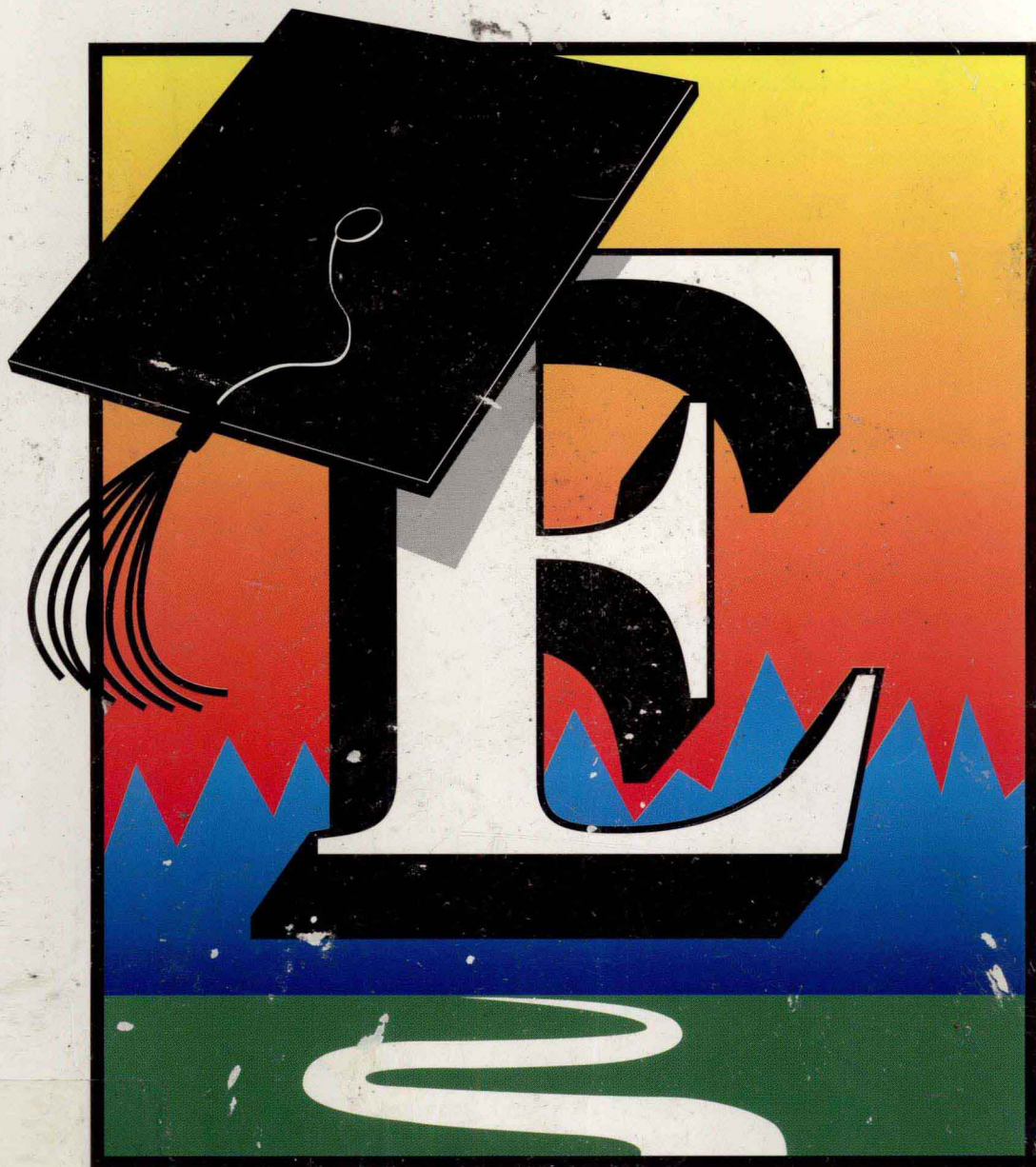


# **Studying Engineering**

**A Road Map to a Rewarding Career**



**RAYMOND B. LANDIS**

# **Studying Engineering**

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**A Road Map to a Rewarding Career**

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**By  
Raymond B. Landis  
Dean of Engineering and Technology  
California State University, Los Angeles**

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**To Kathy**

# FOREWARD

*Studying Engineering: A Road Map to a Rewarding Career* is a breakthrough book. Engineering educators who teach Introduction to Engineering courses having a student development focus often face a dilemma. If they choose a text written for a university-wide freshman orientation course, the material probably does not address the specific needs of engineering students. If they choose to conduct the course without a book, they can spend an inordinate amount of time finding supporting material for each topic to be covered.

*Studying Engineering* has been written to serve as a change agent within engineering education. It should encourage engineering faculty, as they undertake major revisions in the freshman year curriculum, to seriously consider inclusion of subjects such as professional development, academic success strategies, personal development, and orientation to the engineering education system. These subjects are each important to engineering student success, and in this work, they are presented in a readable, perceptive and thought-provoking manner.

*Studying Engineering* describes behaviors and attitudes critical to engineering student success. One of the unique qualities of this book is the manner in which it leads students through the “how to” process of changing their behavior so as to become more effective at the task of being engineering students and practicing engineers.

*Studying Engineering* is a remarkable compilation of insights developed by the author as engineering student, practicing professional, engineering professor, and engineering dean over the past 30 years. The book is filled with insightful, personal anecdotes that are certain to have an impact on the reader. *Studying Engineering* should be a unique resource to freshman engineering students, engineering educators, and, indeed, anyone interested in gaining a better understanding of the engineering education process.

Frank L. Huband  
Executive Director  
American Society for Engineering Education  
Washington, D.C.

## PREFACE

We aren't born knowing how to be effective. We learn how. We learn from our parents, from our teachers, from our peers, and from supervisors and mentors. We learn from workshops and seminars, from reading books, and from trial and error. Developing our effectiveness is a life-long process. Sometimes we get more help than other times. For example, when we join an organization as a professional, we generally receive lots of help. The organization benefits if we are successful, and so it takes steps to ensure that we are.

Industry executives are well aware that new engineering graduates have a long way to go before they can "earn their salary." New engineering hires are thus provided with formal training, on-the-job training, close supervision, progressively more challenging assignments, rotating work assignments, and time to mature.

Strangely, when new students (or, in fact, new faculty) come to the university, they are left primarily on their own to figure out how to be successful. Academic organizations seem more interested in evaluating their newest members than in doing things to ensure that they succeed.

Within engineering education, this "sink or swim" approach is not working. Only about forty percent of students who start engineering study ever graduate. Most drop out, flunk out, or change their majors. And many of those who do graduate fail to work up to their full potential.

Even deans of engineering need training. As a new dean, I had four separate consultants in for two days each to teach me (and my school's faculty) how to be effective in preparing for our upcoming accreditation process. In addition, I have participated in formal training in personnel management, fund raising, Total Quality Management, computer technology, and teaching methods.

If new engineering graduates and new engineering deans need orientation, training, mentoring, and time to mature to be effective, how is it that as engineering educators we expect our students to know how to go about the task of engineering study the day they arrive?

Sometimes it appears that we don't want our students to succeed. We seem to go out of our way to avoid helping our students learn to be effective. Our view of subjects like professional development, academic success strategies, personal development, and orientation is that they are



not “academic.” We are reluctant to find room for them in our already full curricula.

But it even goes further than that. We sometimes seem pleased by the fact that many of our students don’t succeed. We find satisfaction in the view that “not everyone can be an engineer.” Our approach is to put up a difficult challenge and believe that we have done a service to the profession by “weeding out” those who don’t measure up. We tend to hold the black-and-white view that “some have it, and some don’t.”

If it were true that some students have it and some don’t, then it probably wouldn’t make sense to devote time and effort to helping students develop the skills they need to succeed. It wouldn’t make a difference anyway. But this is one heck of a view for educators to have.

The good news, however, is that engineering education in the United States appears to be undergoing a revolution. We are in the process of a shift from the “sink or swim” paradigm to one of “student development.” Engineering colleges all across the nation are revising their freshman year curricula with the primary goal of enhancing student success.

Although much of this curricular change involves moving more engineering content in areas such as design, graphics, computing, problem solving, and creativity into the freshman year, I hope that many engineering programs will find room for the “student development” content of this book in their freshman year curriculum.

The basic premise of this book is that a small amount of time spent working with students on how to be effective early on can have an enormous payoff through the remainder of their college experience.

Chapter 1 lays the foundation for the entire book by putting forth three keys to success in engineering study: 1) determination; 2) effort; and 3) approach. These keys to success are followed by three models which will help students understand what is meant by a quality education and how to go about getting that education.

Chapter 2 addresses the subject of professional development. One of the primary purposes of the chapter is to motivate students through an increased understanding of the engineering profession and an increased awareness of the rewards and opportunities that will come to them if they are successful in graduating in engineering.

Chapter 3 addresses those strategies and approaches that are essential to academic success. Strategies for utilizing important resources including

fellow students and professors are discussed and study skills that are particularly important in math, science, and engineering courses are put forth.

Chapter 4 focuses on the important subject of personal development. A *Student Success Model* is presented to assist students in understanding the process of making behavioral and attitudinal changes essential to success in engineering study. Sections on Maslow's Hierarchy of Needs, self-esteem, Meyers-Briggs, and Herrmann Brain Dominance Instrument assist students in understanding themselves as well as others. Important personal development topics of personal assessment, communication skills, and health and wellness are included in this chapter.

Chapter 5 addresses four extracurricular activities that can greatly improve the quality of a student's education: 1) student organizations; 2) engineering projects; 3) pre-professional employment; and 4) service to the university.

Chapter 6 provides an orientation to the engineering education system including faculty, curriculum, students, facilities, administration, and institutional commitment. Academic regulations, student ethics, and opportunities for graduate education are also covered in this chapter.

This book is ideally suited for use in an *Introduction to Engineering* course that has a "student development" objective. However, the book can be used in a variety of other ways. Students can read the book prior to entering the university, perhaps in conjunction with summer orientations or summer bridge programs. Much of what is in the book has direct application to the community college experience, and the topics that are specific to the four-year university experience can provide community college students with a preview of what they will encounter when they transfer to four-year institutions.

The book may be of interest to other audiences as well. High school students considering engineering as their college major will find the book useful. Engineering faculty can turn to it as a resource for ideas they can convey to students in formal and informal advising sessions or in the classroom. Deans of engineering have indicated that the book contains material to help them prepare talks they give to high school students and freshman engineering students.

This book has been the outgrowth of more than twenty years of teaching *Introduction to Engineering* courses. Much of the material was developed through brainstorming exercises with students. My greatest



thanks to the many students who contributed to the development of the ideas in this book.

Some of the material in the book was originally published as four articles in the *National Society of Black Engineers Journal* and then republished by the National Action Council for Minorities in Engineering (NACME) as a widely distributed monograph titled “Academic Gamesmanship: Becoming a ‘Master’ Engineering Student.” My great thanks to Bill Bowers, then editor of the *NSBE Journal*, and to Ronni Denes, Vice President for Communications at NACME, for their early support of my work.

Many people have contributed directly or indirectly to the creation of the book in its current form. The first draft was written under contract with Benjamin/Cummings and was scheduled to be a module in their new customized text *The Engineers Toolkit*. Eventually, by mutual agreement, it was deemed too comprehensive to be a module in that text. My thanks go to Jennifer Young and Denise Penrose of Benjamin/Cummings for giving me the incentive to write the book.

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George Beakley at Arizona State, Lee Gassert at CSU Northridge, and Alexander Astin at UCLA provided me with the models that form the heart of Chapter 1.

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Raymond B. Landis  
Burbank, California  
June, 1995

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