REVIEW: Teaching Engineering

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sets the tone for the book by describing the importance of teaching. An overview of the components of good teaching is presented along with a list of learning principles.

Chapter 2 focuses on efficiency, which is important for faculty in both teaching and research. Since most faculty have a myriad of responsibilities, this chapter helps by dealing with topics such as setting goals, establishing priorities, and maintaining "to-do" lists, so that efficiency can be increased.

Chapter 3, "Designing Your First Class," is an excellent step-by-step guide for any new assistant professor and leads the reader into the following chapters for more detailed information. Course objectives and textbooks are the subject of Chapter 4; the topics include taxonomies of educational objectives, teaching approaches, textbook selection, and addressing ABET course requirements.

Chapter 5 covers problem solving and creativity, both of which have been the focus of many engineering studies over the years. Development of effective problem solving strategies is very important to an engineering student's success and the subject is concisely presented here. Teaching students to be creative is also addressed. This chapter has a particularly thorough reference listing.

Chapter 6 describes lecture format and style. Since lecturing is by far the most popular style of teaching engineering, this chapter is quite important—improving one's lecture style significantly benefits any course. The chapter treats topics such as the advantages/disadvantages of lecturing, improving lecture content, organization, performance aspects, and interaction with students. The problem of how to effectively teach large class sizes is also addressed.

Chapter 7, "Nontechnological Alternatives to Lecture," presents some options to the lecture format, such as discussion, cooperative group learning, panels, debates, and "quiz shows,"—all of which are used in other educational fields. Independent study, mastery learning, and self-paced instruction are also covered.

"Teaching with Technology," Chapter 8, describes some of the delivery techniques useful to teaching. The delivery medias profiled include television and video, and computers. The audiotutorial method is also mentioned.

"Design and Laboratories" are featured in Chapter 9. Both topics are quite important to engineering education and are crucial to the accreditation process. Although they are not extensively covered in this chapter, they are effectively summarized. General aspects of incorporating design throughout the curriculum, as well as teaching design projects, are presented. Laboratory structure for different student levels is also reviewed.

Chapter 10, "One-to-One Teaching and Advising," covers listening skills, tutoring and helping students, and advising and counseling strategies. Proper advising of research students from undergraduates through doctoral candidates is presented.

Chapter 11 reviews the various aspects of "Testing, Homework, and Grading," while Chapter 12 explores "Student Cheating, Discipline, and Ethics." It is designed to assist faculty in preventing cheating and also addresses how to incorporate the subject of ethics into the curriculum.

"Psychological Type and Learning," Chapter 13, focuses on the natural differences among students which need to be considered when teaching plans are made and in the teacher's interactions with students. Both Piaget's and Perry's theories of cognitive development and their application to engineering education are presented in Chapter 14. Learning theories are explained in more detail in Chapter 15, which includes further discussion of learning and teaching styles, Kolb's learning cycle, and student motivation.

"Evaluation of Teaching" is covered in Chapter 16, and topics ranging from promotion and tenture to professional development are mentioned in Chapter 17. Information for graduate students interested in finding an academic position is presented in Appendix A, and a sample outline for a course on teaching is presented in Appendix B.

Overall, this is an excellent book. It brings together all the topics necessary for developing as a superb teacher. The authors incorporate a significant amount of material into the 370 pages and do so in a way that is easy to follow and to use for improving one's performance as an engineering educator. I am sure that students would want to see this book on the *professor's* required reading list for next semester! ❐

ChE book review

UNIT OPERATIONS HANDBOOK
Vol. 1: Mass Transfer

Edited by John J. McKetta
Marcel Dekker, 270 Madison Ave., New York, NY 10016
$350 for set of Vols. 1 & 2 (1993)

Reviewed by
Scott Lynn
University of California, Berkeley

In the Preface, the editor of this handbook describes it as "up-to-date" and "presented by world authorities in their specialties." That statement is, perhaps, only half-accurate. Many of the contributors are certainly the grand old men in their respective areas—but the overside of the title page notes that the contents of this volume were previously pub-

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judgments. They find comfort in numbers and are less fearful of looking foolish. While individual students are unlikely to have sufficient experience to manage a design problem, the situation is different for several students working together. The sum is truly greater than the parts.

Culture (One-Room Schoolhouse) • Students benefit a great deal from observing the performance of other students at the same level as well as in the levels above and below theirs. It is obvious to them that the higher-level students can do what they cannot do, and that they can now do what they could not do earlier. Upper-class students can be a great help to other students in their courses, telling them what to expect in future courses and why they need to know the subjects they are studying.

Need-to-Know • Students are more motivated to understand and to retain knowledge and principles when their studies are the result of a sequence of events that begins with a need-to-know. The steps following the need-to-know are to gather information, learn the necessary principles, and apply principles to an original problem.

Depth and Breadth • It is essential that students be exposed to a wide range of knowledge. It is also essential for students to pursue some knowledge in depth and to understand how it is applied to the development of chemical processes.

All the items listed above have a common element: they require the student to take an active, rather than a passive, role in learning. Their design skills (not the subject of this paper) are significantly advanced by this process. Students' success in this program provides them with additional attributes resulting from focused participation in activities invariant with time—attributes that will serve them well throughout their professional careers.

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3. Gardner, A.A., P.H. Whiting, and A.F. Galli, "From Raw Materials to Profit: Career Role-Playing in a Senior Design Project," Paper #74c, presented at Annual AIChE Meeting, Los Angeles, CA (1982) ❐

REVIEW: Unit Operations Handbook

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lished in *Encyclopedia of Chemical Processing and Design,* edited by McKetta and Cunningham, first printed in 1976 and reprinted at one- to two-year intervals through 1990. Many of the sections do not appear to have been updated since their first appearance. The most recent reference found by this reviewer in any section was from 1986; most of the sections cite nothing more recent than the 1970s. The section on batch distillation cites only a single reference that was published in 1958, while the section on packed towers shortcuts cites only material from two chapters in the 4th edition of *Perry's Handbook*, which appeared in 1963.

As a result, many of the sections are seriously out of date. For instance, the section on absorption presents an overly long, highly empirical example for calculating steam stripping that makes no use of computer techniques. The section on packed column internals (as well as the introductory section on distillation) contains nothing about packings that have been introduced in the past decade. The section on the costs associated with gas adsorption cites the price of activated carbon that prevailed in 1977, which may or may not correspond with current costs when the M & S cost index is employed.

As is to be expected in a multi-authored handbook, the sections are uneven in quality. Many (but by no means all) of the sections are highly tilted toward petroleum processing. The section on estimating naphtha cuts in distillation, for instance, uses so much oil-company jargon that it is almost unintelligible to someone who wasn't working in that area in the 1960s. A diagram of the VLE data for methanol/water shows a non-existent tangent pinch, and absorption is described as a purely physical phenomenon (despite the use of the alkanol amines to remove acid gases). To illustrate the separation of azeotrope-forming compounds by distillation, using benzene to break the ethanol/water azeotrope, a four-column sequence is presented even though the use of three columns is more common and two columns can do the job.

Some of the examples used to illustrate principles are curious: The case of an absorber with a pinch at the bottom tray is illustrated with a column in which an insufficient stream of pure water is used so that only a specified fraction of the SO_2 is removed from a flue gas. No mention is made of the improbability of a) using water, with its low capacity for SO_2, as the absorbent, or b) not using a stream of absorbent that is sufficiently large to shift the pinch point to the top tray when designing a scrubber to remove SO_2.

In a similar exercise, natural gas is used to strip H_2S from crude oil in a process deemed advantageous because it would be once-through for both the gas and liquid streams. No mention is made of the fact that the H_2S will subsequently have to be recovered before the natural gas can be used for any other purpose, and that this requirement may make its use as the stripping medium somewhat less attractive.

Of course, much of the basic material on the key unit operations (adsorption, distillation, liquid-liquid extraction, crystallization, etc.) is timeless and can bear retelling by a master in the field. Nevertheless, one may question the value of a handbook of this type in which many of the sections are one to two decades out of date in the first year of its publication. ❐