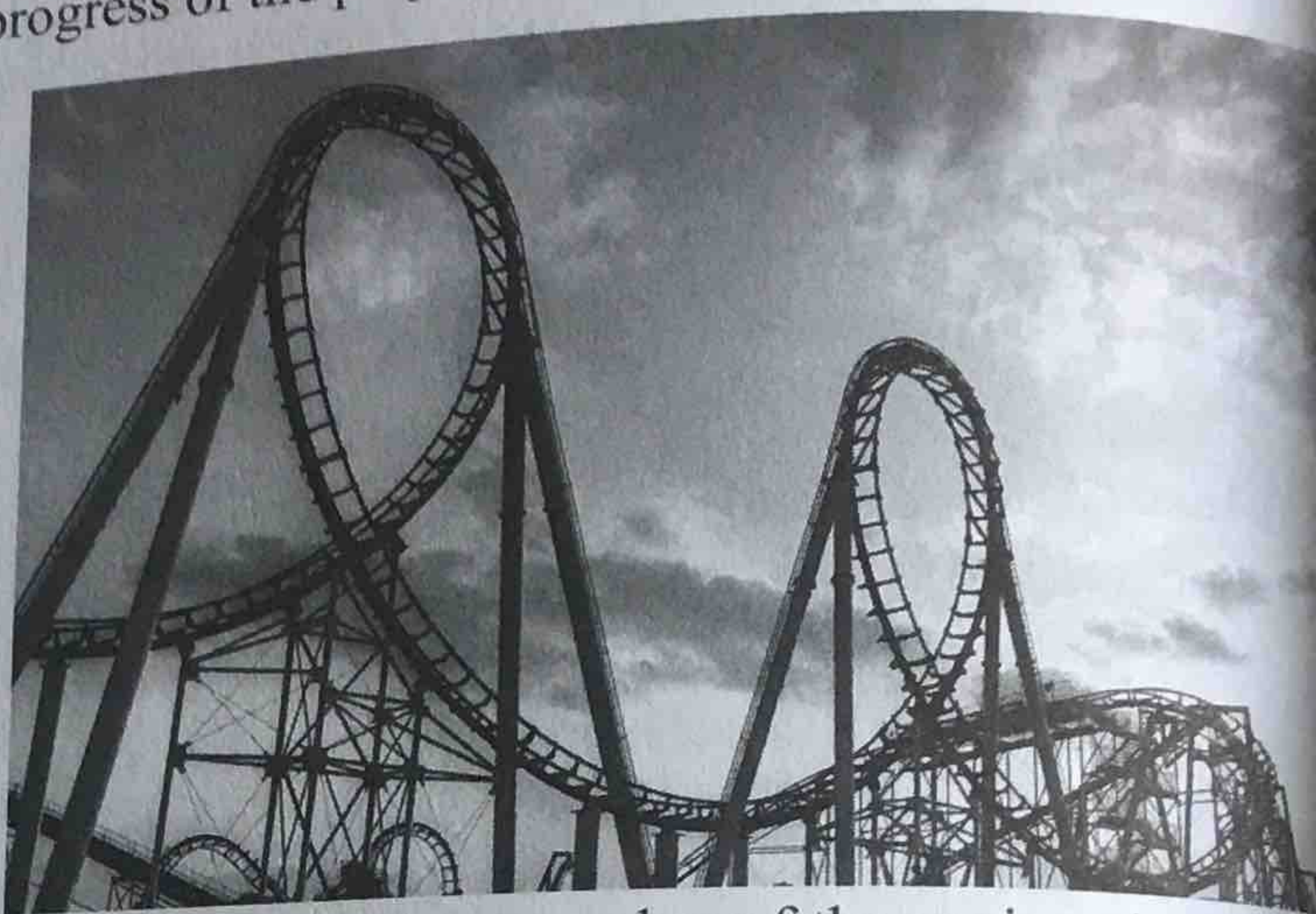


team of 30 engineers and construction workers. Every two weeks, you must submit a written report to your superiors detailing the progress of the project.

At stake in each of these scenarios is not so much your technical expertise as your ability to communicate – both orally and in writing. To patent, produce, and market the Internet device would involve extensive interactions with all kinds of people, groups, and organizations – from the U.S. Patent Office to prospective clients. To land a job after graduation will depend largely on how well you comport yourself and communicate with others (from your resume and cover letters to follow-up phone calls, interviews, and possibly short presentations). As a member of the engineering team at the alternate-energy vehicle company, you will take part in either writing a technical report or presenting your findings to management. The same applies to your meeting at NASA or your progress reports to superiors at the amusement park.



I could easily add many more scenarios to the ones above or create a lengthy list of the writing and speaking demands that you will typically encounter as an engineer. Here are a few:

- Letters, memoranda, and e-mail correspondences
- Design specifications
- Requests for proposals (“RFPs”)
- Proposals submitted in response to RFPs
- Contracts, patents, and other government documents
- Progress reports (written and oral)
- Daily work logs
- Instruction manuals
- Technical reports
- Formal presentations (often to non-engineering audiences)
- Project and committee meetings
- Short courses and training seminars
- Guest lectures at engineering schools or professional engineering society conferences
- Publications of findings in professional engineering journals
- Written and oral performance evaluations of subordinates

This list goes on, but I think you see how expansive a role communication skills play in an engineer’s world. As a practicing engineer, you will consistently – almost endlessly – draw on your abilities to write and speak effectively.

THE ENGINEERING “DISCOURSE”

The amount and variety of communications, as illustrated above, should be sufficient to convince you of the importance of these skills in engineering. But there is another factor you need to understand in order to appreciate fully the value of strong writing and speaking skills.

In *all* communication transactions, regardless of their importance, length, audience, or medium, your performance will *always* and *inevitably* reflect back on you. Fair or not, your fellow professionals will judge how skillfully you execute every writing or speaking task. If your performance somehow doesn't "measure up," your potential success as an engineering professional will be undermined – and possibly severely limited.

You see, every profession, engineering included, expects certain knowledge, competencies, and an overall presentation of self in order to be accepted into the profession.

James Paul Gee, professor of literacy studies at Arizona State University, explains these professional expectations in terms of a "Discourse" [19]. Gee defines a "Discourse" as a kind of "identity kit" that includes specific "knowledge, costumes, and expectations on how to act, talk, and write so as to [exhibit] a particular role that others in the Discourse will recognize."

The catch is that, to become a member of a professional Discourse, like engineering, you must be able to demonstrate mastery of *all* of the requirements: "Someone cannot participate in a Discourse unless he or she meets all expectations required in that Discourse. Because Discourses are connected with displays of an identity, failing to display *fully* an identity is tantamount to announcing that you don't really have that identity." In short, "you are either in it or you're not." As we have already seen, communication skills play a major role in the engineering profession. You can be sure, then, that your mastery of these skills will be a pivotal factor in determining your eligibility for membership in the engineering Discourse.



EMPLOYERS WANT MORE

Although the term "Discourse" is unfamiliar to engineering employers and educators, they would certainly understand and agree with the concept behind it. For years, employers have complained about the weak communication skills of the engineering graduates they interview, especially when they find a "star" candidate who qualifies in every way except communications. Not surprisingly, a national survey of over 1,000 engineering employers conducted by the National Society of Professional Engineers revealed that industry's number one concern was to give engineering students "more instruction in written and oral communications" [20]. This conclusion was borne out by a recent excellent study [21] by the Corporate Member Council of the American Society for Engineering Education (ASEE) that indicated that the most important attribute of an early-career engineering professional was:

Communicates effectively in a variety of different ways, methods, and media

Educators, too, have long debated ways to improve their engineering students' communication skills. Pressured both by industry's demands and by ABET's criterion that

engineering graduates have “an ability to communicate effectively” (see Chapter 1, Section 1.4), engineering educators everywhere are actively engaged in finding solutions to the problem.

Some engineering schools are developing upper-division, engineering-specific communication courses for their students. To compliment the required composition and speech courses, many institutions are creating writing-intensive courses across the curriculum, and “writing proficiency exit exams.” This increased focus on students’ communication skills will hopefully produce better prepared graduates. In most cases, though, the engineering curriculum is already so full that additional requirements are not possible. So the debate continues.

THE ENGINEERING STUDENT AS COMMUNICATOR: A PROFILE

Take a moment to reflect on your own communication skills. How would you rate your writing? How do you feel about speaking before audiences or giving oral presentations? Chances are that, as an engineering major, you view writing and public speaking with little enthusiasm. They are probably your least favorite and perhaps weakest subjects, and the fewer courses you must take in them, the happier you will be. After all, you likely chose engineering because your strengths lie in math and science; your engineering curriculum centers largely on developing these strengths; and a “good” engineer is one who excels in these areas.

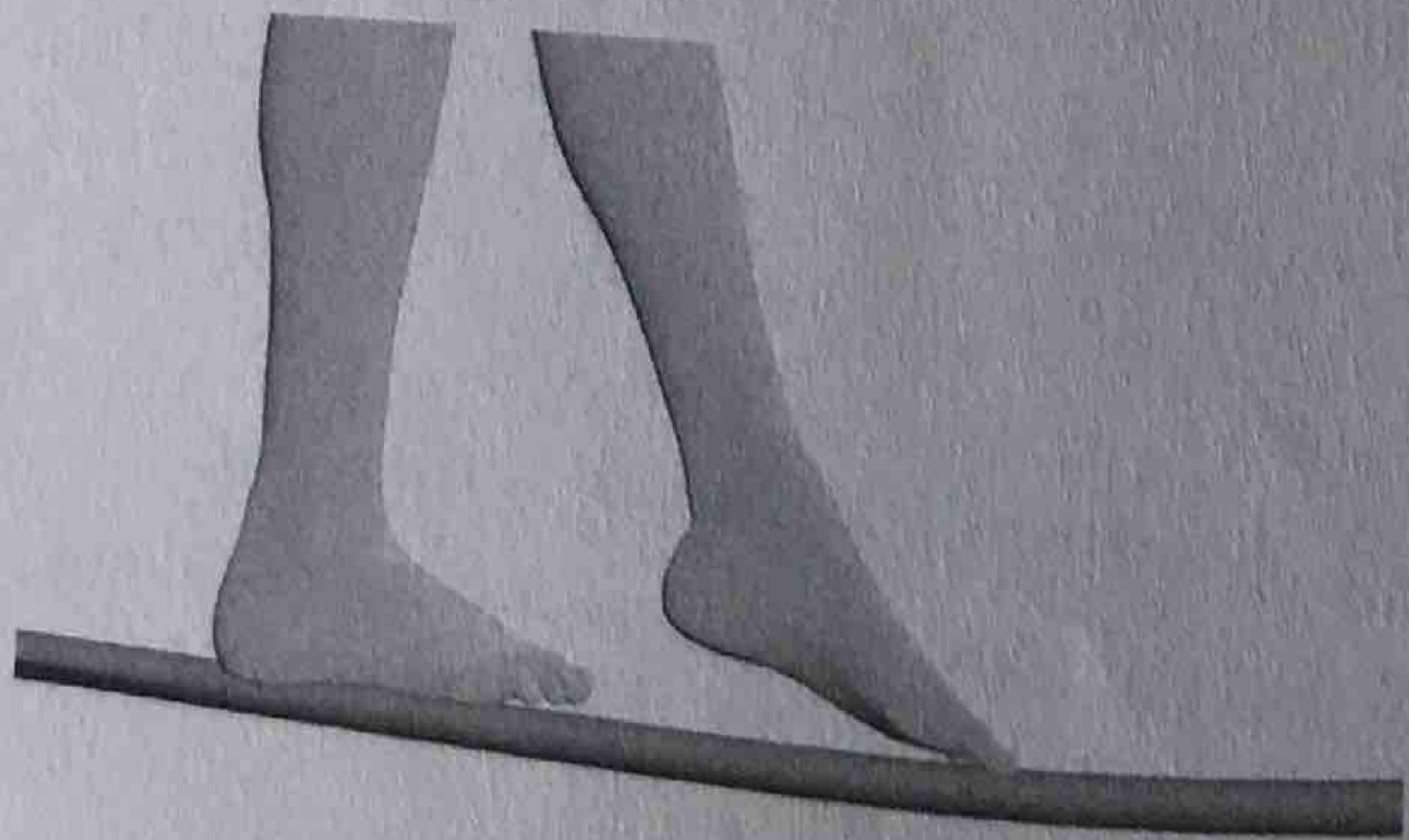
Although you now understand the need for strong communication skills, you may lack confidence or feel discouraged about your ability to improve them. Many new engineering students do, especially those whose native language is not English. To make matters worse, you are bound to encounter fellow engineering students whose communication skills clearly outshine your own. How, you wonder, can you ever learn to communicate as well as they do? Your required coursework in communications will help, but will that be enough? Probably not.

The answer is that you *can* become an effective communicator. The skills are not all that difficult to master, but they do require two commitments from you:

- (1) **A positive attitude**
- (2) **A 4-5 year plan to ensure regular practice**

DEVELOPING A POSITIVE ATTITUDE

Let’s address attitude first. The profile above, highlighting the fear, intimidation, discouragement, and perceived inability that many engineering students feel about their communication skills, is quite understandable. Most people, regardless of profession, dislike writing of any kind and abhor public speaking. It’s not surprising. Writing and speaking are like “baring your soul” to others – often strangers. To some extent, you can hide weak writing skills by hiring an editor or ghostwriter. You also have the opportunity to proofread and revise – again and again – before making a written document public. Speaking before an audience, however, offers no such safety nets. Like a ballet dancer or tight-rope walker, you need only one wrong step to ruin your performance.



While understandable, the fears associated with writing and public speaking are counterproductive – particularly for you, as future engineers. I can’t tell you how many times I have seen promising engineering students try to capitalize on their technical knowledge as a way to compensate for inadequate communication skills. Because they feared or disliked writing and speaking, they

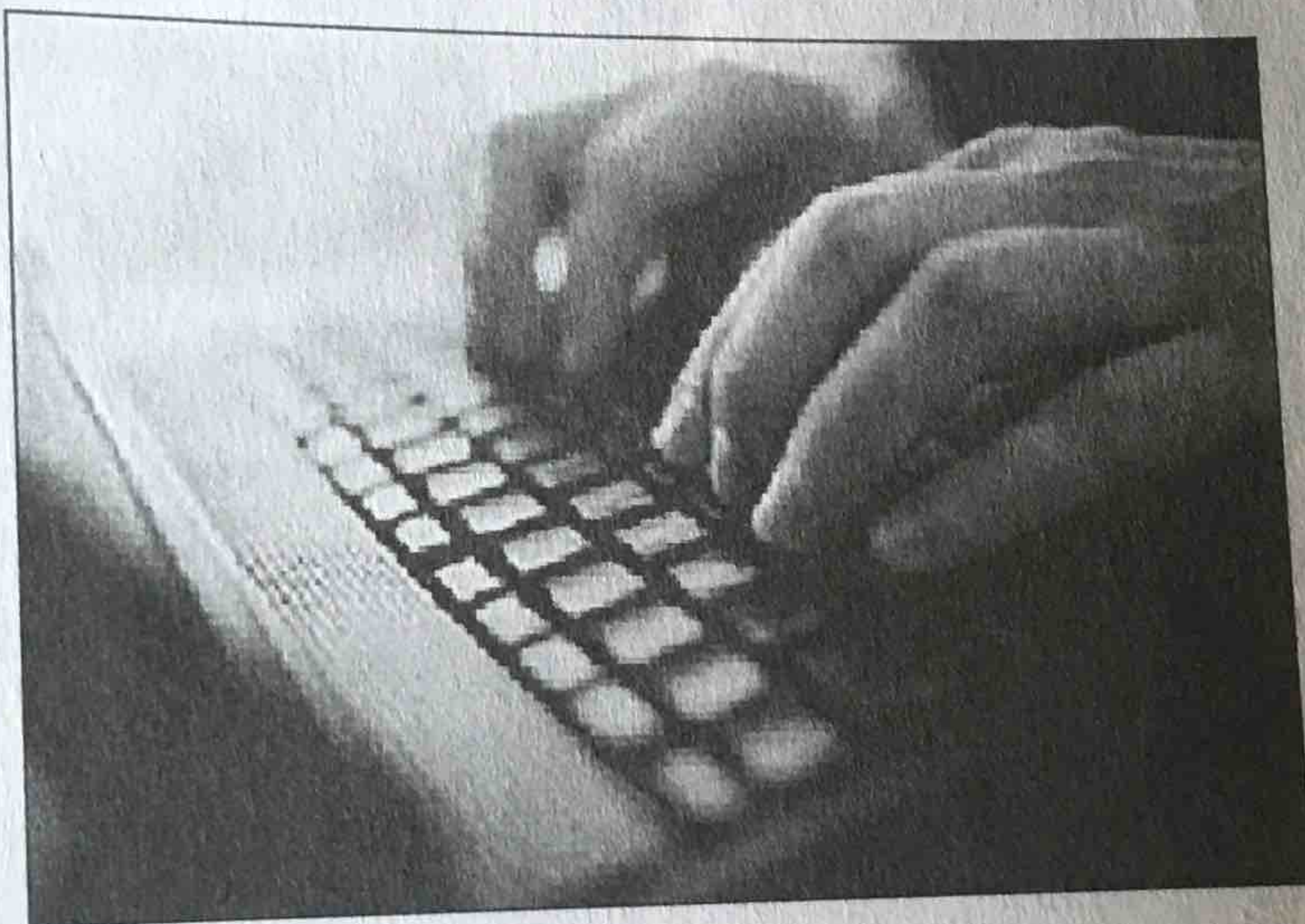
did as little as possible in college to develop these skills. When, as seniors, they began their job search, they repeatedly lost out to others who had wisely balanced their engineering education with training and practice in communication.

It would be great – wouldn't it? – if we could change our negative attitudes about writing and speaking instantaneously. Just one "ZAP!" from Batman or the wave of a magician's wand and – voila! – we can't wait to write a technical report or make a presentation before a group of executives. But, while we may lack such magical swiftness, we do have the capacity to change negative attitudes into positive ones. In terms of writing and speaking, you need just one little success – an "A" grade on a composition or a compliment from a professor about your contributions in class – to start the process. Make one of these small challenges a goal of yours this semester, and watch how your attitude about writing and speaking begins to change.

PLANNING TO IMPROVE YOUR COMMUNICATION SKILLS

You've heard the expression that "practice makes perfect." It's true. No matter how adept or advanced you may be in a skill, you need to practice it regularly to maintain it. Just ask any professional athlete.

Developing strong communication skills takes years (not days, weeks, or even months). That's why you need to start TODAY. The longer you delay tending to them, the weaker they will be when you graduate – and the longer it will take you to prove your eligibility to join the engineering Discourse.



What should you do? Lay out a 4-5 year plan that includes as many courses that focus on communication skills as you can work into your program. Build in your required courses first, like freshman composition and speech communication. Then browse through your university catalog for additional communications courses: advanced writing and speech courses, business communication courses, psychology/human relations courses, theater courses, "writing-intensive" courses, and so forth. See which of these courses could be used to meet your general education requirements. You may also have some free electives that you can devote to developing your communication skills. Another option would be to take a few extra courses in this important developmental area that don't meet graduation requirements. An ideal goal would be to take one course in this area each term during your four-year program.

Once your plan is complete, put it into action. Approach each class with the same enthusiasm and interest you bring to your engineering courses. Sit in the front of the classroom. Be inquisitive: Ask questions. When faced with a writing assignment, do it early so that you can get feedback from your instructor or tutor, and rewrite it based on their suggestions. Do the same for oral assignments. Practice an upcoming presentation before a group of friends or classmates. Even better, video record yourself and then evaluate your performance. **We're always our own toughest critics!**

Beyond formal coursework, look for extracurricular opportunities to write and speak. Practice your writing by keeping a journal or corresponding with friends via email. Write a poem or short story. *Write a critique of this book and send it to me!* Above all, **read** – anything

and everything. Research in language development has shown that reading is a significant way to improve writing skills. Read the newspaper, magazines, technical journals, and novels. Set goals for your reading, particularly during breaks between school terms. Take the time you would normally watch television or play video games and use it for recreational reading.

Develop your oral communication skills with the same vitality and engagement, both in and out of the classroom. A speech class will introduce you to the field of rhetoric and give you practice in the rhetorical modes of discourse (e.g., narrating, describing, analyzing, persuading, and arguing). Psychology courses will teach you the principles of human relations, group dynamics, and cross-cultural communications. A theater course will give you instruction and practice in effective delivery.

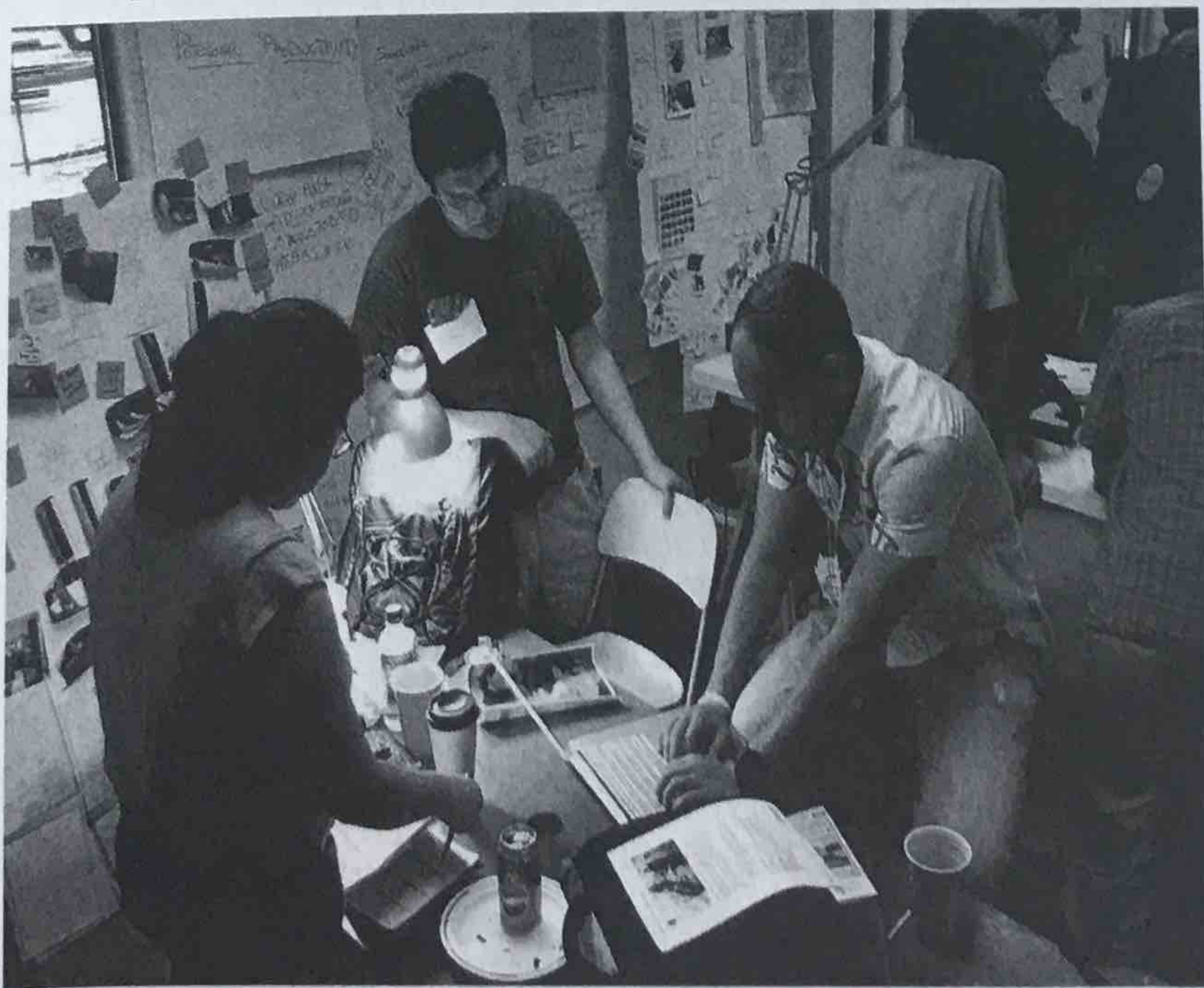
Extracurricular activities are also plentiful and beneficial. Getting involved in engineering student organizations or school athletic programs will go far in building your interpersonal and teamwork skills. Running for student offices and holding positions in the student body government will strengthen your public speaking and presentation skills. Outside of school, scrutinize speakers you hear on television and radio. Study the techniques of famous speakers, like Dr. Martin Luther King, Jr. and John F. Kennedy, or *any* individual whose speaking skills you admire. Take stock of their strengths and weaknesses, and try to incorporate some of their strategies into your own speaking repertoire.

CONCLUSION

Whatever avenues appeal most to you to develop your communication skills, what's most important is that you **DO SOMETHING** and **START TODAY**. A 4-5 year plan begun *now* will help keep you on track. If you sincerely commit to this plan, I guarantee that your most defeatist attitude will change for the better. Watch your self-confidence and poise grow. Note how your fellow engineering students start to admire you and seek your "secret" to success. Don't be surprised when prospective employers start vying for your attention.

6.7 LEADERSHIP AND TEAMWORK

A **team** is defined as two or more people who interact regularly and coordinate their work to accomplish a mutual objective.



Nothing of significance is ever achieved by an individual acting alone. Think of impressive human achievements: climbing of Mt. Everest, launching a fighter jet from an aircraft carrier, placing a human on the moon, building the Golden Gate Bridge. We're all aware that these achievement required significant teamwork. But even things that appear to have been done by individuals – Jonas Salk developing the polio vaccine, Daniel Boone blazing the wilderness trail, Charles Lindbergh flying solo across the Atlantic, Bill Gates creating Microsoft, Mohammed Ali

winning the world heavyweight boxing championship, Mother Teresa ministering to the poor – were really team efforts. Each of these individuals required others to achieve their results. If you, as many students do, prefer to work alone, now is the time to get over it. Virtually all engineering work is teamwork. You will be involved on a team – as a team member or leader – throughout your engineering education, your career as an engineering professional, and your life.

One indication of the importance of teamwork is the fact that, as you learned in Chapter 1, one of the 11 attributes ABET requires of engineering graduates is:

an ability to function on multi-disciplinary teams

Unless you have demonstrated an ability to work on teams, you aren't even eligible to be awarded a degree in engineering. I therefore encourage you to take every opportunity to develop your effectiveness as both a team member and a team leader.

As a student, you will be required as part of your formal coursework to participate extensively on two types of teams:

- Laboratory groups
- Engineering design project teams

But you will have the opportunity to elect to participate on other types of teams including:

- Study groups
- Engineering student design competitions (e.g., steel bridge truss competition, human-powered vehicle, etc.)
- Research teams
- Service project teams
- Student organizations and student government

Furthermore, as you go through your life, you will undoubtedly establish a broader context for "teams" you are involved in, including your family members, neighbors, colleagues at work, community volunteers, or anyone you decide to work with toward a common purpose.

Comprehensive coverage of the subject of teamwork and leadership is beyond the scope of this book. In this section, we give an overview of the subject, with the goal of persuading you to learn and practice teamwork and leadership skills.

Many complete books are available on the subjects [22, 23, 24], as are courses you will find on your campus (in the business school or the communication studies department). The following sections provide an overview of the subject of teamwork and leadership.



PRINCIPLES OF TEAMWORK

Following are some general principles that govern every high- performing team.

Purpose – Teams need a clear, well-defined vision of what needs to be accomplished.

Synergy – By combining efforts and talents, teams can outperform any individual.

Cooperation – Team members must be willing to subordinate their self-interests on behalf of the team's purpose.

Roles – Each team member contributes optimally when in the correct, clearly-assigned role.

Difficulty – The more challenging the goal, the more important the teamwork is.

Motivation – Team members need to find ways to spark the team's greatest possible accomplishments.

Weakest Link – The team's results will be limited by the performance of its weakest member.

Attitude – Poor attitudes can spoil the greatest of talents.

Trust/Reliance – Team members need to be able to rely on one another.

Discipline – Team members must be prepared to make the necessary sacrifices to do what needs to be done.

Focus – Teams need a system to track their progress and keep them focused on their goal(s).

Values – Team members should have shared values about their project.

Leadership – The team needs to have effective leadership.

Morale – Team members should feel good about being a member of their team.

Planning and Resources – The team should effectively plan and use resources.

Decision-Making – The team needs to be able to make good decisions.

REFLECTION

Have you ever been a member of a team of any kind? If so, did the team exhibit the attributes listed above? Do you feel as though you could help bring some or all of these attributes to any teams you are part of in the future? In what ways? Which attributes do you think are most important? Could you be part of a high-performing team that lacked one or more of these attributes? If so, explain?

ATTRIBUTES OF AN EFFECTIVE TEAM LEADER

As every ship needs a captain, every team needs a team leader. Depending on the context, the team leader might be appointed (e.g., by your professor) or elected by team members. The purpose of the leader is to direct the actions of the team to achieve its goal.

Some of the important attributes of an effective team leader include:

- Willingness to lead and take charge
- Ability to keep the team focused on its purpose
- Ability to set goals, priorities, and standards of performance
- Proficiency at being a team builder
- Ability to plan appropriately/accordingly
- Able to run productive meetings
- Ability to communicate effectively
- Ability to promote harmony and inspire trust
- Ability to foster high levels of performance by team members

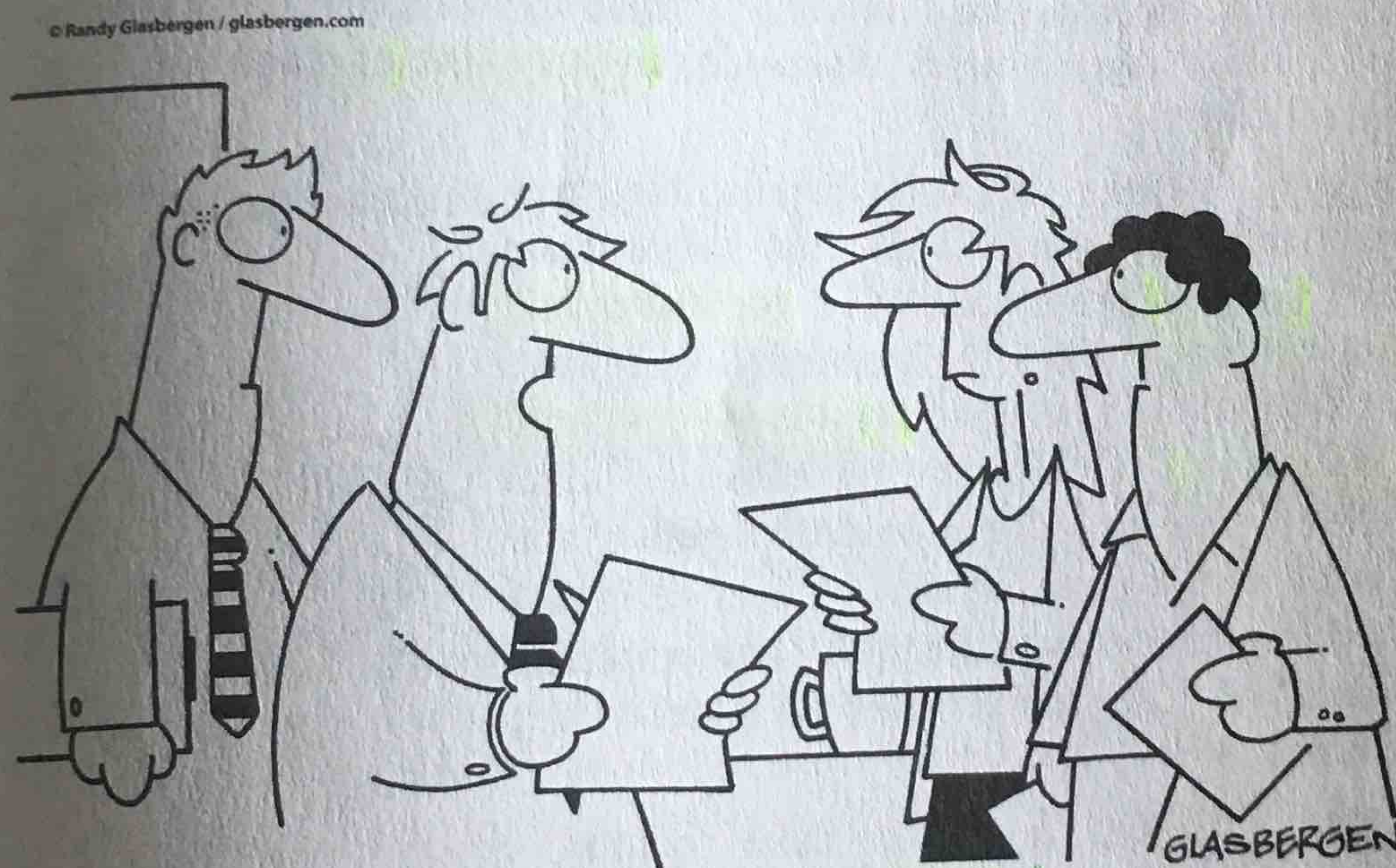
No matter what their traits or skills, leaders carry out their roles in a wide variety of styles. Three of the most common are:

- 1) **Autocratic** – Leader makes decisions independently with little input from team members.
- 2) **Democratic** – Leader offers guidance but also encourages strong participation from team members.
- 3) **Laissez-Faire** – Leaders offer little guidance and leave decision-making up to team members.

REFLECTION

Review the attributes of an effective team leader. Do you think you would be an effective team leader? Which of the attributes of a team leader would you be strongest in? Which would you be weakest in? What could you do to develop those attributes in which you need improvement?

In sum, the leadership style portrayed in the cartoon below is NOT something you want to aim for!



"If we want to succeed as a team, we need to put aside our own selfish, individual interests and start doing things my way."

CHARACTERISTICS OF AN EFFECTIVE TEAM MEMBER

Some of the characteristics of an effective team member are:

- Supports and helps the team leader succeed
- Understands and supports the team mission, purpose, and goal
- Subordinates self-interest on behalf of the team's purpose
- Welcomes being a member of the team and works to get to know and build trust with other team members
- Communicates openly and honestly
- Respects differences and diversity in team members
- Works to elicit the ideas of others; listens to understand others' points of view

- Views conflict as useful and necessary; works toward consensus
- Is reliable; follows through on tasks; meets deadlines
- Is willing to work hard, often "beyond the call of duty," for the success of the team

STAGES OF TEAM DEVELOPMENT

You can't expect a newly formed team to perform at a high level from very start. Team formation takes time and effort, and team development usually follows distinct stages as the team moves from being a group of strangers to becoming a united team with a common goal.

The **Tuckman Forming Storming Norming Performing Adjourning Model** [25] is a highly regarded and widely accepted model of the stages that are inevitable for a team to grow to the point where they are functioning effectively together and delivering high quality results.

Once a team leader is appointed or elected, the following five stages in the team's development generally take place.

STAGE 1: FORMING. The team may be formed in an **initial meeting** where **team members meet** each other and share information about their backgrounds, interests, and experience. At this point the role of the team leader is vital, as he or she will provide information about the project's objectives and goals, lead discussion about the scope of the task, and solicit ideas about how the team will work. This stage focuses mainly on **routine issues** such as team organization, assignments, and scheduling.

STAGE 2: STORMING. Once the work begins, the team moves into the "storming" stage. In this stage team members typically **compete** with each other **for status and acceptance of their ideas**. They undoubtedly will have differences about what should be done—**an area of potential conflict within the team**. Guided by an effective team leader, members learn how to solve problems together and settle into their roles and responsibilities. Team members must learn to listen to each other and respect one another's differences and ideas. At this state, members should have become team-focused.

STAGE 3: NORMING. During this stage team members begin to work together as a team. **Roles and responsibilities are clear and accepted** and **decisions are "group approved."** Team members have learned to respect each other's opinions, and they begin to trust each one another's input and assistance. Rather than competing against each other, they now help each other in pursuit of their common goal.

At this stage the team starts to make **significant progress on the project**. Since team members are collaborating, the team leader begins to function more like a coach.

STAGE 4: PERFORMING. In this stage the team should be **functioning at a very high level**. Group identity, loyalty, and morale should be strong, with the team highly motivated to get the job done. Team members should trust and rely on each other, making decisions and solving problems quickly and effectively. Team members do not need the oversight from the team leader that was necessary earlier.

STAGE 5: ADJOURNING. Adjourning takes place **once the task is completed**. If the project was successful, lessons learned should be documented and, of course, the team's success celebrated.



As team members move on to new endeavors, they will be enriched by the successes and challenges/obstacles that will help them in future projects.

6.8 MENTAL AND PHYSICAL WELLNESS

To be productive and happy, it is important that you take care of your mental and physical well-being. With the rigors and demands of being a student – and, later an engineering professional – it is easy to ignore these areas of your life. But that is a big mistake. Tending to these personal needs is a must.

Many people are not aware of the connection between one's physical and emotional health. The truth is they are strongly interrelated: Our physical well-being greatly affects our emotional state – and vice versa. For example, one of the best **remedies for emotional stress is vigorous physical exercise**. And I'm sure you've noticed that when you are mentally "up," you tend to feel good physically, whereas if you're emotionally down, you often feel physically fatigued or even get sick.

TIPS FOR GOOD HEALTH

Since each of us is so unique and our emotional and physical states so complicated, this section is only meant to offer you a few ideas. Most obviously and most importantly, to expect a high level of mental and physical health, you must:

- **Eat nutritionally**
- **Engage in regular aerobic exercise**
- **Get adequate sleep**
- **Avoid drugs**

EAT NUTRITIONALLY. What you eat significantly affects your physical and mental state. A proper diet consists of fresh fruits and vegetables, lean meat and fish in moderation, and whole-grain products. Avoid processed foods, fatty foods, and sugar. Not only will you feel better now but you'll reduce your chances of heart attack, cancer, and other diseases later.

ENGAGE IN REGULAR AEROBIC EXERCISE. Regular vigorous exercise, in which you get your heart rate above 130 beats per minute for more than 20 minutes at least three times a week, is essential to good physical condition. If you're not already engaged in some form of exercise, you should consider taking up jogging, brisk walking, swimming, biking, rowing, dancing, spinning, or any activity you commit to doing regularly.

GET ADEQUATE SLEEP. Different people require different amounts of sleep, and the amount needed will likely change as you grow older. Only you can determine how much sleep you need. Just remember that your work efficiency will decrease if you are getting either less or more sleep than you need.

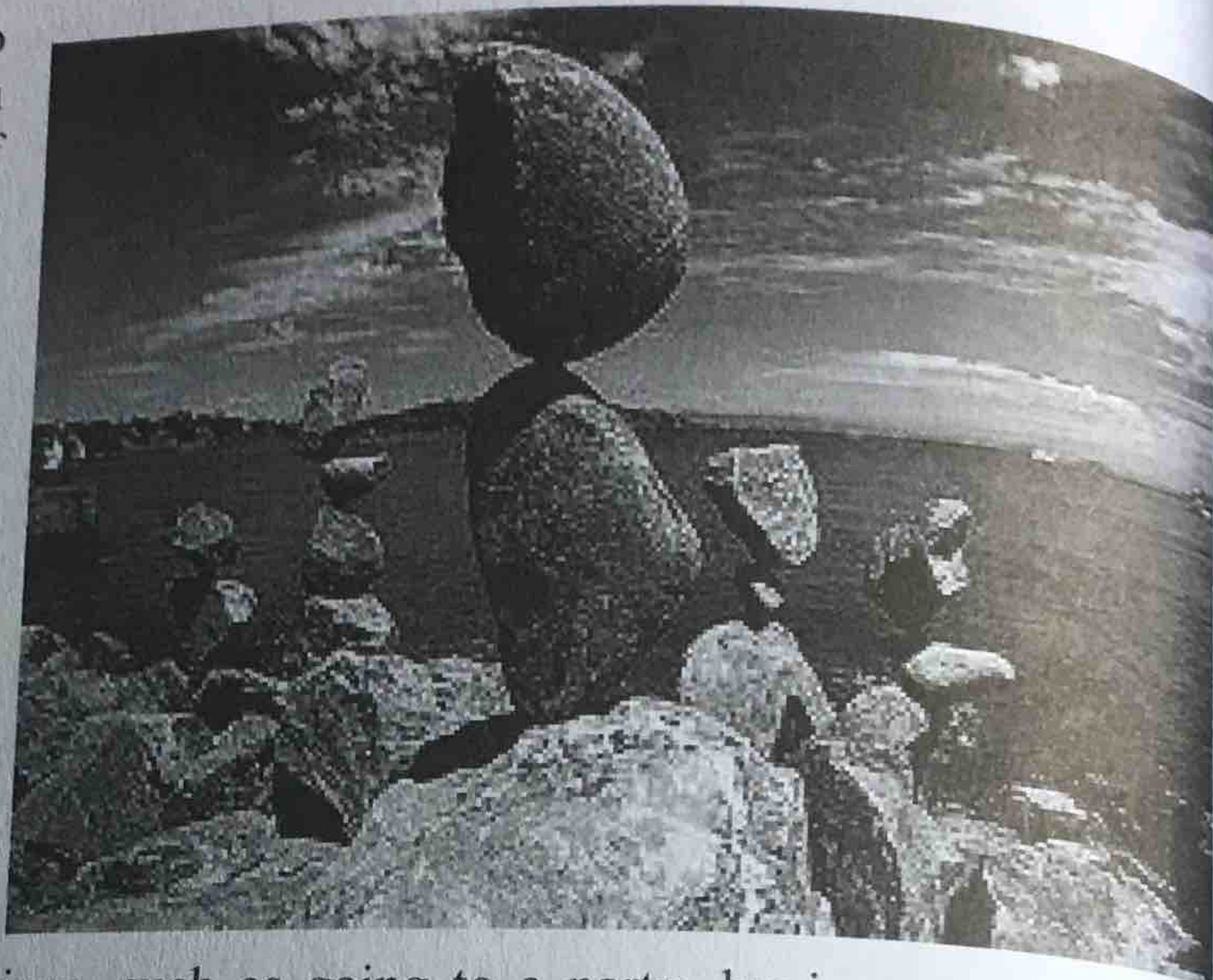
AVOID DRUGS. Drugs are abundant in our society. Some, such as caffeine, alcohol, and nicotine, are legal; others, such as marijuana and cocaine, are illegal. Regardless of their legality, all can be harmful and my advice to you is simple: Avoid them. Not only do drugs detract from your physical and mental health, they also can greatly interfere with your ability to study.

BALANCING WORK AND PLAY

To ensure a healthy mental state, you need to **strike a balance between immediate and future gratification**. By seeking too much immediate gratification (and therefore not getting your work done), you are likely to feel guilty. You'll probably then worry about the fact that you are not studying, putting yourself into a mental state in which you cannot study.

On the other hand if you work too much, too long, or too hard, you begin to feel deprived. Feelings of deprivation and resentment can be bound to sabotage your commitment to your studies. You may begin to doubt whether the sacrifice is worth it.

What you need to establish is a healthy balance between work and play. One approach is to tie work and play together through a system of rewards. Rewards can be small things, like taking a break, going for a walk, watching your favorite TV show, taking an hour for recreational reading. They could also be larger things, such as going to a party, buying new clothes, or planning a weekend getaway.

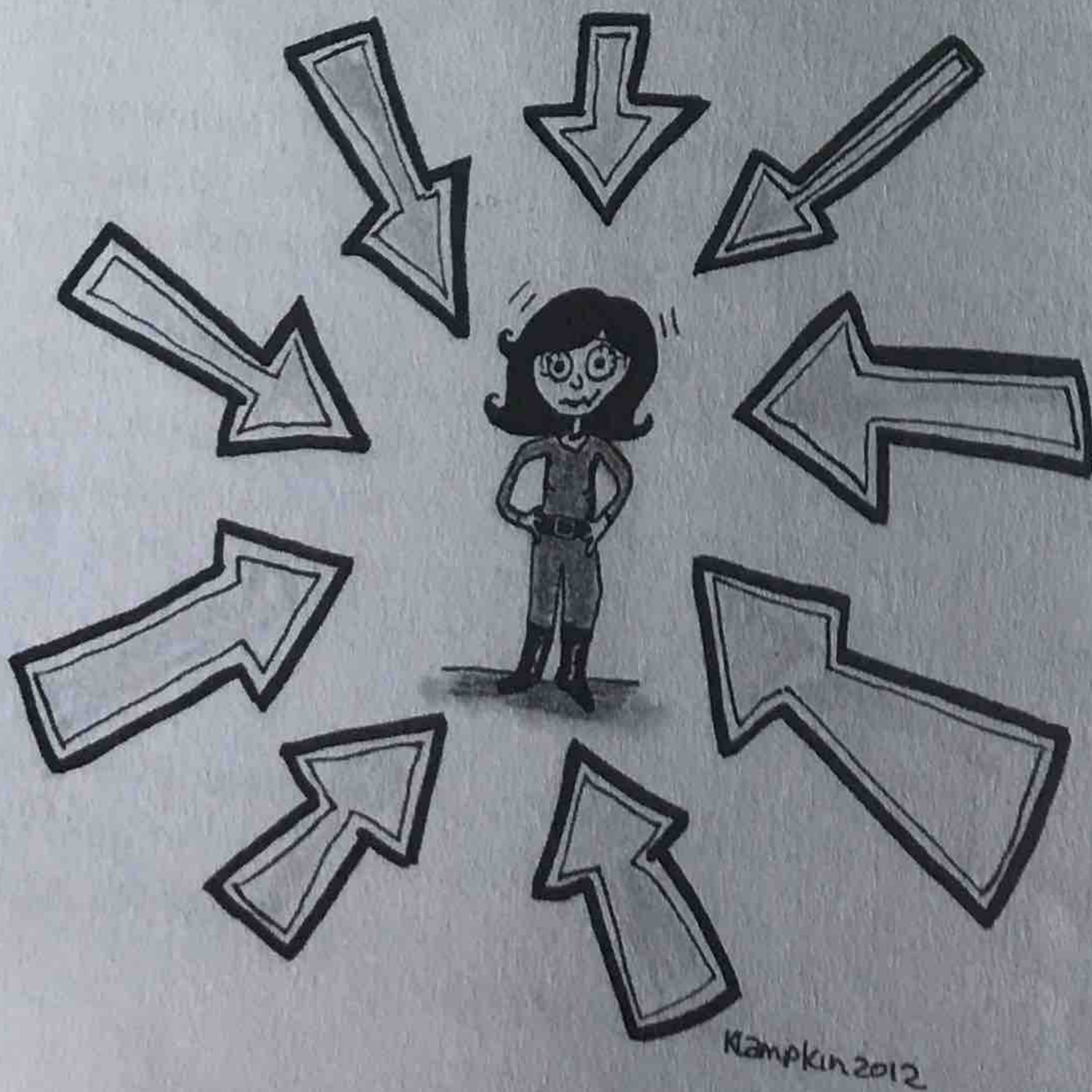


The point is that, rather than take the view that the work you are doing will not have a payoff until far into the future, you provide yourself with frequent and immediate rewards for your hard work.

MANAGING STRESS

Interestingly, the term *stress* was borrowed from engineering by Dr. Hans Selye, an early pioneer in the area of stress management. Selye defined stress as “the response of the body to any demand made upon it to adapt, whether that demand produces pleasure or pain.” [26]

Stress can be imposed externally or internally. Certainly, the announcement by three of your professors that each has scheduled a midterm exam on the same day can create external stress. Causes of internally imposed stress include unmet expectations, high performance standards, and unrealistic demands you place on yourself.



Stress can be either positive or negative. **Eustress** is a positive form that motivates individuals to attain high levels of performance. For example, the “butterflies” a football player experiences before a big game can produce inspired play. **Distress** is the negative form of stress. It distracts you from being the best you can be. It can debilitate both your physical and mental health.

Some common causes of distress include worry, frustration, anxiety, and depression. Frustration is our response

to being prevented from gratifying certain impulses or desires. For example, it would be frustrating if you were unable to enroll in a mathematics course you needed to take. Worry and anxiety are closely related. Both are your response to a perceived threat. Anxiety is a somewhat stronger emotion. You become worried if your roommate fails to come home for several days. You become anxious when you develop pains in your chest. Depression is an extreme form of worry and is an emotional condition characterized by feelings of hopelessness and inadequacy.

Each of these emotions is a potential stressor. Of course, stressors do not affect everyone the same way. What would cause stress for one person may not even bother another.

What is clear, though, is that stressors are directly related to your self-esteem. If you feel competent and worthy, you are in a good position to handle stress. Your reaction to stressors is also tied to your sense of control over your life. For individuals who lack self-esteem and do not feel in control of their lives, stress can wreak all kinds of emotional and physical havoc.

Whether *eustress* or *distress*, Selye demonstrated that stress stimulated our "fight or flight" response. This is an instinctive physical reaction to threat, either physical or psychological, which we inherited from our ancient ancestors. Under stress, more blood is diverted to the brain and muscles for clearer thinking and quicker reflexes, the heart rate accelerates, blood pressure rises, and respiration rate increases. For engineering students, this response is not appropriate, since you will need to neither "fight" nor "take flight." The stressors we're talking about are mental or emotional ones, so the concepts behind "fight or flight" are, at best, metaphoric. Still, it is interesting to understand the interactions between perceived stressors and one's response to them.

To bolster your effectiveness as an engineering student, it is important that you learn to cope with and manage stress. HelpGuide.org (www.helpguide.org/topics/stress.htm), a non-profit mental health organization, puts forth 14 healthy ways to reduce stress and relax and recharge:

(1)	Go for a walk.	
(2)	Spend time in nature.	•
(3)	Call a good friend.	
(4)	Sweat out tension with a good workout.	•
(5)	Write in your journal.	
(6)	Take a long bath.	
(7)	Light scented candles.	
(8)	Savor a warm cup of coffee or tea.	
(9)	Play with a pet.	
(10)	Work in your garden.	
(11)	Get a massage.	•
(12)	Curl up with a good book.	
(13)	Listen to music.	•
(14)	Watch a comedy.	•

It is important that you use practical strategies such as these to prevent the burn-out that can come from unchecked or unresolved stress. In the long term, proper nutrition, regular exercise, relaxation, and good time management will help to keep your stress level low.

If all else fails, it is important that you seek counseling or medical treatment. Extreme stress can lead to severe physical incapacitation – often to the point of prolonged diseases or even death.

6.9 MOTIVATING YOURSELF

We will conclude this chapter on student development with several inspirational messages. If you accept the premise of behavior modification that you hold the reins for becoming the best you can be, the messages of others who have succeeded will reinforce your motivation to do the same.

Another Personal Story

Sometimes I wish I could bottle and sell the feeling I have about the value of my education. I owe almost everything of quality in my life to my education. I have had so many unique and rewarding experiences, so many challenges, so many opportunities. I've been paid well to do work I enjoy. I have been able to travel, write, speak, teach, and influence others. I have gotten to know many interesting people. I have had options and choices and control over where I live and what I do. I can hardly imagine going through life without an education.

Often I wonder why I have been so fortunate. How is it that I went so far with my education? Where did my motivation come from? Actually, it is as clear as day. My mother gave it to me. And she did it in such a dramatic way that, as I look back, there was no possibility I would not go to college and no possibility I would not succeed. If I had failed, I would have let down my mother's number one dream.

How did she motivate me so strongly? When I was two years old, my father died. He had just changed jobs, so my mother received only a very modest pension of \$15 a month.

As a single parent, my mother could have really used that money, but every month she put \$3.75 with that \$15 and with the \$18.75 she purchased a \$25 United States Savings Bond for my education. Every month she took me to the bank to put the savings bond in her safe deposit box and told me that the money was for my college education.

Your parents or guardians may have sent you similar messages about the importance of education. If they did, you are indeed fortunate. You are very likely to succeed.

Not all students have parents or guardians who sent them positive messages about the value of a college education. I have known many students, in fact, whose parents were opposed to their going to college, preferring instead that they work to help support the family.

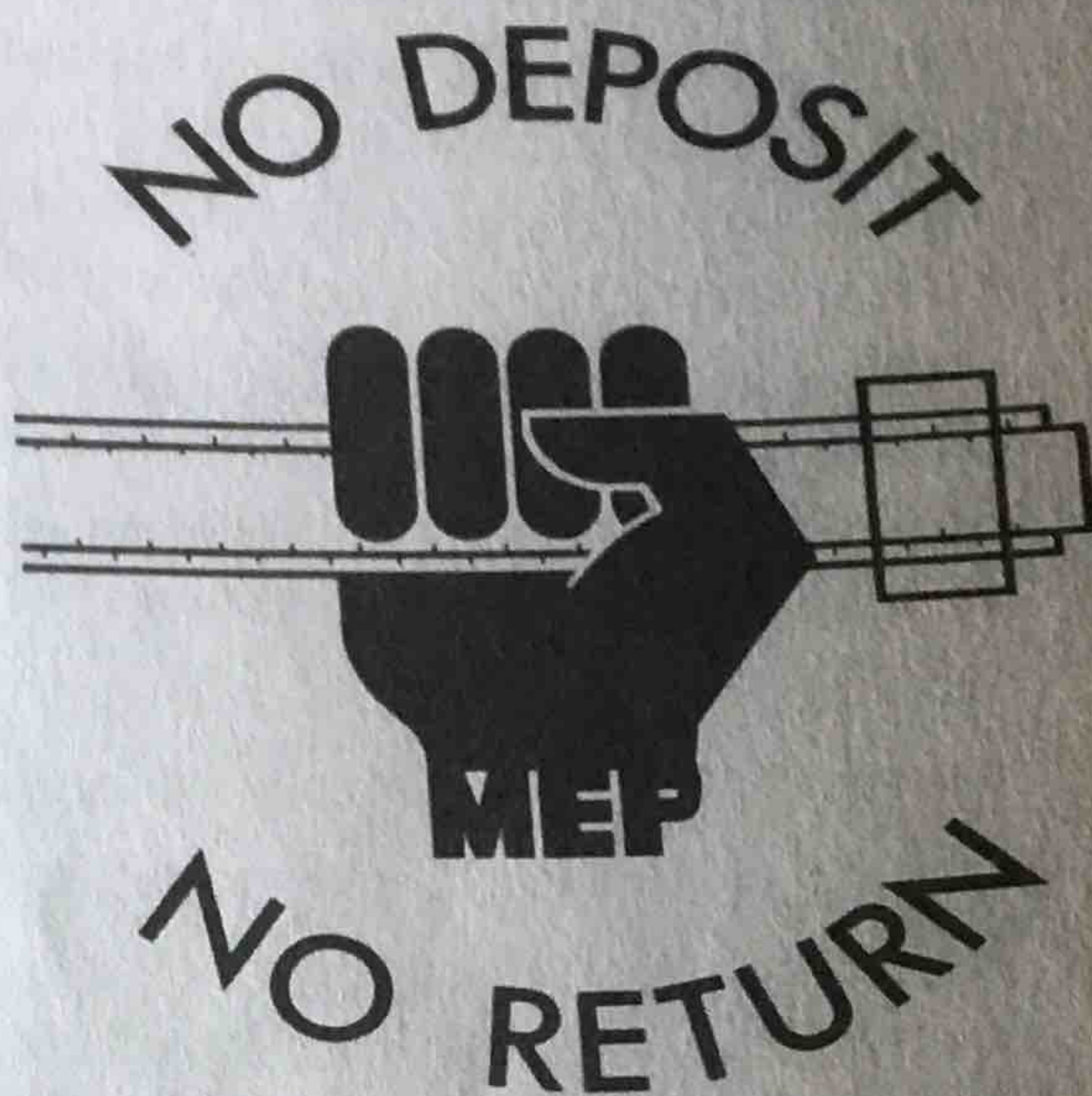
However, regardless of any messages you received growing up about the value of a college education (and the consequent success it will bring you), you are now an adult. You can think for yourself. You can define your own reasons for wanting to get your education. You can motivate yourself.

We already addressed the idea of motivating yourself through an awareness of the rewards and opportunities an engineering career offers. In Chapter 2, we discussed my "top ten" list of what it will mean to the quality of your life if you are successful in completing your engineering degree. The following sections present additional perspectives regarding the value of your education.

"NO DEPOSIT, NO RETURN"

When I was Director of the Minority Engineering Program at California State University, Northridge, we wore a motivational button with the logo shown to the right.

The clenched fist holding the slide rule (a symbol of engineering in years past) represents the power that comes to an individual through a technical education. The motto "No Deposit, No Return" reminds us, however, that this power does not come without a "deposit." Getting a college education is not easy, and majoring in engineering is even more challenging. Without a doubt, the "deposit" you must make as an engineering major is a rigorous, demanding one. But I guarantee that you will be paid back for the investment many, many times over.



JESSE JACKSON'S "EXCEL" MESSAGE

The Reverend Jesse Jackson has spent much of his career motivating young students. His *Push for Excellence* program had a significant impact on African-American youth in Chicago and across the nation.

Reverend Jackson's basic message is that you should strive to excel in everything you do.

But what does it mean to excel? Very simply, it means:

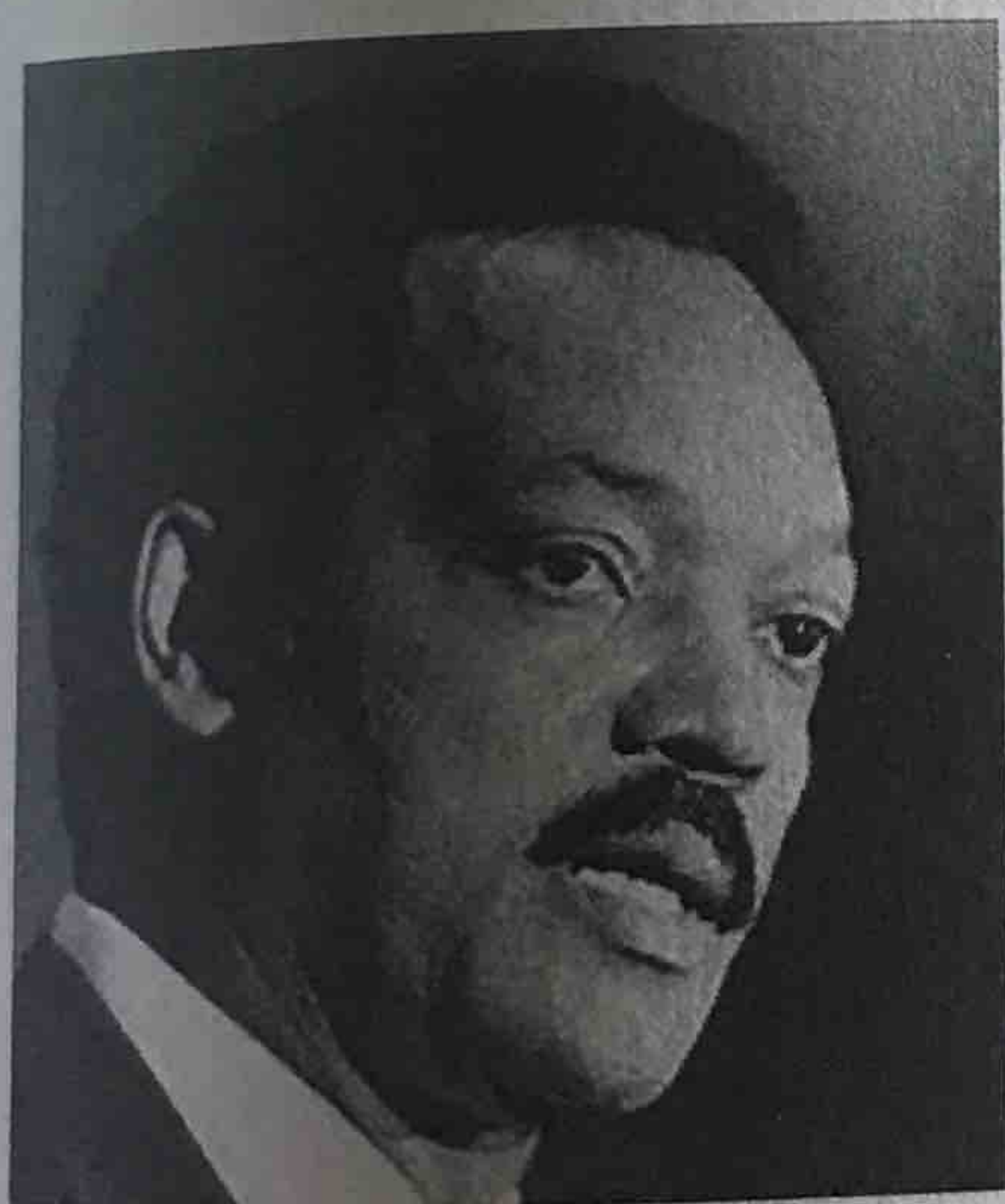
Do your personal best!

If your "personal best" produces a "C" grade in a course, then you have excelled in that course. But how many of us do our best? Do you?

There are reasons why you should strive to excel – to do your best. We have already discussed some:

- It will enhance your self-esteem.
- It will be good for society.
- You will have a challenging and rewarding career.

Can you think of others?



Rev. Jesse Jackson

INSPIRATIONAL AND MOTIVATIONAL QUOTATIONS

I like inspirational and motivational quotations. You have probably gathered that by the fact that each chapter in this book starts with a quotation and others are dispersed throughout the chapters. Many of these quotations speak to me personally, reminding me of what's important. And they offer so much wisdom. One from former British Prime Minister Benjamin Disraeli aptly notes that:

Much of the wisdom of the wise and the experience of the ages are perpetuated by quotations.

You can find a tremendous resource of more than 500 of the most famous quotes at:

www.discovery-press.com/discovery-press/studyengr/quotes.htm

There are so many wonderful quotes at that website that it's hard for me to choose favorites. Examples of ones I like are:

"Do not go where the path may lead; go instead where there is no path and leave a trail."

– Ralph Waldo Emerson

"You've got to get up every morning with determination, if you're going to go to bed with satisfaction." – George Lorimer

"When one door of happiness closes, another opens, but often we look so long at the closed door that we do not see the one that has been opened up for us." – Helen Keller

"The tragedy of life doesn't lie in not reaching your goal. The tragedy lies in having no goals to reach." – Benjamin Mays

"Whether you think you can or think you can't, you're right." – Henry Ford

"Do first things first, and second things not at all." – Peter Drucker

"Tell me and I forget. Teach me and I remember. Involve me and I learn." – Benjamin Franklin

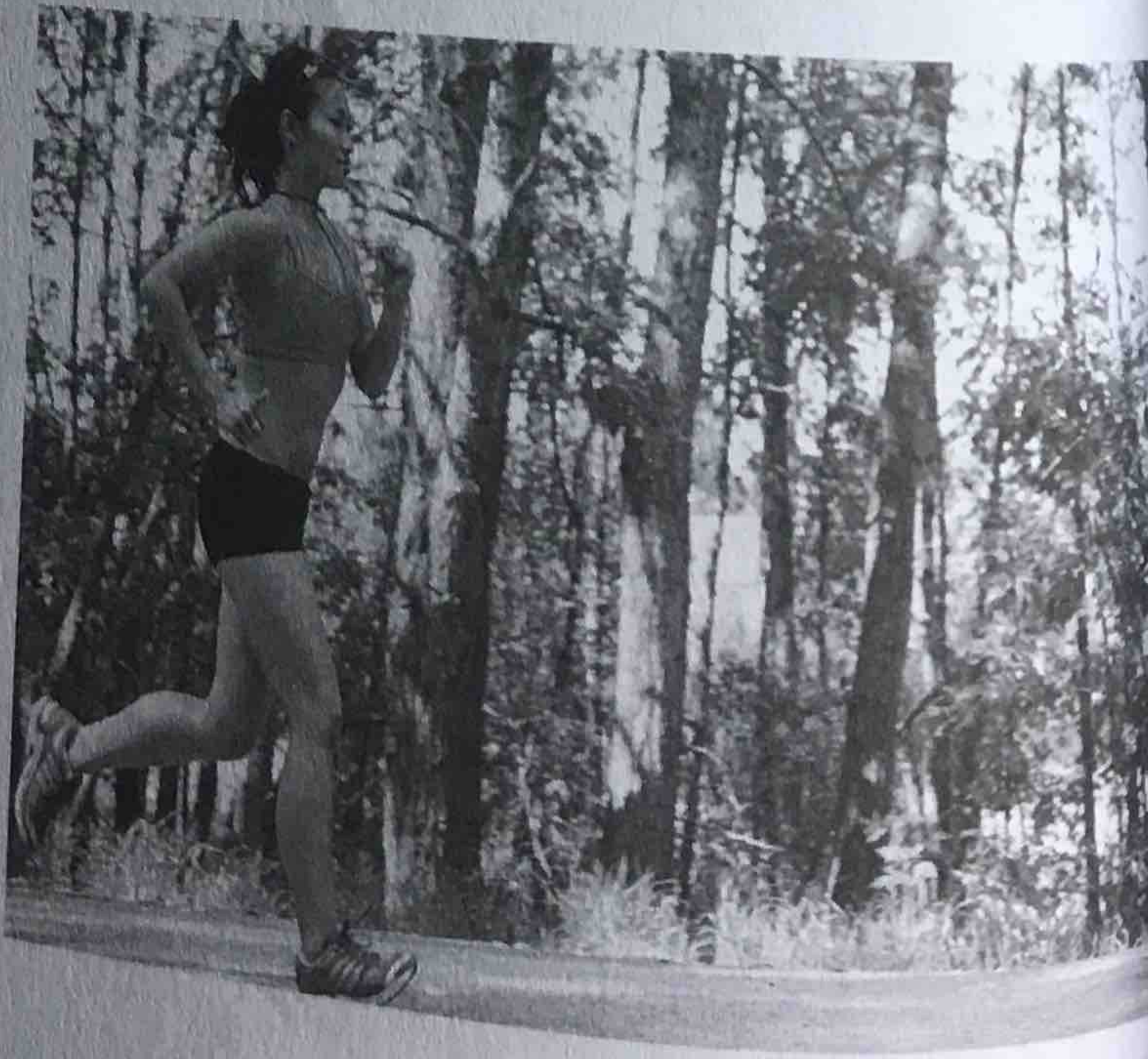
Reaping the potential benefits of quotations will take time and effort on your part. I encourage you to read as many of the 500 ones at the website above as possible. But reading a quotation is not enough. Select a few that particularly speak to you. Reflect on each one's meaning and the changes in your attitudes or behaviors each calls on you to make. Write each quotation on an index card and post the cards where you can readily see them. Reread the quotations often for seven days. Memorize several and use them in conversation with others. Above all, be guided by Benjamin Franklin's above astute connection between involvement and learning.

REFLECTION

Reflect on Peter Drucker's quotation, "Do first things first, and second things not at all." What does this mean to you? Do you see something of yourself in this quotation? Are you a person who prioritizes the tasks in front of you and does the top priority item first? Or do you choose to do things that are easy or you enjoy? Once you have completed your top priority task, do you go to your second priority task? Or do you reprioritize the remaining tasks?

POWER OF POSITIVE THINKING

I like to use an analogy between jogging and going to college. People take up jogging because they perceive certain benefits. They expect to live longer, feel better, breathe more easily, and lose weight. Initially they may dislike the experience of jogging, suffering through it solely for the end result. Eventually, however, most joggers learn to enjoy the experience. They come to enjoy the physical elements – the rhythmic cadences of moving and breathing, the harmony between body and mind – and they find



that long periods of jogging can lead to a particularly unique experiences: the so-called "runner's high," a heightened sensitivity to the world around them, along with an ability to think more creatively.

As an engineering student, you can liken yourself to a jogger. At first you may resent or dislike the college experience but you persevere because of the future benefits you anticipate: career opportunities, money, social status, security. But you also will come to appreciate your time in school, not only for the benefits it promises, but for the experience itself.

If, like the novice jogger, you find that you dislike school, you are not focusing on the positive aspects of being a college student. You need to recognize that you have created an attitude that may have nothing to do with reality. In fact, you probably are in the best situation of your life and just not aware of it. Surely you have heard people say that their college years were the best years of their lives. Why do you suppose they say this?

If you do have a negative attitude toward school, now is the time to change it. For it's more than likely that you are neither performing at your peak effectiveness nor enjoying what should be the most exciting, rewarding time in your life. Learn to focus on the positive aspects of being a college student, like the ones listed below.

GROWTH PERIOD. As a college student, you are in a significant growth period. One indication of this is the way in which you are outgrowing your friends from high school who are not going to college. Probably never in your life will you be in such an intense period of learning and personal growth as when you are in college.

EXPOSURE TO PEOPLE. College puts you in an extremely people-oriented environment. Never again will you be with so many people of the same age and interests. You'll find that many of the friends you make during your college years will be important and helpful to you throughout your life.

MANAGER OF YOUR TIME. As a college student you are working for yourself. You have no boss, no one to tell you what to do. Except for your class time, you are pretty much free to manage your time and affairs.

STARTS AND STOPS. School starts and stops, somewhat like the running of a race. When the race starts you put out a great deal of effort, maybe more than you would like to, but you do so because you know it will end. When it does end, you then have an extended period of time for rest and rejuvenation – a break you will not have once you start working as an engineer.

When you learn to appreciate these and other unique aspects of being a college student, you will see an improvement in your academic performance. Remember that:

Positive attitudes bring positive results! Negative attitudes bring negative results!

REFLECTION

Consider the following quote from Winston Churchill: "The pessimist sees difficulty in every opportunity. The optimist sees the opportunity in every difficulty." Which statement best describes you? Do you tend to see difficulties in every opportunity? Or do you tend to see opportunities in every difficulty?

SUMMARY

This chapter focused on your personal growth and your development as a student. Because change is such a critical factor in personal growth and student development, we first discussed

the psychology of change. We particularly noted how people's receptiveness to change has grown dramatically in recent years – a credit owed largely to U.S. business and industry's embracing the philosophy of "continuous improvement" and its derivative program, Total Quality Management (TQM).

We then proposed a personal adaptation of TQM, which we called "student development." The particulars of each individual student's development plan will certainly vary, but all are based on the following premises:

- (1) Your goals set the context and direction of your personal development plan.
- (2) You monitor the progress of your personal development by a measurement system that analyzes your actions, thoughts, and feelings.
- (3) You not only implement the plan and track your progress; you also continuously revise the plan to ensure your "continuous improvement."

Next, we discussed mechanisms for human behavioral change and presented one based on behavior modification theory: a three-step process that is the most practical and accessible for students. Those three steps entail (1) knowledge, (2) commitment, and (3) implementation. As part of this presentation, we also discussed barriers to change that you are likely to encounter as you move through the three steps.

A necessary backdrop to behavioral and attitudinal changes is self-understanding, so we discussed various models of human behavior to help you understand yourself better.

Maslow's Hierarchy of Needs showed you what basic human needs must be met before you can undertake a plan of self-improvement. Along with this discussion of basic needs, we pointed out the role self-esteem plays in the process of personal growth and change.

The Myers-Briggs Type Indicator (and the closely related Keirsey Temperament Sorter II) was presented as another way to understand yourself. These instruments give key insight into personality types.

The topic of understanding others and respecting differences in people was also discussed. An important component of your personal growth is your effectiveness in working with people who differ from you.

Next we discussed assessment as a tool to identify and work on areas in which you need improvement. We focused on three particular areas that are often overlooked in personal development: communication skills, teamwork and leadership, and physical and mental wellness. In this latter area, we emphasized the importance of managing stress.

We concluded by offering multiple motivational messages and quotations to support your commitment to the difficult process of behavioral and attitudinal change. In conjunction with these messages, we highlighted the positive aspects of being a college student.

The intention of this chapter was to stress how change leads to personal growth, how personal growth leads to the accomplishment of goals, and how the accomplishment of goals leads to success in school, in the engineering profession, and in life in general.

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PROBLEMS

1. After doing some research, write a 500- to 750-word essay on "Total Quality Management." How does TQM compare to the management approaches you have observed in the university you attend, organizations you belong to, or companies you have worked for?
2. For the next week, write down any negative thoughts you have. Describe at least one non-productive action that is likely to result from each negative thought. Also write down a positive thought you could substitute for the negative thought. Describe at least one productive action that is likely to result from each positive thought.
3. Scrutinize your behavior in the past week and then write down five non-productive actions you have done. Why did you choose these non-productive actions?
4. When we receive a stimulus (e.g., seeing food), we often act (e.g., eating the food) and then think about our action (e.g., "I shouldn't have eaten the whole thing."). How can you change this order (stimulus $\Rightarrow$ action $\Rightarrow$ thought) in a way that would lead you to choose productive actions more frequently?
5. Add ten examples of productive actions (actions that will enhance your academic success) to the list of seven given in Section 6.2.
6. Do you think behavior modification could work for you? Why? Do you think counseling/therapy would benefit you? Why?
7. Convert the following negative thoughts to positive ones by finding a higher context from which to view the situation that led to the negative thought:
 - a. I wish I were taller.
 - b. I'm homesick.
 - c. I don't have any friends.
 - d. My chemistry lectures are boring.
 - e. I don't know if I like engineering.
 - f. I wish I could find a better roommate.
 - g. I don't have time to exercise regularly.
8. Go to the following website and print out the survey form there (www.discoverypress.com/discovery-press/studyengr/attitudesurvey.pdf). Complete the "Freshman Engineering Student Attitudes Survey." Review the results and identify any negative attitudes you have. What criteria did you use to make the determination? Pick three important negative attitudes that you hold and try to change them by working through the process described on Pages 170-171. Write a one-page statement on what you learned from this exercise.
9. Consider your view about life-long learning. Are you excited or discouraged about the prospect of learning throughout your career? Prepare a 2-3 minute presentation for your *Introduction to Engineering* course on why life-long learning is particularly important for professional engineers.
10. Consider the following productive behaviors:
 - a. Studying collaboratively with other students

- b. Devoting significant time and energy to studying
- c. Preparing for each lecture
- d. Studying from class to class rather than from test to test
- e. Making effective use of professors outside of the classroom
- f. Practicing good time management principles
- g. Immersing yourself in the academic environment of the institution
- h. Actively participating in student organizations

Answer the following questions about each behavior:

- (1) Do you have adequate knowledge about each behavior?
 - (2) Have you made a commitment to the behavior? If not, why?
 - (3) Are you implementing the behavior? If not, what is keeping you from doing so?
11. Read Albert E.N. Gray's presentation "The Common Denominator of Success." (You can find it at: www.discovery-press.com/discovery-press/studyengr/CommonDenominator.pdf). Write a one-page review of the presentation. What do you think of the ideas presented there? Do they stand the test of time? Do you agree with the "common denominator of success" that Mr. Gray identifies?
12. Review Abraham Maslow's Hierarchy of Needs. How well are you meeting your needs at each level? Think up one or two ways to better meet your needs at each level. Do them.
13. Research the term *self-actualization*. What does it mean? How strong is your need for self-actualization?
14. Consider the ten items listed in Section 6.3 that correlate with healthy self-esteem. Write down a brief definition of each item. How many of the items would you use to describe yourself?
15. Consider the ten items listed in Section 6.3 that correlate with poor self-esteem. Write down a brief definition of each item. How many of the items would you use to describe yourself?
16. Based on the results of Problems 14 and 15, would you say you have a healthy or poor self-esteem? Explain. What could you do to improve your self-esteem?
17. Write a paragraph describing yourself in terms of the four personality indicators that are measured through the Myers-Briggs Type Indicator (MBTI). From this analysis, what MBTI indicator (e.g., ENFP) do you think best describes you?
18. List five ways you benefit from knowing your MBTI personality type.
19. Find out if you can take the MBTI on your campus (at the testing office, counseling center, etc.). If you can, take the test and determine your MBTI personality type. Compare the results with Problem 17.
20. Take the Keirsey Temperament Sorter II online at: www.keirsey.com/sorter/register.aspx. What temperament type are you? Find the description of that temperament type on the Keirsey website. How accurately does it describe you? Print out the description and ask someone who knows you well how on-target the description fits you.
21. Go to the Keirsey website (www.keirsey.com/sorter/register.aspx) and read the description of the Guardian Inspector (ISTJ) and the Idealist Healer (INFP). Do you think an ISTJ would make a good engineer? What about an INFP?
22. List five reasons why you should strive to improve your effectiveness in working and communicating with people who are different from you.

23. Conduct a personal assessment based on the "Attributes Model" by rating yourself on a scale of zero to ten (ten being highest) on each of the 11 attributes listed in Section 6.5. Identify the five areas in which you rate the lowest. Pick the three of those you feel are the most important. Develop a personal development plan to improve in each of these areas.
24. Evaluate yourself, on a scale of zero to ten (ten being highest), with regard to the following personal qualities:

- a. Enthusiasm
- b. Initiative
- c. Maturity
- d. Poise
- e. Integrity
- f. Flexibility
- g. Ability to work with other people

What can you do to improve yourself in the areas with the lowest evaluations?

25. Assess the quality of your education as measured by Alexander Astin's "Student Involvement Model." Give yourself a rating of zero to ten (ten being highest) for each of the five areas listed in Section 6.5. Develop a plan for improving in any area you feel you need to improve. Implement the plan.
26. List ten types of documents that an engineer might have to write. Which of these documents do you feel qualified to write at this time?
27. Write a proposal seeking funding (e.g., from parents, private foundation, scholarship committee, etc.) to support your education. Explain how much money you need, why it's needed, and how giving you the money will ultimately benefit the *funding source*.
28. Develop a personal development plan for improving your writing skills over the next three to five years. Implement the plan.
29. Pick one of the personal development books listed at the end of Chapter 6 (Reference 2, 8, 9, 12, 13, or 15). Read the entire book (or a specific part of it) and write a critique of what you read.
30. Develop a personal development plan for improving your oral communication skills over the next three to five years in each of the following areas:
- a. One-on-one communication
 - b. Group communication
 - c. Formal presentations
- How do your plans differ in each area?
31. You are hired to conduct a telephone campaign to request contributions from graduates of your engineering school. Write an opening statement and follow-up statements or questions that would persuade an alum to make a contribution.
32. A common strategy for improving your vocabulary is to write down unfamiliar words from your reading, find their definition in the dictionary, and try to use them when you speak or write. Carry this strategy out for the following words which appeared in Chapter 6:
- paradigm
conduce
discourse

efficacy
attribution
stereotype

33. Pick one of the achievements below:

- a. Jonas Salk developing the polio vaccine
- b. Daniel Boone blazing the wilderness trail
- c. Charles Lindbergh flying solo across the Atlantic
- d. Bill Gates creating Microsoft
- e. Mohammed Ali winning the world heavyweight boxing championship
- f. Mother Teresa ministering to the poor

Research the achievement and write a short paper describing the type of team that was necessary to make the achievement possible.

34. Review the 16 "Principles of Teamwork" on Page 194. Rank them in order of importance. Pick your top five and write a paragraph for each principle, describing it in more detail and explaining why it is important to team effectiveness.

35. Do you seek opportunities for leadership? If not, explain in a short paper why such opportunities do not capture your interest. If, however, you do seek such opportunities, explain in a short essay which of the "Attributes of an Effective Team Leader" on Page 194 describe you and why.

36. Review the ten "Characteristics of an Effective Team Member" on Pages 195-196. Have you ever been a member of a team? If so, explain which of the characteristics best refer to you as a team member. List three characteristics that you need to improve to be a "world-class" team member. Develop a plan for making that improvement.

37. Conduct a personal assessment based on the four keys to good health listed in Section 6.8:

- a. Eat nutritionally
- b. Engage in regular aerobic exercise
- c. Get adequate sleep
- d. Avoid drugs

Develop a personal development plan for any areas in which you rate yourself low.

38. For the next week, schedule your study time in blocks. Following each block of study time schedule something you enjoy as a reward for doing your work. At the end of the week evaluate how this plan worked for you.

39. Write your recollections of the messages your parents or guardians sent you about the value of a college education. Do you agree with these messages?

40. Pick a quotation that speaks to you from the 500+ motivational quotations www.discovery-press.com/discovery-press/studyengr/quotes.htm. Jot down the following

- a. What does the quotation mean to you?
 - b. What changes in your attitudes and/or behaviors does the quotation call for?
- Develop a plan for implementing the changes.

41. At the “Inspirational and Motivational Quotes” website: www.discoverypress.com/discovery-press/studyengr/quotes.htm, pick at least one quote from the following four individuals:

- a. Wayne Dyer
- b. Jim Rohn
- c. Zig Ziglar
- d. Peter Drucker

Do an Internet search of each of these individuals and write a short paragraph on each describing who they are. Why do you think their wisdom is valued?

Put each of the quotes on an index card and place the four cards prominently in your primary study area. Read and reflect on each quote daily for seven days.

42. Read the 200+ Benjamin Franklin quotes you will find at: www.discoverypress.com/discovery-press/studyengr/quotes.htm (Click on “Benjamin Franklin Quotes”). Pick your favorite quote. Write a one-page statement on why you picked the quote and what changes it calls on you to make in your life.

43. In addition to the four positive aspects of being a college student discussed in Section 6.9, list five others. Do you believe the adage that “positive attitudes bring positive results; negative attitudes bring negative results”? Explain your thinking.