

A SYMPOSIUM

The Relationship Between Teaching of Chemistry in the Secondary Schools and in the Colleges and Universities of Indiana

INTRODUCTION

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The problem of supply and demand for chemists has received much attention recently, including a special symposium at the September meeting of the American Chemical Society in Atlantic City. Rather startling were the statistics released by the Society that in 1954-55 only 5,000 will receive bachelor's degrees with a chemistry major in contrast to 11,000 in 1949-50. There is some evidence that percentage wise of the total college enrollment chemistry is holding its own but industry and government have greatly expanded their needs in the last decade.

It is recognized that vocational guidance programs must start early, certainly at the secondary school level and perhaps even in the primary grades. The remarkable surge in freshman engineering registration this fall proves the usefulness of a "grass-roots" selling program. Much must be done to aid the secondary school chemistry teachers, especially those in the smaller high schools who have to teach many subjects and who may not be adequately trained in chemistry. A number of interesting facts concerning these teachers were published by Professor Watson of Harvard University in the September 5, 1952 issue of *Science*.

Much has been accomplished by the American Chemical Society with its revitalized vocational guidance program and its participation in general manpower studies. A number of the local sections of the Society has devised special methods of cooperation with the schools in their areas. Associations like the New England Association of Chemistry Teachers with its monthly reports in the *Journal of Chemical Education* or the Northeastern Ohio group to be described later in this symposium, have been very helpful. Science Talent Search, state science fairs and other such activities play an important part in stimulating interest.

Work of the Northeastern Ohio Chemistry Teachers Organization. E. EUGENE WEAVER, Wabash College.—Northeastern Ohio Chemistry Teachers Organization was formed December 12, 1925 by a group of high school chemistry teachers who were attending a teachers' convention. The group was called together by Vernon S. Culp who was a chemistry teacher in West High School, Akron. NeoChemto, from the beginning, included chemistry teachers from high schools in Cleveland, Akron, Canton and Medina; and from the colleges of Oberlin, Baldwin-Wallace, Hiram, Wooster, Western Reserve and Kent State.

Meetings were held twice yearly on a Saturday, usually on one of the college campuses. The program often consisted of a trip through one of the local industries in the morning followed by a group luncheon; the afternoon was devoted to a talk by local faculty member or, more often, a panel discussion on some common problem of the group.

Such an opportunity for an exchange of ideas about, and constructive criticism of, our high school and college programs seems to be lacking in Indiana. As desirable as such an organization would be, it would be extremely difficult to start without the full-fledged support of the high school teachers. Since the trend seems to be for the high school chemistry teacher to frequently have a college major in a field other than chemistry, professional interest in such an organization is not likely.

The success of NeoChemto was dependent upon: the fact that there was an awakening in the field of chemical education, the interest and activity of the high school teachers, and the realization that the two groups had common problems which could best be met by working together.

Preparation for college chemistry. F. C. SCHMIDT, Indiana University.—Perhaps more important than a previous training in High School chemistry as a preparation for the beginning course in College General Chemistry is a thorough training in High School algebra and a year of physics.

By means of a series of tests over the last four years based on the mathematical manipulations employed in the first year of college chemistry, we at Indiana University have found that the students coming in are woefully lacking in the ability to use logarithms, handle exponentials, and solve quadratic equations. We have been forced to require the student taking General Chemistry to take college algebra as a prerequisite or concurrently, if he has not presented four half-years of algebra for admission to the College.

Counsellors in the High Schools should advise those students contemplating work in science in a college to take two full years of algebra. Such advice would save the student 5 hours which he could use in other studies.

Findings of a Purdue committee on how to stimulate interest in young students to choose a career in chemistry. ROBERT A. BENKESER, Purdue University.—A recent survey showed that during the past three years fewer than 0.4% of the entering freshmen at Purdue University were graduating with B.S. degrees and a chemistry major. Accordingly a committee in the chemistry department was appointed to study this rather alarming situation since the rapid growth of Chemical Industry was causing an increased demand for scientifically trained college graduates.

The committee report listed five major reasons for the decline of college science enrollments. 1.) Students today are choosing easier fields in which to major in college. 2.) A rumor persists that chemists are underpaid. 3.) Students feel that a successful career in chemistry necessitates obtaining an advanced degree. 4.) Small high schools seldom have adequate laboratory facilities for chemistry. Hence much of the stimulation and interest that can be aroused in the chemical laboratory is lost. 5.) Many of our high school teachers are overburdened by teaching other courses in addition to chemistry.

As a partial remedy for this situation the committee suggested that the chemistry department at Purdue hire a full-time man whose principal job would be to act as a liaison with the Indiana high school chemistry teachers. In essence they would act as a team to stimulate interest in chemistry in students at the high school level. Secondly, this "sales program" might also be extended to the colleges. In this regard Purdue is contemplating a "high school day" to be sponsored at least in part by the chemistry department. A program would be planned so as to stimulate latent interests in these students to choose chemistry for their career.

Comments on teaching chemistry in high school and college. NED GUTHRIE, Hanover College.—From my work during some twenty summers in the registrar's office of Hanover College I have observed that students take less mathematics, bookkeeping, physics and foreign language in their high school course. They have more credits in general business, music, art, social studies, health, safety and physical education. The following table shows the per cent of all students in Hanover College during the years indicated who presented entrance units in the sciences listed:

	1933-34	1937-38	1941-42	1952-52
Physics	46	41	35	35
Chemistry	35	41	45	46
Biological Science	68	68	70	82
General Science	16	14	16	18

Only thirty per cent of the entering freshman class of 1952 at Hanover College took physics in high school while thirty-seven per cent took more than one year of algebra in high school.

Many of the smaller high schools do not have adequate laboratory equipment for teaching any science. Some have group work instead of individual laboratory work while some have only demonstrations by the teacher. Some substitute movies for laboratory work. There is no uniformity of content in the chemistry course of the high schools. There is too much memorizing of facts with insufficient understanding of the scientific principles involved. There is also the tendency to avoid those subjects which are considered difficult. It is necessary to consider these factors in teaching the first course in college chemistry.

In some fifteen states where I have made out applications for teaching certificates or licenses, it is possible to obtain a teaching license in chemistry in all of them by taking from fifteen to eighteen semester hours work in chemistry. Permits require even less chemistry. Data collected for three periods of five years each show that two-thirds of those preparing for high school teaching rank in the middle third of their college class while the remaining third were equally divided between the upper and lower thirds of their college class. This indicates that high school teaching does not attract the best students. Far too many teachers take a master's degree in education rather than additional training in the sciences. Seven of my students who are teaching chemistry in high school have taken a master's degree in education while only one took a master's

degree in chemistry. We would have better teaching of chemistry in the high school if we required more training in chemistry, physics, mathematics, geology, botany and zoology. Most high schools lack funds for purchase of laboratory equipment and many teachers lack time and ingenuity for making laboratory equipment. I am not advocating that a master's degree in chemistry should be required in order to teach the subject in high school or to receive a life teaching license or certificate. Considerable training beyond the fifteen to eighteen semester hours in chemistry should be required as well as additional training in other sciences. This is probably more valuable to the student than to require the teacher to earn a master's degree.

If we could start a science curriculum with the first grade, it would be much easier to teach chemistry and other sciences in high school and college. A six-year-old child has the natural curiosity for the study of science and has not been spoiled by too much memory work. We cannot make scientists of all, nor do we want to do so, but we can interest young people in science, give them a better understanding of science and an appreciation of science. Since we are living in a scientific environment, such training will enable them to become better citizens. We need a suitable curriculum, suitable laboratory facilities and competent teachers.

Comments by a secondary school teacher. E. WAYNE GROSS, University School, Indiana University.—The colleges and secondary schools have a common interest in the education and development of the student. Many problems and conflicts arise in this development. Discussion and clarification of these problems is needed for their solution.

Chemistry as a course in the small high school is being examined closely. Better techniques and materials in the course are needed. One suggestion for the small school is the alternation of physics and chemistry.

The teacher preparation program must be improved if the teaching is to be improved. The college chemistry departments can help in this task by providing opportunities for teachers and professors to talk over their mutual problems.

Another mutual problem is the education of the gifted student. All too often, they are neglected. The secondary schools and colleges should work together to capitalize to the fullest extent on the students that are, or may be, interested in science.