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Some Possibilities for Broadening High School Programs through Industry Participation¹

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The Minnesota and Ontario Paper Company insulation board and paper mills, located at International Falls, have become an important potential source of education for young people. About 5 years ago Falls High School recognized that such opportunities existed, and a start was made that resulted in two co-operative science programs. These programs have been evolving ever since and, although more change is expected, they now seem firmly established.

The first program is for all members of our chemistry classes. It consists of four parts, preliminary work, tour of the International Falls plant, follow-up lectures and a final report by each student.

The preliminary work includes planning meetings with Mando, and whatever can be done in the classroom to prepare the student for what is coming. A movie on papermaking, slides taken at the mills and a number of pamphlets and other sources of information furnished by Mando are used. This preparatory work is important, but there is another kind that is just as important. The student must understand that only his very best behavior is acceptable and that less than this will not be tolerated. Also, by now, he knows that a report will be required and that he is responsible for gathering and organizing information.

On the day of the first tour this year, two classes of students and one teacher left school in time to arrive at Mando's Education Center by 10 o'clock a.m. They were given there a general idea of what would happen that day, were divided into groups of four or five and introduced to their guides, who were highly trained, technical people. At intervals of several minutes between groups, they were started on the first part of the tour. A little past noon they were again at the Education Center for lunch, a short rest and a lecture on the Company's organization and business. The afternoon part of the tour lasted until about 4:30. The tour was not the same as that given visitors but much more thorough and pointed toward chemistry.

The next day, Mando's chief chemist came to the high school and talked to those students who had completed the tour. He spoke to them for the most part about technical matters and the chemistry of the mill processes, areas in which there was almost certain to be confusion. The following day, he came again and with flow diagrams reviewed the entire paper and insulate-making processes. This cycle was repeated until all six chemistry classes had

gone through it. Then the students were given 10 days in which to complete their reports. Specific directions were avoided but they were asked to write reports that they considered adequate.

The objectives include the following (and are given here rather than earlier because they evolved with the program):

- (1) The students learn some chemistry.
- (2) They meet people working with chemistry and learn what their jobs are like.
- (3) They learn something about the main industry of their town.
- (4) They learn about gathering information from several kinds of sources and organizing it into a report.
- (5) They learn how some of the theory of their course is put into practical use.

The main problem that has appeared is simply that the students get too much in too short a time during the tour day and so, for many, the result is a great deal of confusion. The tour cannot be stretched out because of the much greater burden this would place upon Mando, therefore, the problem is being attacked by better preparatory and follow-up work.

The second program is conducted with the Research Laboratory of the Minnesota and Ontario Paper Company. It is called "The Co-operative Research Program" and may be familiar to some readers because of the publication of a number of student reports.

Early in the school year, up to twelve students of high ability who are especially interested in science are selected from the junior and senior classes. The juniors are expected to stay in the program for 2 years. Also during this early period, meetings are held with Mando's Research Laboratory Manager, Dr. W. H. McPherson, and interested members of his staff, to plan the year's work. This is probably the most critical part of the program and in describing it, in his introduction to the 1962 student reports, Dr. McPherson wrote,

"The problem has been to devise a cooperative research program for industrial research people and high school science students which would introduce students to the nature of industrial research and at the same time provoke active interest of industrial researchers. In the first place it was necessary to select a few high school students who had more than average interest in science and who, in the estimation of their high school teachers, would be willing to participate actively in such an extracurricular program. Fortunately, in this initial experience the selection appeared to be entirely satisfactory. Next it was necessary to

¹ A condensation of the original paper that was given at the Science Education Section of the 1964 Annual Meeting of the Minnesota Academy of Science.

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find a group of research scientists who were sympathetic toward working with high school students and acquainting them with their profession. This was no problem. A third important requirement was the choice of a project or projects for research investigation challenging enough to get enthusiastic participation, especially on the part of the industry people. And so, after much deliberation over alternative programs and projects, a central theme, 'Wood Bark Properties and Possible Uses,' was chosen for investigation. It was pointed out that the state of knowledge on the properties and uses for wood bark was limited. Each industrial researcher was asked to explore some new phase of this general subject which he would like to know more about and which could be profitably investigated with high school students in a relatively short period of time."

During December, two general sessions are held with the students to acquaint them with the Research Laboratory and the plans for the year. Groups of two or three students are formed and assigned to an industrial research advisor who usually makes some reading assignments. As soon as possible after the Christmas vacation, work begins in earnest and continues until late March or early April. At periods of several weeks general progress-report meetings are held. During April, a final report is written by students in each group, and then one last meeting is held to hear these reports.

Originally, there was no more clear-cut objective for this than for the chemistry program; it seemed that something worthwhile could be worked out if a real attempt were made. However, 3 years ago when the nature of this program was changed to that of a research project there were some fairly definite objectives, and these included the following:

- (1) to carry out a research investigation;
- (2) to give these students an accurate impression of industrial research in one company;
- (3) to help a little with their decisions concerning choice of college and career;
- (4) to make a start at filling the gap between what they learn in school and how to use this knowledge;
- (5) to learn how to go about attacking a problem of which little is known and, in the process, to be-

come familiar with some kinds of laboratory equipment;

- (6) to learn how to write a technical report;
- (7) to have the benefit of an active association with these temporary teachers from industry, who, unlike regular teachers basically are aligned toward doing something with their knowledge other than teaching.

It became evident very early in this program that the selection and placing of students were extremely important. High ability and interest should not be the only criteria for admission. Such traits as initiative, determination and something that may be called flexibility of mind were found to be essential for good results.

The idea of a central theme seemed to work out well and has been used each year with a different topic. Not only has this tended to tie the whole effort together, but it has been possible to introduce a general topic to the students, giving them basic information in introductory sessions that proved useful in their later studies and group discussions.

The progress report meetings were of such great value that they should always be included in some form in programs of this kind. A student of high-school age can begin to learn to explain what he did and why he did it or why he didn't do something else and what he thinks he should do next while being barraged with questions that he doesn't expect. This helps him to see the importance of asking the right questions.

These programs are extremely difficult to evaluate but it does seem that our main objectives are at least partly being reached. Students have indicated upon their return from a year or two in college that this work has helped them a great deal. It is true that weaknesses in both programs are still evident, but improvements are being made each year, and probably the most significant thing has been accomplished. A determined start has been made.

By now it must be evident that the main load in programs like these is carried by industry and its people. Without their enthusiasm and willingness to give, very little could be accomplished. The people of International Falls are unusually fortunate in this respect.