Michigan high school counselors and students in response to a poster mailing, and from high school counselors and chemistry teachers who had previously seen this film. In some instances chemical engineering faculty members accompanied the film and were available to answer questions from the students after its showing.

POSTER MAILINGS

An attractive poster was prepared with returnable post cards attached inviting high school students to inquire about the chemical engineering program at Michigan State University. Information on the availability of our film was included on the poster. This poster was mailed to counselors and senior class presidents in approximately 900 high schools in Michigan. There were about 250 requests from this poster for information on chemical engineering. These inquiries were answered via a personal communication describing the profession, opportunities, and our program at Michigan State University along with a curriculum brochure and the AIChE pamphlet "Will You Be A Chemical Engineer?".

SPECIAL ON-CAMPUS PROGRAMS

During the spring terms of 1968 and 1971, the chemical engineering department held a one evening program for Michigan high school chemistry teachers. The objectives of these programs were to familiarize high school chemistry teachers with the chemical engineering profession, career opportunities, and our program at Michigan State.

This past year our program consisted of a dinner followed by a talk entitled "Trends and Fads" presented by H. D. Doan, former President and Chairman of the Board of Dow Chemical Company. Mr. Doan pointed out new challenges and opportunities available to chemical engineers along with increased demands. About 150 chemistry teachers attended each of these sessions and copies of Mr. Doan's talk were sent to all counselors in Michigan.

OTHER ACTIVITIES

Faculty members have cooperated with the local AIChE section (Midland, Michigan) on career guidance activities. Our Chairman, Dr. Chetrick, has appeared on local television panel discussion sessions with leaders of the chemical industry and government to inform the public of the chemical engineering profession.

Also the College of Engineering at Michigan State sponsors career guidance and recruiting activities in which we participate. Michigan State University has a very successful program for recruiting merit scholars; many of these top students over the past few years have chosen chemical engineering.

SUMMARY

During the past seven years, the number of Chemical Engineering graduates has risen from 16 in 1964 to 29 in 1971. We have had five students place in National competition of the AIChE student contest problem. It is difficult to assess the effect on enrollments of career guidance efforts. However, we believe these efforts are well worthwhile and plan to continue these types of activities. □

Motivating for ChE

WAYNE R. KUBE
University of North Dakota
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I assume that my comments will differ from the other speakers on the program as I have no intention of playing the numbers game. I have read too many conflicting estimates and projections, seen many of them prove to be erroneous, and I have been burnt too badly myself in making estimates to indulge in this pastime. Personally, I believe that the biggest mistake made in projections and estimates was in the number of advanced degrees required, both from the viewpoint of demand from students and the demand by organizations utilizing the graduates.

Other differences are that I will take this opportunity to air some of my personal prejudices and biases. I will also briefly discuss some of the activities of the AIChE in motivation of students to enter chemical engineering.

Actually, we as engineering educators, or more specifically chemical engineering educators, are in trouble. The image of our product has been seriously tarnished as evidenced by the decline in interest of the bright students to pursue engineering as a career. I view this as being more serious than the overall decline in percentage of high school students considering engineering careers. The present shortage of job opportunities for the

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new graduates has also occurred at a most inopportune time. Lack of opportunities, coupled with the concept that engineers are responsible for the deterioration of environment, has "turned off" many from pursuing engineering careers. A recent article in *Business Week* stressed a major decline in freshman applications even at the most prestigious engineering schools. I have no way of estimating what these effects are but it is my belief that the present drying up of the student pipeline will be seriously felt four or five years from now. No one knows how long the present employment situation will last, but I believe the effect will be devastating. What we need is some way of motivating the young people into taking chemical engineering despite the present uncertainties. We have to do more to change our image than to call ourselves molecular engineers.

In considering the problem we should go back to fundamentals and consider basic questions. Let's ask ourselves these questions: **(1) Why, (2) Where, (3) When, and (4) How?**

WHY DO WE NEED CHEMICAL ENGINEERS?

This is a very fundamental question and one I have never heard a chemical engineer educator ask. However, I have heard many engineers in industry question the desirability of graduating more chemical engineers. Their philosophy is "the less, the better" as they apparently believe that they are then more certain of their position. I usually answer them by asking, "Who are you going to boss if there are no new chemical engineers coming up through the ranks?" We as educators, intuitively at least, feel the more the better and never question this feeling. This is reasonable as new students are our bread and butter, and training in the concepts of chemical engineering is good for everyone.

WHERE ARE THE NEW ENGINEERS COMING FROM?

Figure 1 shows roughly where we obtain our raw material. Obviously, the basic source is the high schools and the majority of students enter college directly from high school. Some, however, may enter at any of the four years from either having completed their service requirement, transfer from a Junior College, entering from other disciplines, or starting school after working a few years. With the emphasis on Junior or Community Colleges one would suspect that the number of junior college transfers would be an increasing source of students. However, it has been my experience that those transferring into chemical engineering never replace by numbers those who are lost by attrition. Attrition is a problem in its own right and should deserve special consideration. Why do we lose so many good students who at least at one time were interested in chemical engineering?

We should seriously look at whom we attempt to motivate into chemical engineering. Most of us, myself included, have a tendency to think in terms of proselytizing the outstanding male high school student. By not considering the feminine gender, we automatically lose a large number of possible engineers and in these days of women's

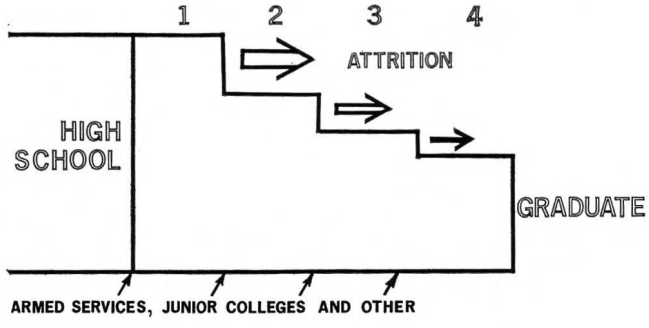

Figure 1.

lib, more women will be interested in engineering. We should also be interested in the disadvantaged and minority groups. Many of these, if properly motivated, will become good chemical engineers. I have noticed that few children of engineers become engineers. They seem to have more "relevant" career goals. Sons of the lower middle class, or blue collar workers, appear to be more motivated towards engineering, apparently as a method of improving their "station," and many do well.

WHEN TO MOTIVATE?

From my observations most of our attempts to interest students toward engineering, or more specifically chemical engineering, have been directed towards the seniors in high school. This is a serious limitation. Most students when they are seniors are fairly well committed towards specific goals and their selection of courses since the 9th grade has essentially committed them to a technical career.

Any recruiting efforts directed toward juniors or seniors in high school might influence a student to take chemical engineering in preference to civil, electrical, mathematics or physics but would not influence him towards a scientific career unless he had already taken the basic science and mathematics sequence. At least in our high school system the student is required to submit his four year program before entering the ninth grade. Admittedly, this is not a hidebound or unchangeable program, but very few students deviate much from the original.

If general career goals are decided before the ninth grade, this means that we must somehow motivate grade school students towards the chemistry, physics, mathematics sequence. In talking to many educators and to those in industry, I find that they have not considered the necessity of motivation in the lower grades. Personally, I feel that this is perhaps our more fruitful area.

HOW TO MOTIVATE

The question of motivation, of course, is the sixty-four thousand dollar question. Everyone has his pet ideas about this and most of these ideas work in special circumstances. There cannot be any hard or fast rules concerning approaches as it is so much a function of the personality, interest and methods of both the student and the person doing the motivation. Much discussion has been

By not considering the feminine gender we lose a large number of engineers.

given concerning who or what motivates the young people. Actually, it is difficult to find out from students why they did choose a particular career. Most are apparently not clear themselves. From my experience I have the firm belief that in the school system the person who has most to do with selection with a scientific career is the science, chemistry or mathematics teacher. The professional counselors apparently have little influence and then mostly in selection of a specific field. Apparently the parents have very little to do with career selections. Illogically as it seems, chance remarks or comments of their peers seem to have a major influence.

All of this does not mean that the individual chemical engineering professor does not play an important role. He is very instrumental in keeping a student in chemical engineering. His kindness and personal dedication to the interest of the student and the profession is necessary and important.

I have not suggested any mechanics for motivation. The mechanics depend greatly on the special circumstances, the individual institutions, and upon personality, dedication and individual methods of the motivator. Other speakers will undoubtedly explain their methods. I will briefly talk about some of the techniques used by the National Career Guidance Committee, AIChE, rather than those at the University of North Dakota.

The National Career Guidance Committee of the Institute was established in 1952 by action of council. The boundary of its authority was established as: to provide information, counsel and leadership for Local Section Committees who are responsible for guidance for pre-high school and high school students, supplying information for high school faculties and parent groups concerning careers in science and engineering in general, and in chemical engineering in particular. It shall:

a. Develop and recommend to council the scope and basic policies of guidance activities
b. Integrate guidance committees with AIChE committees concerned with similar problems, and
c. Coordinate the Institute's guidance activities with other educational science, engineering and service organizations.

The Committee has evolved through the inter-

(Continued on page 141).

KUBE (from p. 113)

vening years and presently has the relation within the Institute as shown in Figure 2. The Career Guidance Committee is directly responsible to

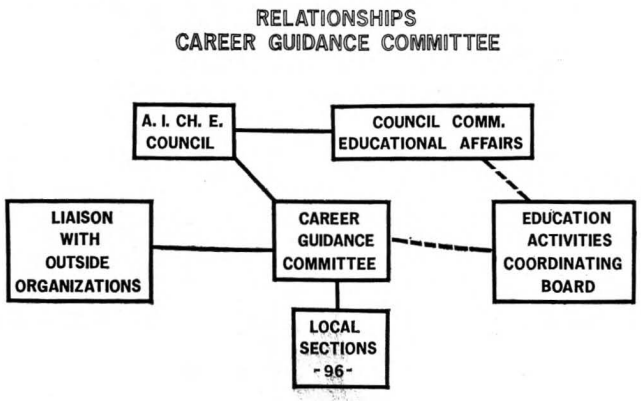

Figure 2.

the Council. Activities with the Institute are coordinated with the education activities coordinating the board which consists of the chairman of the Career Guidance, Education and Accreditation, Professional Development, Student Chapters, Continuing Education, and Chemical Engineering Education Project Committees. The Committee has attempted liaison with outside guidance organizations, quite frequently with only mediocre success. Typical organizations are Engineers Council for Professional Development, American Chemical Society, Manufacturing Chemists Association, National Science Teachers Association, Engineers Joint Council, American Personnel Guidance Association. Perhaps the two most successful arrangements have been with the Junior Engineers Technical Society (JETS) and ECPD. Arrangements in a limited area are under discussion with ACS and MCA.

Primarily the National Career Guidance Committee works with the Career Guidance Chairman of the local sections of the Institute. Each section is supposed to appoint a career guidance chairman who has a goal, the education of students, counselors, teachers and parents in what comprises chemical engineering as a profession, so that the student can make an informed decision in choosing his life's working. The philosophy is supposed to be one of information not recruitment. I presume I set the activities of the Committee back by many years by constantly referring to the activities as proselytizing.

The National Committee has a responsibility of providing the Local Section Committees with the necessary information and tools to carry out the basic guidance work. The responsibilities of the Local Section Committee is to make the direct contacts with students, teachers, counselors, and others.

All of this works fine on paper but the problem is that all of these positions are nonpaying and are in addition to the regular duties of the people involved. Consequently, only those who are extremely dedicated do any work in this field.

A disadvantage of working only through Local Sections is that the sections are usually in areas of high population and even under the best of circumstances, do not get coverage of schools outside their immediate area. Again, any contribution is made through the personal efforts and dedicated activities of those in the Local Sections.

To provide contact, and to disseminate information to the Local Sections, a newsletter containing developments and suggestions is distributed three times a year. To provide some continuity, a portfolio consisting of visual aids, career guidance brochures and general instructions are provided to each Local Section Chairman. It is a continuing activity to update and improve this portfolio. Use of symposia and training sessions at National Meetings are useful. Data, statistics, mailing lists, bibliographies and other working documents pertinent to science and engineering professions are distributed as available.

Many suggestions have been made concerning work in areas effecting activities of students, teachers, counselors and parents. With the student, some effective activities are lectures at career days, being judges at science fairs, organize planned trips for students, give them summer jobs in plants, provide pertinent literature, assist with JETS chapters and science and chemistry clubs, and even provide scholarships. The teachers and counselors can generally be educated in the facets of profession and find out what chemical engineering is if taken on plant trips, or provided summer jobs in significant positions. An effective method has been to invite science teachers and/or counselors to Local Section at dinner meetings. One year we had the slogan, "Take a Science Teacher to Lunch."

It is apparently more effective to establish rapport with the science teacher rather than the counselor. If one can get a high school science teacher enthusiastic about a summer project, this carries over very well into the classroom and is highly effective. With parents it is suggested that

a Local Section representative accept speaking engagements with organizations such as parent-teacher associations.

Essentially all the National Career Guidance Committee can do is suggest possible methods of contact and furnish some basic material to the Local Sections. Special circumstances for each Local Section makes it impossible to be quite specific. What may work in a New York section would not be applicable to an Iowa or the Minneapolis-St. Paul section.

BROCHURE

Many times it is nice to have something to send or to hand out specifically directed towards chemical engineering. The National Career Guidance Committee planned a two-step procedure. For the first step they developed an ad printed in a throw-away type brochure entitled, "Chemical Engineering and You." This brochure was to serve as initial contact with a second more extensive and permanent type brochure to be available for more interested students, counselors or high school science teachers. Meanwhile the JETS organization devoted one of their Journal issues to chemical engineering and Volume 16, No. 6, Feb. 1969, was published. There has been at least two reprintings of the issue and over 15,000 reprints distributed. This great demand for reprints indicates the necessity of completing an attractive permanent type brochure.

FILM

Most of you are familiar with the film put out by the Institute entitled, "The Chemical Engineer."

It has been edited to remove dated material and the revised film is available from the National Office.

DOCTOR HECKMAN'S PROGRAM

Dr. Heckman, Chairman of ChE in South Dakota School of Mines, initiated a program of direct contact with high school students. The basis of this was selection of students who were apparently qualified to become chemical engineers as evidenced by their ACT or other college test scores. Contact was made by personal letters explaining what chemical engineering is and inviting further inquiries. Under the circumstances at South Dakota this worked amazingly well. Dr. Heckman has been successful in the last few years in vastly increasing enrollment in ChE in his department. National Career Guidance Committee wanted to find out if this method would work at other institutions, and at present have three additional schools working on a modification. Circumstances at the various schools differ but basically the programs are the same as Dr. Heckman's. Each of the three additional schools have reported significant increases in enrollment, usually in the face of a declining overall enrollment in their engineering college. Apparently the methods work but there are a few pitfalls. By "grape vine" I understand that Dr. Heckman's program is in some difficulty because student organizations have claimed that he has violated some "freedom" by making a selection based on test scores (ability) and the selection procedures are no longer available to him.

PROGRAM FOR DISADVANTAGED YOUTH

Previously I have mentioned that minority groups could be a particularly fruitful area for recruitment for engineers. Children in minority groups are often disadvantaged in regards to their basic education but not ability. Very few finish high school with a background to take engineering in college. Again the problem is motivation and the National Career Guidance Committee has a permanent subcommittee to work on this specific problem. Some 15 Local Sections have special programs in this area. The main thrust of the programs are towards motivation of the junior high school students so that they would take the required high school courses and be so motivated that they would do well. The program has not been underway long enough to have any measure of success, but potentially it could be very successful.

I have attempted to ask some basic questions in regards to the motivation of students into engineering and specifically chemical engineering. No one has all of the answers. What works under one set of circumstances may not be applicable in a different situation. The secret is that of a dedicated person working as best he knows how to contact and motivate bright young minds into the engineering fields. There is no substitute for the personal touch and this is best achieved through much practice and above all, dedication and interest in what is best for the student. □