

A TELEPHONE TUTORIAL SERVICE

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THE TELEPHONE TUTORIAL program in the Chemical Engineering Department at The University of Texas is now in its twelfth year. It is possible to cite many individual cases of undergraduate students who have been helped through difficult periods in various courses with the aid of this service, and who have gone on to achieve an enviable record in their college work. Our tutorial activity supplies individual tutoring in the afternoons as well as a telephone tutoring service both in the afternoons and in the evenings.

I will first describe some of the reasons why the program was established and then explain the details of the program itself. For those interested in initiating a similar program I have included an explanation of how the tutors are chosen, how the work is handled by the tutors, and a description of the facilities and equipment. Some advantages and difficulties with the program will be discussed as well as the costs.

REASONS FOR THE PROGRAM

IN ChE A STUDENT must understand a substantial number of basic concepts in the curriculum if he or she expects to progress satisfactorily. Any concept not fully understood at the time he or she first encounters it may continue to cause the student trouble as subsequent material is encountered. One way a student can get almost instant help is via an ongoing tutoring program.

Freshmen and sophomores particularly feel isolated from professors and other students at large universities, and they experience difficulty in obtaining help quickly when they flounder on a problem. Such a student is then likely not to learn what he or she should when he should. The Chemical Engineering tutoring program was established at The University of Texas to give

students who had to work alone, or found it convenient to work alone, or found it inconvenient to work with others, a chance to interact with another more advanced student on a problem of personal interest.

There were some additional reasons for establishing the tutorial program that are not so obvious. First, it is convincing evidence to our undergraduate students that we are sincerely interested in their difficulties. A student who has a difficulty in a course might first go to see the professor in charge of the course. On the other hand, the student may be slightly embarrassed to bother the professor but would not hesitate to see a tutor. Second, we have to admit with all due candor, that professors are busy individuals and



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that students sometimes do not have the incentive, perseverance, or time to locate a professor at the time the question arises. Therefore, the fact that he knows a tutor is available four days a week and is available by telephone as well, makes the tutorial program a definite convenience.

It is interesting to note that some of the better students also take advantage of consulting a tutor in order to resolve questions and probe more deeply into the subject material.

HOW THE PROGRAM OPERATES

LET ME NEXT EXPLAIN how the tutoring program is carried out. Every Monday, Wednesday, and Thursday afternoon from 3:00 to 5:00 p.m., and for variety, Tuesdays from

monthly or semester assignment sheets from those professors who hand out such sheets so that the tutors can prepare themselves for questions whenever they are momentarily unoccupied.

Some tutors prefer to help in certain courses, but all are sufficiently competent to tutor in any course. For increased efficiency often each tutor will answer all questions concerning one or two classes on a given day. However, the tutors continually change the classes they tutor to gain additional experience. Sometimes it takes all three tutors to answer a particularly difficult question.

If a student demonstrates that he or she has not seriously attempted to start the homework assignment or read the required material, the student is asked to return after doing so. This is done to prevent the tutoring program from be-

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12:00-2:00 p.m., three tutors are available to help undergraduate chemical engineering students. Due to scheduling problems and lack of demand by students, the Friday session we used to have has been terminated. During these afternoon tutoring sessions, an average of twelve students are helped by calls or visits. The length of each student's visit varies from about a minute for a brief question to over an hour if he or she is thoroughly confused and does not even understand how to start the homework assignment. Most students find personal visits more effective than telephone inquiries for complicated problems so that our experience during the day is that only about ten percent of the tutoring contacts are via the telephone.

Tutoring takes place in a four hundred square foot seminar room. A large table is placed in the center around which are seats for up to fifteen students. An additional table at one side of the room holds the telephone and Code-a-phone. A large blackboard on one wall is used for explanations when four or more students from a particular class have the same questions. The tutors have access to a copy of the textbooks currently being used in all the required courses in the ChE curriculum. Every attempt is made to obtain

coming a problem work session, with the tutors assisting in working the homework assignments. We have recitation sections in many classes for such activities.

Any tutor who is free at the moment or closest to the telephone answers it. To provide help over the telephone is often difficult because the tutor often does not have the particular problem or text available at hand to read as does the student. Consequently, the tutor has difficulty in understanding what the student is asking. Even when the tutor understands the problem, he finds it more difficult to explain equations over the phone than it is to write them down and show them to the student directly. As a result, most students with long, involved questions visit the tutors in person, and the phone is used for brief questions.

THE TUTORS AND THE CLIENTS

USUALLY FIVE individuals work in the tutorial program, but not all on the same day. One graduate student is placed in charge of the entire operation. He finds suitable tutors, coordinates tutoring activities, and sees that daily tapes are made. Explanations and hints to problems prepared one day by one group of tutors do not have to be redetermined on a succeeding day

because the head tutor is present every day. The remaining tutors each work only one or two days a week.

A good tutor needs to be patient, speak English well, be technically competent, and be relatively familiar with the assignments of the undergraduate courses. To meet the latter requirement it is best (but not essential) that the tutor have gone to undergraduate school where he tutors so that he has been in the classes of most of the professors. An academically qualified senior student best meets the requirements but may not have the maturity of a graduate student. Because many of the questions of ChE students relate to homework problems, we found it helpful to employ as tutors individuals who were graders in the sophomore and junior classes. These are the primary classes that cause students to come for help. The head tutor can also easily work with the class grader to give appropriate information to the students.

Although the tutors are available to answer questions concerning any of the undergraduate ChE courses, the bulk of the questions come from 4 or 5 sophomore and junior courses, particularly material and energy balances, transport phenomena, and unit operations. Hence, after one semester the tutors become fairly familiar with those classes that cause students the most problems, which increases the effectiveness of the tutoring.

TELEPHONE TUTORING

IN ADDITION TO tutors answering telephone calls in the day, we have an automatic telephone

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response in the evening. A Model 200-A "Code-a-phone" by Ford Industries, Inc. is connected to the tutorial telephone line. This machine can record up to six minutes of taped messages. It permits a student to listen to the recorded message but does not enable him to leave a message on the tape.

What bothers one student about an assignment usually bothers others. Consequently, students ask identical or related questions about ChE homework assignments due in the next day

or two. Because several students are likely to encounter the same difficulties, but for various reasons might not contact the tutors during the day session, a recorded message is prepared by the tutors at the end of each tutoring period. An extract of a typical message about one and one-half minutes in length is in the Appendix. This tape contains suggested approaches to homework assignments and discussions of difficulties that had caused the most questions during the tutoring proceedings of the day. Also included on the tapes are changes, corrections, or additions to homework assignments called in by the ChE instructors, and announcements by ChE organizations.

An average of one hundred fifty calls are received by the tape machine per night. (We get this information from a digital counter attached to the machine.)

IMPROVING THE SERVICE

ONE OF THE PROBLEMS a student faces in getting a message from the Code-a-phone is he must go through all of the message up to the point of interest. We examined different ways of having the student dial directly to his class number, but have not yet found any inexpensive equipment that would be suitable. In principle the introduction of such equipment would save a student the boring wait until his pertinent message came up on the tape.

At one time we thought we might make a tape available on which a student could leave a message to which a tutor could reply at some hour in the evening, but the demand for such a service was low. No one wished to stay home waiting for the reply. Several years ago we not only had the telephone service but also broadcast the tape over the student radio at 10:30 p.m. each day. Eventually the broadcast was stopped.

COSTS AND BENEFITS

MANPOWER COSTS comprise the bulk of the operating costs of the tutoring program. One teaching assistant supervises the program and assists in the tutoring at a cost of \$2,200 per semester or about \$500 per month. In addition, about 4 seniors or graduate students are employed each for about 5 hours per week at a rate of \$4 to \$5 per hour, or another roughly \$2,000 per semester. The telephone rental is only \$16 per month or about \$200 per year, and the cost of the recorder has been written off long ago. In terms of the student visits, the cost is about \$3.50

per visit. However, in terms of visits plus telephone calls, the cost is less than \$1 per contact.

Our tutoring program has the usual benefits you might deem pertinent. It helps a student understand the class assignments as he goes along so that future material will be less difficult. This prevents a slow learner from getting too far behind his or her classmates. Some students at large universities are afraid to or are actively discouraged from asking their professors outside class about those small troubling questions that bother them. The tutoring program allows these students the satisfaction of getting their questions answered. The tutors also answer questions concerning the teaching style of a professor and what he stresses on exams. A professor who wishes can use the tutoring program as a current and informal tool of teaching evaluation by finding the types and degree of difficulties students have with his classes. Also, an instructor if he goofs on an assignment, can leave a message concerning last minute changes in the homework assignments for the tutors to place on the tape.

In addition to the primary benefits, some additional advantages exist because of the tutoring program. Undergraduates gain contact with upperclassmen, contact that they would not otherwise have. From this interaction they obtain informal advice concerning course scheduling, future job interviews, and graduate school. The tutoring program gives students an additional opportunity to meet each other outside of their classes. By getting to know other students they begin to help each other directly. We find seniors rarely use the tutoring service largely because by the time they become seniors they know many students in their classes and are therefore able to study with each other.

SOME DIFFICULTIES

IF THE STUDENTS who use the tutoring service are required to be prepared the best they can by themselves before they ask for help, the tutoring program does not make addicts of students. Such difficulties as exist tend to be operational.

Some students cannot find a spot in their schedules for a visit to the tutors because of time conflicts with other courses or outside work. Often the tutors are flooded with visits and frequently interrupted by telephone calls. On such days the tutors may not be as effective as they should be.

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They often give quick answers rather than help the student get to the answer by indirect questioning. On other days, the tutors are not called on to help as many students as they could efficiently handle. Sometimes the tutors run into a question or problem that they cannot immediately answer because they do not have the proper background. In such cases the student is asked to return the next day in order to give the tutor time to check into the matter. A student is encouraged to see his professor in such circumstances.

But on the whole the program has been favorably accepted and widely used by an ever changing student population, and strongly supported by the faculty. □

APPENDIX

Example of Recorded Message Heard by Students During Non Tutoring Hours

Tonight the Chemical Engineering Tutoring Service will discuss ChE 317 problems 4.69 and 5.9, and Dr. Smith's section of ChE 322 problem number two. First, I would like to announce that there will be an AIChE meeting this Friday the thirteenth in the Geology Building, room number 100 at 4:00 p.m. The program will consist of a panel discussion with the Chemical Engineering Department Visiting Committee.

ChE 317 Problem 4.69: This is a review problem. Don't forget that you are supposed to work part b only. This problem is worked in a similar manner as example 4.33. Use equation 4.51 on page 301. Note that equation 4.51 is actually a special case of the general energy balance you used throughout chapter four when working heat of reaction problems.

ChE 317 Problem 5.9: For this problem use the enthalpy concentration chart for the sulfuric acid water system on page 463. Use the chart as shown in example 5.09 for the sodium hydroxide water system. This problem is of the mass and energy balance type you have had many times before and is used merely to illustrate use of enthalpy concentration charts.

ChE 322: This is a multistage adiabatic compressor problem. There is intercooling between each stage and a 5 psi pressure drop in each intercooler. Equation 78 on page 674 should be used since the gas temperature entering each stage is the same and each stage may be assumed to have the same compression ratio. For a given number of stages, calculate the total work required. Then guess a different number of stages and again calculate the total work required. A plot of total work required as a function of compressor stages is used to determine the desired number of stages and hence the operating costs of the system.