking a deep breath, holding it for ten seconds, and then slowly letting it out. This simple exercise is useful to hold in reserve in case a student becomes extremely anxious during an examination. Various stretching exercises and methods to relax one set of muscles at a time are also useful and easy to learn. Humphrey (1988) presents a variety of simple exercises that can be used to reduce stress.

Excessive stress can be very detrimental to students. It is helpful to be able to recognize this and help the student cope with the stress. The procedures for doing this are similar to those for coping with your own stress and are discussed in detail by Whitman et al. (1986).

## 2.9. LIMITATIONS

Efforts at efficiency can be overdone, and many things cannot be done extremely efficiently. Most activities that require personal contact with other people have some built-in inefficiency. Examples include:

- Starting a class period
- Tutoring
- Advising students
- Mentoring graduate students
- Building consensus (e.g., within a department for a curriculum revision)
- Marriage
- Raising children

If you try to do these activities in a very efficient manner, then others may feel rushed and devalued. The net result is a rapid transaction that may minimize your time but is not efficient since what needs to get done doesn't get done. A classic horror story, which may be true, involves a professor who set a three-minute egg timer whenever a student came in to ask a question. After a short period most students stopped coming in, and the professor saved himself time, but he did not help students learn. Limit interruptions by scheduling personal contacts at specified times of the day. This will help overall efficiency even though the individual interactions are inefficient.

Innovation and creativity in research and teaching tend to be messy and not particularly efficient processes. It is hard to sit down and say, "In the next ten minutes I will have a brilliant idea." The paradox here is that being innovative and creative can drastically increase your overall efficiency even though the processes themselves are inefficient. Once a professor has a great idea for research, actually conducting the research may be relatively quick and easy. In addition, the research may have considerable impact. To a lesser extent, the same is true of creative ideas in teaching. Students enjoy a bit of change and creativity in their classes.

The planning of an entire career does not appear to be an efficient process, despite many books and courses on career planning. Many biographies and autobiographies tell of famous people who go through a period of wandering about before they seize upon their life's work. There are often false starts and failures until they settle down into their great work.

It is useful to separate tactics from strategy. Efficiency is almost always a good idea in day-to-day tactical concerns such as preparing for a class. If you want to break new ground in research or develop a new teaching method, it is probably not possible to have an extremely efficient long-range or strategic plan.

Relaxation is necessary to be efficient over long periods; however, relaxation itself almost appears to be the opposite of efficiency. As noted in Section 2.8, we can learn to relax better or more efficiently. During the period of relaxation, it appears that nothing useful is occurring, yet useful things must be occurring. The paradox that we must learn to live with is that only by allowing for inefficiencies can we truly be efficient.

## 2.10. CHAPTER COMMENTS

It is easy to get the sense that we believe your life should be absolutely centered on your faculty position. We don't believe this. Sigmund Freud was closer to the truth, "Love and work . . . work and love, that's all there is." Balancing work and your personal life can be challenging. At times one needs more attention—sometimes a lot more attention—and at times the other needs more attention.

One of the common problems in designing a course or a textbook is that there is no order that really works. There is always some part of the subject that should be discussed before covering the current topic, but not everything can be last. In addition, for motivational purposes it is useful to present a practical part of the course early so that students know why they are studying the theory. Not all aspects of this chapter will be completely clear until other chapters have been covered, and some won't be clear until after you have had experience as a professor. We put this chapter early to help you think about being efficient when designing courses. In addition, putting important material early in a course ensures that sufficient time

will be devoted to it. This illustrates a second problem in course design: The most interesting and most useful material such as efficiency and creative design is often left until last so that all prerequisite material can be covered first. When this is done, the interesting material is crowded into the end of the semester when there is never enough time and everyone is tired.

Teaching efficiency in class is a challenge. The concepts are simple and often just common sense. The hard part is applying the principles. Perhaps the best approach would be to not lecture but require students to apply one or two principles to their lives. Then three or four weeks later require an informal oral report on the results. We have found that experienced professors are much more attentive and receptive to a lecture on efficiency than graduate students.

Effective collaboration and networking have become much more important for professors in the last 20 years and are discussed in Chapter 17.

## HOMEWORK

1. Develop your lifetime goals as of now.
2. Develop your goals for the next three or five years, whichever time frame appears more appropriate.
3. Develop activities that will help you attain your lifetime goals.
4. Develop activities to help you attain your goals for Problem 2.
5. Assume one of your goals is to become a good teacher
  - a. Define the term "good teacher."
  - b. Develop activities to reach this goal.
  - c. How will you know when you have reached this goal?
6. Develop a semester to-do list. Be sure to include some of your activities to reach your goals on this list.
7. Explain why a professor's effectiveness in teaching a class or a student's effectiveness in taking a class will crash if some minimum amount of time is not put into the course.
8. Learn one relaxation method and practice it every week for two months. After two months, you will probably have developed a new habit.

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## APPENDIX. THE RATIONAL-EMOTIVE BEHAVIORAL THERAPY (REBT) APPROACH

The REBT approach postulates an ABC method of viewing human reactions. The *activating experience A* is the outside stimulus that the person reacts to (e.g., bad reviews of a research paper or the acceptance of a paper). Step B consists of the *internal beliefs* which lead the person to interpret what has happened. These beliefs can be rational or irrational. For example, a rational belief is that a rejection is unfortunate since more work will be required, but that the rejection is not a catastrophe. An irrational belief is that rejection is a catastrophe which *must* not happen. Eventually, the person experiences an *emotional consequence C* which he or she thinks is caused directly by activating experience A. An emotional consequence C is anger and depression. Thinking that A caused C is irrational. This must be irrational since another person will react to the same A in a very different way and experience a completely different C. The emotional consequence C is caused by the beliefs B which the person has. If these beliefs are rational, then C will be reasonable (e.g., if the belief is that bad reviews are unfortunate since they will require additional work, then C will be a mild displeasure). If the beliefs are irrational, then C can be an extreme reaction.

Most people have irrational beliefs about something. Examples of irrational beliefs are:

- It is horrible to be rejected.
- I have no control over my feelings.
- I must be liked by everyone.
- All my lectures must be perfect.
- It is catastrophic if something I do is not perfect or is criticized.

The amount of disruption these beliefs cause depends upon the belief and how strong it is.

The REBT method involves rigorously analyzing your thoughts to determine the irrational beliefs and to replace them with rational beliefs. Suppose you have just received a letter from a funding agency rejecting a proposal which you thought was very good. Your first reaction is to become angry and you know that you will be depressed and angry for several days. With the REBT approach you first stop and listen to what you are saying to yourself.

Ask, "Why am I angry?" Then listen to your own response, "Because I was turned down." Now the REBT approach pushes deeper. Ask yourself, "But why does being turned down make you angry?" Here the response might be, "Because I'm not supposed to be turned down." A further push could be, "Why aren't you supposed to be turned down?" "Because I should be perfect." "And what else?" "Well, everyone should always approve of my work."

The beliefs that one is supposed to be perfect and have everyone approve of one's work are clearly irrational. REBT postulates that the appropriate place to intervene is in the irrational belief system. Continuing our example, you could respond to yourself, "Perfect! No one is perfect. That is not rational. It's also not rational to expect everyone to like your work." Next you need to substitute a rational belief for the irrational one. For example, "A rational approach is that it is nice and certainly preferable if your work is good and is approved by everyone. However, it is not a catastrophe if someone does not like your work. It is unfortunate that the proposal was not funded since you will have additional work to do to resubmit it, but it is not worth becoming angry and depressed over for days."

This approach may sound simplistic or too good to be true. The method works but requires considerable work and practice. The irrational beliefs have been there for a long time and are usually difficult to eradicate. However, if these beliefs are attacked logically every time they appear, they become weaker. In addition, as one practices REBT on oneself, one becomes much more adept at spotting irrational beliefs and at fighting them. Readers interested in this method should read one of the books by Ellis (Ellis and Harper, 1997; Ellis, 2006).

The irrational beliefs attacked by REBT have been causing difficulties for centuries and were attacked by stoic philosophers in similar fashion albeit with a different vocabulary. Irvine's (2009) book is an excellent guide to applying stoic principles to everyday life. Perhaps because Irvine is a professor, his approach is relatively easy to apply to problems professors' experience.