

Industry's Role in Supporting High-School Science Programs

J. O. PAIVINEN†, *Chairman*

AN introductory statement was presented by the chairman, a member of the WJCC Technical Program Committee. He pointed out that the objective of the meeting was to bring information on cooperative industry-school programs to the attention of interested computer people as well as invited high-school principals from the Bay area (20 out of 100 invitees attended). Through this meeting, the computer industry expressed interest and willingness to cooperate in additional similar programs wherever the need may be evidenced by schools or teachers. It is not the intent to restrict such programs to involve computer technology only, but to participate in broad science programs including a computer portion. In this way, students aiming at careers in science will be exposed to computer techniques as one of their available tools, while potential computer people will have attained a broader grasp of basic technology.

Dr. Paul Hurd, *Chairman (Professor of Science Education at Stanford University, Calif.)*

Dr. Hurd portrayed the program as illustrating examples of cooperation between industry, professional people, and civic groups, working with high schools to enrich the technical exposure of high-school students. The needs of our society have expanded from one in 300 employees in 1900 needing a scientific, engineering, or mathematical training for their positions to one in 37 needing such training in 1958. The trend is still increasing for such training. Conversely, schools need the help of industry and civic groups to establish such programs not only to avoid increasing the teacher's burdens but to bring to the teachers a knowledge and background in newer areas of technology and science. Examples in the program will point out that the success of cooperative programs depends always on both an interested teacher and interested community members to participate in the extra work. In summary, the examples in the program show how a new dimension can be brought to education in which the community itself takes an active part by contributing time, technical skills, and support to enrich high-school and junior high-school programs.

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Darryl Littlefield (*Physics and Science Teacher, Livermore Union High School, Livermore, Calif.*)

An elective course is offered as part of the curriculum at the high school to cover applications and programming of the IBM 650. The objective of the course is to convey a real appreciation of the power and application of computers in modern research, engineering, and business. Problems are generally of a nature that would not normally be encountered by high-school students. Littlefield and Herman Thomas of the Math Department cooperate in the project.

The course stemmed from Littlefield's contact with the 650 at the Lawrence Radiation Laboratory (University of California) at Livermore and his consequent interest toward using the community resources to establish programs of real educational growth for his students. Dr. Sidney Fernbach of the Radiation Laboratory acts as consultant for the course while the Laboratory makes available machine time for use by the students. The Radiation Laboratory has also made available charts, models, and speakers for the classroom.

The benefit of a week-long seminar on computer instruction for teachers and engineers, arranged by Dr. Van Etta of Hughes Aircraft Co. of Los Angeles, was stressed. As another part of the school program, the construction of a relay binary adder-subtractor by two students using parts donated by Pacific Telephone and Telegraph and IBM was mentioned. Dr. LaFrangi of the Radiation Laboratory acted as advisor.

Joanne Watkins (*Senior Student, Livermore High School, Livermore, Calif.*)

Programming to solve the motion of a projectile in vacuum was described and flow charts, coding sheets, and plots of trajectories for varying initial elevations were shown. The course was enjoyable because it was new and interesting and has given a background applicable even to other computers, together with an appreciation for what jobs can best be done on computers.

Doug McMillin (*Junior Student, Livermore High School, Livermore, Calif.*)

A payroll calculation on the 650 was described and the input and output card layouts, flow charts, and programming sheets shown. The main points of the calculations were described. Personal access to a ma-

chine was found fascinating and mathematical principles in practical use enjoyed. The training in logical thinking was valuable and resulted from working a problem as a whole, with simultaneous attention to detail, while observing the strict rules of computer programming.

Tom Doyen and Ross Harrower (*Students, Livermore High School, Livermore, Calif.*)

The operation of the binary adder they had constructed was explained, including mention of subtraction by complements. A demonstration followed the description.

Dr. Sidney Fernbach (*Staff Member, Lawrence Radiation Laboratory, Livermore, Calif.*)

Other cooperative programs supported by the Radiation Laboratory were described. A high-school committee attempts to get students interested in individual projects, providing advisers on such topics as rocketry and nuclear energy. Speakers are also provided for science clubs and classrooms, and student tours are arranged at both Berkeley and Livermore Laboratories. Training of high-school teachers in modern physics is arranged through summertime and parttime employment where three lectures per week are provided on computers, modern physics, and chemistry.

High-school students have been employed during the summer to convey a working knowledge of laboratory procedures; this summer, participation requiring even Q clearance will be arranged.

Finally, general scholarship is encouraged by trying to increase student enrollment in college preparatory courses and by arranging for awards from the community for outstanding students.

Henry Martin (*Physics Teacher, Palo Alto High School, Palo Alto, Calif.*)

Five to six years ago, industry help was sought in guiding the efforts of students who evidenced their eagerness to learn by after-hours and Saturday use of school facilities and the laboratory. However, little success was encountered due to the lack of any concrete program that Martin and the short-handed science staff had time to generate. This stalemate was broken in 1957 by a consultant from the Joe Berg Foundation, 1712 South Michigan Avenue, Chicago 16, Ill., an organization that volunteers help in establishing an initial relation between industry and schools. This resulted in the Palo Alto Science Seminar, which is an entirely locally conducted program. Fifty-two weekly sessions are conducted throughout the year, with 1 to 1½ hours of each session devoted to a general program given by an industry expert or a panel discussion with subsequent group discussions specializing in chemistry, geology, biology, physics, engineering, and mathematics. A student joins at about the tenth grade level and will ulti-

mately undertake a project of interest to him with the counselling available of a volunteer industry professional. Industry also provides equipment, speakers, demonstrations, and sometimes facilities where the student often works in proximity to an engineer or a scientist. Advantages to the students include familiarization with work conditions and opportunities, opportunity for individual creative study (since projects are not group efforts), personal satisfaction of a hobby with prestige value, and the opportunity to seek and earn scholarships.

Advantages to industry include an early encouraging hand to potential Ph.D. scientists, an opportunity to demonstrate to a broad slice of the community that scientists are normal human beings with families and a sense of humor, and an opportunity to contribute to the community and the future of our country.

Other programs recommended in closing for industry's consideration are:

- 1) Participation of students as well as teachers at professional dinners and educational programs arranged by industry.
- 2) The assignment to some member of a company management team the specific responsibility of support and cooperation in educational affairs.
- 3) The opportunity for students on field trips to spend sufficient time with the engineers and scientists to gain some insight into the significance of the projects or laboratories visited.
- 4) Summer jobs for students which will increase their knowledge of industry practices and expectations.
- 5) Screening and testing programs to select outstanding students to receive substantial scholarships.
- 6) Summer schools at local universities so that students can see what they will be up against in the future.
- 7) Public competitions for scholarship so that recognition could be given in a manner comparable to school athletic letters and Father's Club dinners for athletes.

Larry Hubbart (*Student, Palo Alto High School, Palo Alto, Calif.*)

Hubbart's construction of a test stand as well as his subsequent experiments in measuring the lift of rotating airfoils (similar to an inverted pie plate) were described. An engineer from Hiller Helicopter Co. acts as adviser: his contribution was described as helping to suggest directions of investigation to pursue as well as to help maintain morale when the project appears to bog down. The test stand consisted of a counter-balanced scale with a drive motor and a photocell rpm counter. Airfoils of varying shapes and textures (some with added ducts) have been measured. The project was described as representing a success "even if it never leaves the

ground" due to the experience it provided in how to conduct an experiment and how to present the results.

Mike Macauley (*Student, Palo Alto High School, Palo Alto, Calif.*)

An experiment in combatting muscle fatigue by injected chemical solutions is being conducted. A rabbit is anesthetized and muscle contractions are caused by mild electric shock until exhaustion occurs. Injection of a mild hydrogen peroxide solution results in acceleration of the recovery: recovery periods range from 3 minutes for a 3 per cent solution to 0.3 second for 15 per cent. Hydrogen peroxide was chosen due to the safe decomposition products; procedures are followed to safeguard against bubble formation in the blood.

The insights gained into medicine and medical research have reinforced interest in entering the field of medicine.

Wallace Burton (*Engineer, R-S Electronics, Palo Alto, Calif.*)

The YMCA Men's Club, in seeking to further encourage science students and to provide recognition for work done in the Palo Alto Science Seminar, chose to present an annual Palo Alto Industry-Youth Science Show. The show presents awards to outstanding student science projects and also presents an opportunity for exhibits by local industrial firms.

Announcements of the show with award categories are sent to all the high schools in the Palo Alto district and a participation of about 10 per cent of the students is experienced (the only other such event, the Bay Area Science Fair, accommodates only 1 per cent of the Palo Alto students). Three categories of participation are provided: 1) physical sciences, 2) biological sciences, and 3) technical reports (given orally in competition). About

one-half of the industrial firms contacted responded favorably to requests for financial support and industrial exhibits. In the first year, industry met \$650 of the \$850 expenditures, and this year the show will be self-supporting together with an expected elimination of the club deficit.

The Science Show provides wide recognition to students through substantial adult attendance as well as the interest and awareness of the industry people who work as judges and exhibitors for the show. The Men's Club provides the planning and organizing for the show so that the participation of the various schools can be drawn together into an integrated plan, this having been found necessary to obtain effective support from industry.

Even smaller communities can establish Science Shows. Community members are sure to lend help if given an opportunity while local commercial businessmen would undoubtedly help support the expenses.

A member of the audience (*Staff Member, Systems Development Corp., Los Angeles, Calif.*)

Educational support activities performed by the staff at Systems Development Corporation were described. At the junior high-school level, package lectures are available in 1) data processing, 2) automatic feedback, 3) binary and octal notation in programming, etc. For the high-school level, talks are available in 1) concepts of programming, 2) environmental simulation in air defense, etc. City colleges have available 1) computer design philosophies, 2) logic design, 3) computer system design, etc. A symposium has been held for teachers in "Implications of the Computer Age for Teaching Mathematics" while other lectures and special courses on programming and advanced math for high-school students have also been provided.
