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By E. M. VAUGHAN

This question and a very good answer appeared in a recent issue of Physic Today. The answer in case you didn't see it was given by Eaton H. Draper of AVCO.

"Top level associates, freedom from routine, and technically sophisticated assignments are all vital. But the one most important factor is a climate which encourages a healthy questioning of the known, as well as the unknown. Given this a scientist or physicist will perform at his peak, and beyond." He needs says Mr. Draper, "An atmosphere of inquiry." It is important that this atmosphere be available to the scientist from the moment that science first interests him. Scientists are sculptured through the secondary school and undergraduate college course. The graduate schools merely add the polish.

In the class rooms and laboratories of our under graduate colleges this atmosphere can be created. But what about the time spent outside. "Is there an atmosphere of inquiry?"

A personal survey was conducted during the 54-55 school year among a group of General Physics students to obtain ideas for increasing their interests in Science. Many good students tend to drop out after one or two years of college and attempts were made to find the reason. An inquiry was made concerning outside work. A large number of the students indicated they had outside part time jobs. These jobs varied from grocery clerk to dining hall waiter. Included were: pick-up and delivery serviceman, juke box serviceman, newspaper distributor, gas station attendant, night watchman, and swing shift timekeeper at a local factory. The students having these jobs were junior and seniors in Physics, Chemistry and Biology.

There is a degree of similarity that is readily apparent among these positions. First, all can be considered as transient work with low pay rates; second, all are, in effect, part time jobs and work can be arranged to fit any schedule; next there are none of the jobs that could be considered as desirable for college graduates or even for high school graduates.

Moreover, none of these part time jobs could be considered of the type that creates this "atmosphere of inquiry."

Finally, a factor of major significance particularly to a college student advisor is that jobs of this type can be accumulating. By that I mean, the jobs may start out as a 2 or 3 hour a day proposition but can build gradually into a 8 to 10 hour periods.

A student accepting such a proposition could be sincere in merely taking the position to earn a bit of money. Before he or his college

advisor realize it there is less and less time spent on school preparations and more and more time spent on the outside job. Grades degenerate and a good student often seriously considered dropping classes or out of school entirely or changing majors because of a temporary interfering situation in return for an immediate momentary return.

As can be seen from the results of the personal survey, science students at St. Ambrose sought part time work. The jobs obtained did not provide the proper environment for scientific development. And yet personnel with their type scientific backgrounds were and are needed. The very companies that hire these students as timekeepers and night watchman would advertise continuously for "Engineers, Scientists and Technicians."

It may seem that the simple solution to create the proper atmosphere and also make use of technical talent would be to use these trained students to assist in technical work in industries that need this type help. However, there were seemingly unsurmountable obstacles encountered.

For example, industry works on definite schedules. Part time work is practically unheard of. This appeared to be especially true of project engineering, and applied research and development; yet these science students who take jobs as part time service station operators are much better prepared for applied research and development projects than many of the present day technicians industrial organizations are required to hire. Pay had to be considered. Timekeeping would be a problem. The entire idea of science students helping industry and industry helping the student seemed to be a fantastic dream.

During the summer of 1955 it was found that the dream of science student working part time for industry was not as fantastic as it might seem.

The management, Pioneer-Central Division, Bendix Aviation Corporation was aggressively attacking the problem of obtaining personnel with desirable technical knowledge. The atmosphere at Pioneer-Central is definitely one of progress.

In addition, Mr. Walter Dray, Executive Engineer, had been considering an industrial-education program for some time. Mr. Norman Hosford, Chief Engineer and Mr. George Lewthwaite, General Manager, of the Davenport plant were very much in favor of the industrial-educational co-operation. With advice from Bendix Senior Engineers, Dr. Tom Bulat, Mr. Roy Lundquist and Mr. Paul Gardner, the Bendix legal adviser, Mr. George Hyde, and Father John Dolan, St. Ambrose Dean, the student-industrial aid program presently in force was worked out.

Tuition plans and scholarship programs were discarded since a close industrial-educational co-operative program was desired.

The program was so planned that the student could feel himself a part of the industrial organization and the scientists working with the student could feel himself a part of the educational system. This program was designated "Student Industrial Research Program—Bendix-St. Ambrose" and a formal contract signed on 4th February 1956.

In essence the main points of the program are:

(1) Bendix buys student hours from St. Ambrose College.

(2) Applied research projects are outlined by engineers and scientists at Bendix or by college advisors. The project is submitted to college co-ordinator (myself), and Bendix co-ordinator (Mr. Dray) who reviews it, consult with the scientists and engineers on feasibility of project, check student aptitudes and qualifications, assign the project to a Bendix supervisor (Senior Engineer or Scientist) and to a student. Many of the projects that are presently being worked on have been dormant due to lack of trained personnel to further their investigation.

(3) The student consults with his supervisor, reads recommended bibliography and expands on it. He obtains a thorough theoretical knowledge of subjects dealing with this problem.

(4) He then determines a feasible way to approach a solution with, of course, advice from his supervisor.

(5) Special equipment needed is furnished by Bendix if not available at the college. The student is encouraged to build up his own apparatus even though commercial equipment is available if it will assist him to obtain a better outlook on the problem under investigation. Of course this does not mean building a device like a rectifier or ultrasonic generator.

(6) The student may set up his experimental work at Bendix or at St. Ambrose, the location is dependent on location of equipment needed.

(7) The student consults frequently with his supervisor. He submits a monthly report to college coordinator and frequent oral reports to his supervisor. Written reports are usually submitted at the end of critical phases of investigation.

(8) The student keeps his own time slips and time can be counted for; bibliography work, writing reports, consulting with supervisor, reporting at conventions and experimental investigations. He does not keep definite hours but can work when he desires. There is no undue strain to meet a deadline.

(9) Pay is at the rate of $1.00 an hour.

(10) Plant badges are issued each student that sets his experiment up at Bendix to allow free access to the plant.

There have been ten assigned projects. Four others are a present being considered. Seven students are at present working on these. The projects that either have been or at present are being worked

on include:

1. Ultrasonic Etching
2. Paramagnetic Effect of Oxygen
3. Iridited Aluminum Checks
4. Ultrasonic Plating
5. Oxygen Container Analysis
6. Accoustical Deadening Device for Ultrasonic Generators
7. Effect of Infra Red Radiation on Metal Surfaces
8. Physiological Effects of Ultrasonics
9. Radioactive Decontamination
10. Dielectric Measurements of Oxygen

The projects that are being considered include:

1. Ear Microphone
2. Synthetic Elastomers for use in High Pressure & Liquid Oxygen Systems
3. Fuels for Fuel Flowmeters
4. Silicone Rubber Compounds

It is felt that there are numerous advantages to all parties concerned in our program. There are probable disadvantages also. However, if the advantages are listed it can be seen that they outweigh the disadvantages.

The advantages are:

A. To the Company
   1. Provide technically trained personnel at reasonable rates for work that previously could not be properly accomplished.
   2. Provide an inexpensive method for recruiting qualified employees. The company can determine if the student will fit into the organization. They will not be stuck with a "tramp engineer or scientist" that habitually moves on after several months in one position.
   3. Provides the supervising scientist or engineer an opportunity to use acquired abilities in the development of the student. This stimulates submerged talents in the supervisor. It also helps the supervisor in his own processes of learning and enables him to keep up with latest theories and equipment as taught and used in college classes.

B. To the Student:
   1. Industrial experience on problems from his field of study.
   2. Familiarization with supervisory personnel as a contact for employment upon graduation.
   3. Expert advise on applied research projects.
   4. Part time job with flexible hours and nominal pay.
   5. Summer employment in his field of interest.
   6. Collection of material for a scientific paper.
   7. Shows industrial personnel that the college student does

more than drive rah-rah cars and attend football rallies.

C. To the College:
   1. A control of outside hours the student works.
   2. Representation at national, state, and local scientific meetings on a contributional basis.
   3. Use of equipment that is normally not available or too expensive to be purchased by the college.
   4. Information on the capabilities of potential instructors for part time teaching assignments.

The Bendix-St. Ambrose program has been officially in operation since 4 February 1956 and actually in operation since 1 November 1955. Its success can be partially measured by the two papers presented at this session of the Iowa Acadamy of Science. These same two papers are to be presented at the Chicago Undergraduate Symposium of the ACS in May and with three other papers to the Iowa-Illinois Undergraduate Symposium at Cornell in May.

Our Bendix associates are well pleased with the progress of the program. The comments from St. Ambrose administration, faculty, and alumni indicate they are pleased. As for the students involved, aside from disgust at not getting plausible results immediately there have been no adverse comments. There has been a bit of cheating in filling out time slips. Occasionally the slips do not register the correct amount of time, the student cheats himself by several hours on bibliography work. An inquiry usually indicated the student feels he should know the material not charge Bendix to learn it.

All in all the success of the program has been greater than anticipated. There are some revisions to be considered if the contract is renewed next year. One is the problem of full time summer work under the program. Another is increased pay rate for students after they have been with the program for a certain number of hours. It has been suggest also that periodic meetings say semimonthly would assist in distributing project information. Two of the students could report each meeting and ideas exchanged.

In this program at present there is no attempt at pure research. It could be considered an intermediate phase between the pure theoretical research that is carried on in graduate school and practical applications that are desperately needed by industry. It is in effect applied research and the program has worked.

There are other industries with a progressive atmosphere, there are other colleges, and there are many interested students. This type of program is needed. All that is necessary is the proper industrial-educational cooperation and interest in your area.

ST. AMBROSE COLLEGE
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