Learning from Scientists at Work

A program pairing secondary students with adult professionals in science and technology teaches students about career choices and how classwork applies to the work world.

A student analyzes tissues of joints of arthritic dogs at Indiana University School of Medicine.

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"I really love biology. What job can I get where I can do biology?" "Working with robots in class is great. What career would let me continue to work with robotics?" Deciding on a career, especially for students with exceptional skills in mathematics and science, can be a difficult task. Where can students interested in science or technology turn for help about available careers? To fill this need, the Indianapolis Public Schools (IPS) established a program to link secondary school students with adult professionals working in these professions.

Through the Science Mentor Program, exemplary professionals help students in grades 7 through 12 to bridge classroom concepts to applications in industry and research. The program's goals are to:

- improve students' scientific and technological literacy;
- show them real applications of science, math, and communication skills;
- demonstrate the critical need for skillful problem solvers;
- identify career opportunities;
- help students make informed curricular and career choices (Turpin 1981).

In 1981, Gilbert Turpin, the district's Science Supervisor, established the program in conjunction with the Indianapolis Chamber of Commerce Partners-in-Education program, which linked local businesses to individual schools for a year of ongoing activities. Created to augment the science and technology instruction of talented students, the program is now part of the Math/Science Magnet programs.

Preliminaries to Mentoring

For those students who have met the rigorous entrance requirements for the Math/Science Magnet, the only additional requirement is that their grades must be B or above for all subjects. Their parent or guardian must also give permission.

The program coordinator then interviews eligible students using a standard protocol about their interests, science fair projects, career goals, and the math and science courses they've taken. From the interviews, the coordinator develops a personal data sheet about each student, which the mentor receives prior to the first meeting.

Next, students learn about their responsibilities. About every three weeks, they will visit with mentors for approximately four hours — from 7 to

11 visits during the year. Each visit includes lunch together so that the student and the mentor can become more acquainted in a relaxed atmosphere. Students are expected to personally notify mentors if illness prevents them from attending. They keep a diary for each visit (see fig. 1) and write a 7-10 page (3-5 page for junior high school students) paper describing the experience. After the last visit, students send their mentors a letter of thanks.

Although many mentors continue from year to year, new mentors are continually being added as more and more businesses ask to participate and as students' interests broaden and change. Before the student's first visit, the coordinator meets with the mentor to help develop an activity for the student. The activity illustrates the mentor's responsibilities and skills, as well as those of other people with whom the mentor interacts (see fig. 2).

The Link-Ups

The program coordinator visits each mentoring location on the first visit; the student's parents are also invited. First-visit activities might include a tour of the facility, a video presentation about the company, a welcome by the chief executive officer, and refreshments. Many institutions give students company-like name badges and take photos of them with their mentors. The coordinator visits the worksites at least one more time to take candid photographs of the students in mentoring activities and to monitor progress.

The final visit is an opportunity to sum up the experience. When two or more students have mentored at a particular site, they are frequently asked to speak about what they have learned before a group of mentors, other students, and company executives. This provides good speaking practice and helps students put together thoughts for the final paper.

What do students do in the program? They participate in activities that demonstrate the application of science, math, computer, and communication skills as integral to successful work. Students learn to use specialized instruments and procedures, and they are expected to be active participants during each visit.

Here's a sample of the projects students have engaged in:

- problem-solving, programming, and troubleshooting with IBM networks;
- preparing and staining specimens for use with light, phase, and electron microscopes;
- calibrating air quality sampling instruments, collecting data via telemetry, using a computer model to examine and manipulate air quality variables;
- investigating the variables influencing hormones and growth;
- programming with machine, Pascal, and Applesoft languages;
- teaming with medical students for dissection in a cadaver lab;
- using scanning electron microscopy in diabetes studies;
- studying enervation mechanisms of joints in arthritic animals;
- designing and constructing a gauge to measure tolerances of machine tools;
- mastering computer commands needed to digitize topographic map information.

About the Business Partners

Local businesses have shown a great interest in the IPS Science Mentor

FIGURE 1

STUDENT RECORD OF VISIT ACTIVITIES

Today's Visit Date: 2-23-90 Student Name: Pat C.

Location of mentor activities today: Allison Transmission Division Manufacturing Design department

Who was your mentor today? (what is his/her name and title; write two sentences about their job that matches their title) Supervisor of manufacturing Design. He oversees many design engineers and Draftsmen. They use computers to design transmissions.

What did you and your mentor do today? used CAD system to draw a modification of a school bus transmission gear on a flat-bed plotter

What tools/instruments or procedures did you learn to use today? flat-bed plotter; CAD workstation; micrometer caliper

What new words and definitions did you add to your vocabulary today? thrust bearing; orientation; perspective; pen carousel; mylar media; vellum; autocad

What was most interesting about today's visit? watching the pen run over the paper in the plotter

What will you be doing in the next visit? check tolerances of a sub-assembly

Program. A diverse collection of public and private enterprises have participated, including those involved with manufacturing, engineering, and research, as well as the broad areas of health care, from hospitals to public and private medical laboratories.[1]

Participants have expressed both altruistic and self-serving reasons for their involvement. Concerned about the quality of education offered in the public schools, business and community leaders see the program as a tangible way to make a difference. Professionals in certain occupations, such as medical technology and engineering, want to interest able students in their particular fields. Others want to recruit future employees. Participation also allows businesses to obtain more minority inclusion and to remind current employees of their community interests.

The pairing of a student with a mentor frequently leads to further involvement after the mentoring experience has ended. Students feel free to contact their mentors with problems or questions about future science fair projects, college choices, or coursework selections. Relationships have also continued through paid summer jobs or college internships.

Evaluation and Recognition

The Science Mentor Program is evaluated in several ways. The mentors complete an evaluation form, describing the good and bad aspects of the experience with suggestions for improvement. For their information, they also receive a copy of the student's written report. In addition, the students complete an evaluation form, and their written reports usually contain a tacit evaluation of the experience.

The classroom teachers of participating students are involved in an ongoing, although informal, manner. Students miss three or four classes every three weeks, and work assigned during the mentoring experiences must be made up. Also, their teachers encourage them to share with class members the new information gained at each mentoring session.

In 1984, the IPS Science Mentor Program received a presidential citation for exemplary efforts in career awareness in the Search for Excellence in Science Education, and it was one of five programs selected for national recognition. In 1990, a study conducted by the Urban Institute and the National Association of Partners in Education cited the program as 1 of 24 exemplary school-business partnerships in science and mathematics (Blair et al. 1990).

Starting Your Own Partnership

Setting up a successful school-business partnership requires several ingredients. The first is a committed school-based person who will make contacts with people in business and

A Day at the Box Factory

STAN BERNARD

As general manager of a corrugated packaging plant in Miamisburg, Ohio, I was glad to participate in the Partners in Education program formed by the local school system. Our company adopted an elementary school near our plant. In addition to helping the school purchase some needed equipment, we gave the classes tours of our facility.

I was a bit taken aback, however, when the teacher of the learning disabled class invited me to talk to the children about our company. How would I communicate the workings of a corrugated container manufacturing facility to children? And even if I could, would they really be interested? The most dedicated Rotarians have been known to nod through such presentations!

I hated to refuse the request, but I was stumped. I talked to my wife about the predicament. Rosalie, an applied communications teacher at a vocational school, has orchestrated many projects that link education with business and industry. Her solution was simple: "Don't tell them; show them."

It would be difficult to take the class through our plant's entire manufacturing process; but if I scaled it down, the students could not only see how it all worked, but they could participate. Rosalie and I came up with a project we hoped would work.

I arrived at the school loaded down with pre-cut corrugated sheets, tape, labels, production forms, and time cards. After a brief explanation of what a corrugated packaging company does, we set up an assembly line. Each student was given a job, a responsibility. They were eager to begin! The first group of students received the pre-cut cartons and delivered them to a second group for folding. Next the

industry to solicit mentors, select and place students, and coordinate arrangements, transportation, and evaluation. A contact person is also needed at each business site, either a mentor or a supervisor, to help coordinate activities with the school-based coordinator. In addition, a written plan is needed for each student's intended activities at the work site to inform the student, his parent, and the mentor.

Another ingredient is a financial commitment to the partnership by both parties for pre-planning, monitoring, and evaluation. Although the costs are minimal, there are some necessary expenses. For example, the district should provide a coordinator, at least half-time, and the businesses must allow personnel release time in which to participate. Funds available through the magnet school federal grant help defray the costs of taxis for students to the worksites in the IPS program. To hold down costs, mentors are encouraged to accept two students, each. At especially large institutions, such as Saint Vincent Hospital, where yearly 11 to 14 professionals work with students, a minibus transports students.

In addition to the mentoring relationship, business people are encouraged to speak at the schools about careers and occupations. In this way, they reach students who don't meet the requirements for the worksite mentoring experience but who are interested in practical uses of science, mathematics, and/or technology. The opportunity to establish a personal relationship with a science professional can lead to summer employment and college scholarships.

cartons went to a group of students responsible for labeling them. After the cartons were folded and labeled, the next group of students bundled and taped them. Finally, the "truck driver" loaded the cartons and left for a company delivery. All went well for a while, and the students were having a great time on their production line. Then I directed the first student to step out of line.

"This worker is late for work today," I said.

"How will we get the cardboard?" the rest of the students asked indignantly, scowling at him.

"We'll either have to shut down production, or one of you will have to do two jobs," I answered.

They all looked at their teacher, but she said they were on their own. Time for a group conference. After some discussion, they agreed that one of the labelers would deliver the sheets.

Other problems arose from time to time. We ran out of labels. The truck driver "called in" to report that he had mechanical problems and would not be able to make a customer delivery promised for that day. By conducting the assembly line simulation, I was able to observe a great deal of cooperative learning and group problem solving among the children.

The children handled each situation first by identifying the problem and then brainstorming to arrive at the best solution. When solutions didn't work, they had to re-group for new ideas. Each problem encountered illustrated the importance of being on the job, on time. The children began to realize and talk about how absenteeism has an effect on everyone and makes the job more difficult to accomplish.

At the end of our production "day," students filled out time cards (another learning experience). Then we discussed how the employees should be paid. Should the person who was late for work receive the same pay as the others? Should the person who had to do the extra work receive more pay than the others? Should the truck driver receive less pay because the truck had mechanical problems? The students discussed all of these issues and came up with answers.

When I left the school, I felt that I had offered the students a firsthand view of a day on the job. They had had fun and, at the same time, gained valuable insights about what the world of work requires in the form of good attendance and old-fashioned job ethics.

I hear many business people today complain about the lack of motivated and dependable entry-level employees. I am convinced that by becoming involved with education, the business sector will benefit. We can offer not only material assistance, but also our time and attention. We can take the world of work into the classroom and stress the qualities that we see as essential in tomorrow's workers. This may be the best and most effective gift we have to offer. □

Stan Bernard is President of the newly formed PAX Corrugated Products, Inc., 147 Circle Freeway, Cincinnati, OH 45246. He will invite nearby schools to contact him for support and assistance. **Rosalie Bernard**, an applied communications teacher at Montgomery County Joint Vocational School, assisted him in this venture and in writing this article.

A school-business partnership can be of tremendous benefit to all participants. The school and students benefit in terms of motivation, career choices, and positive role models. Parents, too, realize the importance of building bridges of communication between the school and the community. Finally, mentors realize that the opportunity is one in which they can enhance learning, encourage continued interest in mathematics and science, broaden student perspectives with respect to real-world applications of school-learned concept, and potentially develop future employees in their own industries.

[1]Agencies that have provided science mentoring opportunities for Indianapolis Public School students include Allison Gas Turbine; Allison Transmission Division of GMC; Amax Coal Company; AT&T Consumer Products Laboratory; Delco Remy; Indiana State Board of Health; Indiana University/Purdue University Schools of Dentistry, Medicine, and Science; Indianapolis Children's Museum; Indianapolis Power and Light; Marion County Department of Public Works-Air Pollution Control; Marion County Health Department; Methodist Hospital; Naval Avionics Center; R.L. Roudebush Veterans Administration Hospital; and Saint Vincent Hospital.

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