SOME PECULIAR TEACHING PROBLEMS

WILLIAM G. KESSEL
Indiana State Teachers College, Terre Haute, Indiana

SINCE the author is in the process of changing from a high-school chemistry teacher to a college chemistry teacher, he has noted some of the problems that exist in both fields and would like to call attention to some of the difficulties that confront high-school teachers. Many college teachers are unaware of these problems and difficulties. Some have been so long away from them that they have forgotten their existence. Before we can have correlation we must be aware of our mutual problems.

This spring one of my colleagues and I made a survey of ninety-two science departments and we obtained figures from seventy-five of them, including colleges and universities in Indiana, Illinois, Michigan, Ohio, Kentucky, Wisconsin, Iowa, Minnesota, and Colorado. This was an effort to show our administration two things: (1) that our load of 20 clock-hours of classes, or 16 credit-hours, was greater than that in other similar institutions, and also (2) to convince them that our laboratory periods of one hour each were of little value and not generally considered good practice. Our replies showed that clock-hours of teaching ranged from 12 to 27, with an average of 17 (or 12.7 credit-hours). The other is not considered here. We won our point. But after my experience in teaching high-school chemistry I felt that 20 clock-hours per week of classes was almost heaven.

Most of the interest that we have in college freshmen chemistry students is in what they have accumulated in the way of facts, in their ability to read, to do some reasonably clear thinking, some good generalizing and interpreting, and perhaps in their manual dexterity. We have noted that some schools give us better chemistry students, in general, than others and we attribute this to the fact that there is a good chemistry teacher in that particular school. Perhaps those students that do not do so well in our college classes come from schools where the teaching situation is not satisfactory; perhaps it is not entirely the teacher's fault. It is with some of these peculiar situations that I wish to deal. Some of these items have been under consideration for some time. Norris Rakestraw wrote an editorial in the January, 1942, issue of THIS JOURNAL that started my thinking on this topic. This editorial prompted a letter to the editor, which was published in the March, 1942, issue. It has resulted in this paper.

First. How many of you can recite the requirements in your state for the teaching of high-school chemistry? They vary rather widely. According to the 13th Edition (1948–49) of "Requirements for Certification of Teachers and Administrators for Elementary and Secondary Schools and Junior Colleges" (University of Chicago Press), this is the situation:

9 states have no specifications for chemistry	8 states require 12 semester hours of chemistry
3 states require 3 semester hours of chemistry	12 states require 15 semester hours of chemistry
1 state requires 5 semester hours of chemistry	3 states require 18 semester hours of chemistry
6 states require 6 semester hours of chemistry	2 states require 20 semester hours of chemistry
1 state each requires 8, 9, and 10 semester hours of chemistry	Only 7 states mention chemistry requirements separately.

Since giving this information I have found on contacting the states that are listed as having no specifications that the above situation is not exactly true. That some of these 9 states do not have specific legal licensing requirements in their law but teacher-preparation requirements makes it mandatory that they do take a certain number of hours in the field of chemistry. Two of these states certify on a general secondary basis rather on subject areas, but expect at least 16 hours of work in the field. Here are some of the variations. Fifteen or sixteen semester hours of chemistry does not give a beginning teacher very much background. For example, one of our seniors who is going to teach this fall confided to me that mathematics was much easier to teach than chemistry, for the students did not ask so many questions that he could not answer.

Recently a graduate of our institution came back with an unusual problem. It seems a revivalist in his town wanted a black solution to represent sin and a red one to represent the blood of Christ so when he poured them together the "blood' would clarify the "sin" and leave a clear solution. We "monkeyed" a bit and solved this pressing problem. But as this teacher left he said, "What does the 3*N* stand for on that bottle?" His background must not have been very satisfactory.

Some years back as a high-school teacher I had a practice student in chemistry who insisted upon telling the students that you make copper sulfate by the reaction of concentrated sulfuric acid with copper. When I asked him to demonstrate this it did not work; he said, nevertheless, getting his text out, "That's what the book says." Although he had tried the reaction and failed, as had the students, he failed to see what happened. He was looking for the answer the book gave—he was prejudiced. Only experience could help

this young man, but if he had had more in his college he would have not exposed his ignorance so badly.

We all have problems, little consulting jobs, during our teaching experience and we have all profited greatly by them, although sometimes they have been tough and expensive. In the March, 1943, issue of THIS JOURNAL is the story of one of my experiences with a local antifreeze distributor who was selling (at $2.65 per gallon) "Bond—the guaranteed permanent antifreeze"—an almost saturated calcium chloride solution. He was going to ride me out of town on a rail because I told my students it was not good. Although I tried to prove to him by some simple corrosion tests that it was dangerous to use, he had some $5000 worth, and as he had paid cash for it, his viewpoint on the subject was somewhat warped. Although the War Production Board banned the sale and manufacture of this type of antifreeze in a short time he just nods today when I see him. I know I learned a lot about antifreeze and human nature during that escapade but I would not care to repeat it.

We might continue with other illustrations of the need for more training for our future teachers. Recently we registered at our summer school a woman junior high-school teacher who had been on a teaching permit for science. She wanted to know what she should take. I had no answer for her as her only previous college work was during the summers of 1910 and 1911. Her background necessarily was very limited.

Let us summarize item one by saying we need a longer training period for prospective teachers, especially in the science field. There are some attempts on the part of various teachers' colleges to help this situation by giving—as our college does—a graduate title of Master Secondary School Teacher, the requirements being 8 hours of advanced education and 12 to 24 hours in major specialization area and 12 or less hours in minor specialization area. Perhaps this could be more satisfactorily used as a *prerequisite* to chemistry teaching, rather than an afterthought.

Second. How many high-school chemistry teachers are there in your state? You would be surprised if you are not familiar with this situation. In our state, Indiana, there are not very many; less than 60 out of 23,000 teachers. Most of them double up with other science, mathematics, social studies, coaching, home economics, etc.

These teachers have multiple jobs and as such divide their interest and ability and put their chief emphasis on the thing they like best. We had in our city, for example, a general science teacher who taught the ten commandments during this course. Although I have nothing but respect for the laws of Moses and recognize the need for some emphasis on these ideals, I seriously doubt if they have a place in the science curriculum. Recognition, perhaps, but not study. Naturally the students from that school were not chemistry-minded or even interested in science. This teacher did a very fine job, however, in another field.

Third. How long has it been since you spent a day in high school? The odds are great that there have been some changes since you were there; perhaps they were for the best. But the chemistry teacher, like every other high-school teacher, has a multitude of jobs. He is perhaps a paper grader, a traffic cop, a social arbiter, a ticket seller or perhaps taker, a study-hall policeman, a stamp salesman, a newspaper or yearbook sponsor, a class sponsor, a theatrical producer, a band leader, a baton-twirling teacher, a truant officer, a guidance specialist, an employment agent, and a committeeman for Honor Society, Hi-Y, or something else.

Of course all these require time and the chemistry teacher is indeed fortunate if he has more than one free period during a six- or eight-period day. He does not have very much time to prepare his lecture or laboratory during or after school because of his many duties. I ran across these lines in the *Syracuse Bulletin* that summarize the requirements for a good high-school chemistry teacher with these problems: "The education of a college president, the executive ability of a financier, the humility of a deacon, the adaptability of a chameleon, the hope of an optimist, the courage of a hero, the gentleness of a dove, the patience of Job, the grace of God, and the persistence of the devil."

Fourth. The problem of equipment alone is sufficient for a long paper. In my state, in 1948, I have seen this sort of a range: at one extreme, a room in which the seats consisted of boards laid across drain-tile, and a couple of boards nailed together for a desk, and NO equipment; at the other extreme, a school with six full-time chemistry teachers giving some quantitative analysis, with students using chainomatic balances.

Some teachers can and will develop their own equipment from odds and ends, and some of it will be better than supply-house apparatus, but others with all the extra jobs cannot or will not do it.

Fifth. The problem of the chemistry teacher's improvement for his own good, and for that of the students, is an important one to consider. The future of good high-school chemistry, as well as the possibility of coordinating the high-school with college work, lies in improvement of the high-school chemistry teacher's situation.

Numerous organizations can contribute much toward improvement. In Indiana before 1941 we had an alphabetical organization, the I.H.S.C.T.A., the Indiana High School Chemistry Teachers' Association, which had two-day annual meetings. We discussed and attempted to solve our mutual problems, had speakers from colleges and industry, and made visits to various chemical industries to remind us of the chemist's contributions. But there were less than fifty regular attendants. Since the war they have merged with the physics teachers to have enough to justify their existence.

Are these indications that high-school chemistry is slipping in Indiana? I don't think so. These are just reminders that there are too many other problems before the teacher.

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