

Don Woods

of McMaster

PREPARED BY

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DON WOODS HAS RECENTLY graduated in chemical engineering—for the second time! Explaining why Don, a Professor of Chemical Engineering, attended undergraduate courses in chemical engineering for four years will highlight what makes Don such an unusual and stimulating teacher and colleague.

This all began in 1974 when several of us expressed concern about whether we were really doing a good enough job of teaching our students how to solve problems. Stimulated by this challenge, and aided by a grant for teaching relief, Don initiated a program to find out how our students now solve problems, what skills they are taught and ultimately how to help them develop their skills.

He led a group of volunteer ChE students through four years of weekly workshops and discussions—attending their classes, exploring many different approaches and stimulating the students to select and develop their own preferred techniques. The students who undertook this program have clearly become very adept at solving engineering problems and at analysing their own

Don organizes what he calls a "traveling circus" of chemical process hardware. This consists of a collection of pieces of equipment associated with a particular unit operation. The students have two weeks to find out what each piece is called, what it is used for and how it works.



The Woods family relaxing at home with Cynthia, recorder; Russell, organ; Suzi, melodica; Don, banjo-uke and wife Diane, guitar.

methods of attack. They were very impressive in running a workshop on problem solving for second year physics students. We have also seen the effectiveness of this program in comparing students who worked with Don to those who did not.

In addition to trying to break down the process of solving a problem into steps (Define, Think About It, Plan, Do It, and Look Back) Don has tried to encourage creative thinking. An example which the current graduating students recount with relish was a brainstorming session on how to crack seeds.

Words and phrases, outlandish or not, were recorded and the craziest was used to generate ideas for the process. The word "No", which arose in response to Don's invitation to share a student's private joke, was chosen. This led one student to "Yes-No" which suggested a reciprocating mechanical device. Another student thought of "Nein" which suggested numbers and a sequential staged operation. A third student took "NON" and was led to a rotary drum (the "O" with blades) fed by a belt (the right "N") and crushed and collected in a hopper (the left "N").

The objective of such sessions is not to achieve detailed or even feasible processes but to liberate thinking from conventional patterns so that unusual proposals may arise.

The result of Don's problem solving program will result, we hope, in a manual which we can all use in our own courses. An added benefit is that we have, through Don, a unique view of our entire undergraduate program, from the receiving end

but with the eye of experience. This should be most valuable in future curriculum revisions.

BACKGROUND

DON IS A PRODUCT of a small town in eastern Ontario, where his father's hardware store stimulated his interest in working with his hands. His house in Waterdown, a nearby town, has been largely remodeled by Don and his wife Diane, and decorated with his paintings and her weaving.

Don graduated from Queen's University, Kingston in 1957 and then went to Wisconsin to study with Warren Stewart. After his Ph.D. in 1961, he went to Britain on a two-year Athlone Fellowship to study and work with three different chemical process industries. These two years involved several case studies which Don has since used in his teaching. In 1964, we were very fortunate to attract Don to join our department and the wisdom of our choice has since been continually reconfirmed.

While Don has taught several different courses over the years, there are two which he pioneered and which demonstrate his concern that students learn not only the conventional ChE science but also skills which are essential to a practising engineer, although peripheral to the classical academic core.

The first is a second year course on Information Management, an important subject but one which is not everyone's first choice to teach. While



Senior undergraduate students, Suzanne Norman and Sue Tyne discuss how to solve a problem with Don Woods.

all of us worry about our students' ability to communicate, Don saw the problem in the wider context of handling, storing and transmitting information. The students learn how to search for information in the library including a few obscure sources that were even unfamiliar to some of the librarians.

Technical report writing, important and much criticized as it is, is also a major component of this

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course. According to Don's plan, topics are offered to students which both interest the faculty member and should stimulate the student's excitement about ChE. Much effort is devoted to advising a student during the writing and to constructively criticizing the finished report. We all share Don's enthusiasm that the effort is worthwhile.

He originated the television taping of two student speeches and the private playback with each student alone with the instructor. This used to be done on a 20-ft screen, which exaggerated each student's shortcomings so much that we now use normal-sized monitors. The assurance which this develops in our students is evident in their oral presentations of design projects in following years and in their critical comments about some speakers at ChE conferences. It is a tribute to Don's original concept that this course is run on the same model even when Don is not involved.

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As a preparation for the job market, the students in that class had to apply for a job with one

of several fictional companies in different fields of chemical operations. Don designed letterheads for each company and treated each application as a real employer would. Subsequently the problem assignments given to the students were related to the company they had joined. In fact, one problem was a real question about tar distillation drawn from a local firm.

Don also gave every student experience in the stock market by giving each one an (imaginary) credit of \$20,000 at the beginning of the year and allowing them to buy and sell stocks through orders placed in his mailbox. The market report was eagerly sought every morning and at the end of the course, the students' remaining assets varied from \$18,000 to \$22,000.

METHOD OF TEACHING

DON ORGANIZES WHAT HE calls a "traveling circus" of chemical process hardware. This consists of a collection of pieces of equipment associated with a particular unit operation. The students have two weeks to find out what each piece is called, what it is used for and how it works.

In order to teach senior students about plant layout, Don has used a piping layout model as a laboratory project. The students are required to locate the piping, valves and pumps so as to conform to practical requirements.

In his approach to teaching, Don has explored, more than most of us, the voluminous literature on the psychology of learning, and on teaching methodology. He is open to any new and different ideas and is eager to try them out with his students.

He is also a showman, especially with overhead transparencies. He always uses two projectors, so that the previous slide is still visible while he discusses the current one. He makes liberal use of overlays to allow the story to unfold gradually. His experience in painting contributes to his use of colors for highlights and to his amusing drawings.

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His showmanship also comes to the fore at the annual welcoming party for new graduate students. He always leads the singing while playing his banjo-ukulele and students newly arrived from abroad are persuaded to join in "She'll be comin'

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Round the Mountain When She Comes' " with all the appropriate noises and gestures.

Another quality which distinguishes Don from many of the rest of us is his extraordinary ability to organize masses of detail. This is seen in his massive collection of cost data for various types of process equipment, which he has been publishing as a series in the *Can. J. Chem. Eng.* He has also compiled an excellent set of course notes on surface chemistry in an attempt to bridge the gap between the different approaches of chemists and engineers. This activity has been noted widely, as shown by an invitation to present a course on surface chemistry with John Berg of the University of Washington at the ASEE Summer School in Snowmass, Colorado in 1977. Don also was invited to contribute to a course on cost estimation to the AIChE local section in Odessa, Texas. He is much in demand for courses and seminars in these and his other areas of interest and experience.

In his research, Don selected the field of two-phase liquid phenomena including mechanical separation and coalescence, as his main interest. He and his students have done some fascinating work, particularly in techniques for producing clean interfaces between two liquids and in filming the Newton's rings during the coalescence of a rising droplet with a liquid layer of the same substance.

DIVERSITY OF INTERESTS

THE DIVERSITY OF DON'S interests and of his publications is impressive, even overwhelming. He has produced books on Communication, Putting Chemistry to Work, Problem Solving, Surface Chemistry, and the Use of the Library through McMaster's Printing Dept. He was one of

six co-authors of "Chemical Plant Simulation" and wrote "Financial Decision Making in the Process Industry", which has been well received. When he and his family went to the Netherlands on sabbatical leave a few years ago, he and his wife were concerned at the quality of first readers available in English. They produced a charming book, "L is for Lucky", with their own illustrations, which was a hit with their children.

For the Canadian centennial year of 1967, Don grew a beard (which was not then a common occurrence) and edited, with his wife and four others, a history of Waterdown and East Flamborough—his home township. He is and has been active in numerous community activities as a leader in Cub Scouts, as a founder and director of the Waterdown and East Flamborough Heritage Society, as a Sunday school teacher and in various other church activities and as member and chairman of the Flamborough Committee of Adjustment (to decide on permits for building and alterations).

We asked the 1978 graduating students for

their evaluation of Don, since many of them had worked and studied with him for four years on the problem-solving project. Their response, put together by Stevan Cosic from talk during a camping weekend, emphasized Don's enthusiasm for sharing his past industrial and educational experiences—both good and bad. They cited his continual efforts to achieve maximum participation of the class such as when he puts a problem on the screen, then goes to the rear of the room and sits down. According to the students, Don makes learning fun and he manages to make the students confident that they can solve their problems on their own.

It is difficult to describe in words what Don Woods is and how he teaches. Those who have not been fortunate enough to see him in action will, we hope, have found here some idea of his many qualities. Those who have met him may have found here some new facets of his character. At McMaster University, we count ourselves very fortunate indeed to have Don Woods as a ChE colleague. □

ChE book reviews

SMOKE, DUST AND HAZE: FUNDAMENTALS OF AEROSOL BEHAVIOR

By S. K. Friedlander, Wiley Interscience, 1977. 317 pp. \$16.95.

Reviewed by Benjamin Y. H. Liu,
University of Minnesota.

This book, by a well-known author in the field of aerosol science, provides a much-needed text on the subject of aerosol behavior. The word "aerosol," according to contemporary scientific usage, refers to a system of particles, either solid or liquid, suspended in a gas. "Smoke, dust and haze," consequently, are all specific examples of aerosols.

The book is divided into eleven chapters, with Chapters 1 through 5 covering the fundamental aerosol properties, including the basic transport and light scattering properties, size distribution functions and particle deposition by convective diffusion and inertial impaction. Chapter 6, on experimental methods, provides a concise but adequate description of the modern aerosol generation, measuring, sampling, and analysis techniques. Chapters 7 through 11 deal with the

general dynamic processes of coagulation, nucleation, gas-to-particle conversion, and source-ambient relationships for particulate air pollutants. Problems at the end of each chapter provide the needed exercise for students. The references given, though not extensive, are well-chosen. They provide a convenient source for further literature studies on the respective topics.

One of the outstanding features of the book is its clarity of presentation. The topics are developed clearly and rigorously from an elementary to an advanced level. Mathematical methods are used to make the theoretical development rigorous, but reference to the actual physical process taking place makes the meaning of the mathematical development clear. The chapter on Collision and Coagulation is particularly well-done, reflecting the author's own original contribution to the field.

Interest in aerosols has mushroomed in the last few years. Many specialized treatises and books have appeared, but none has dealt with the subject in a sufficiently comprehensive manner to be used as an introductory text. *Smoke, Dust and Haze* will provide such an introductory text. It is suitable for the engineering curriculum at the advanced undergraduate or beginning graduate level. It should also serve as a valuable reference book for those working in the field. □