

The PACT Ambassador Outreach Program: More Than Just a Bunch of “Old White-Haired Scientists”

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Partnership for the Advancement of Chemical Technology (PACT) is a 300-member industrial-academic consortium that is working to create a well educated, chemistry-based workforce through curriculum development, teacher enhancement opportunities, and student outreach including school-to-work experiences. This article describes the PACT Ambassador Program, a student outreach initiative that fosters direct interaction between high school students and scientists from the workplace.

Facilitating School-to-work Experiences

The PACT Ambassador Program brings industrial applications of technology to high school students while introducing them to how chemistry is done in the chemical and allied industries. Students experience the complexity of day-to-day operations of a chemical industry, learn about the importance of excellent communication skills, and develop positive perceptions of the chemical industry and potential careers. One female student wrote the following about her experience in the model program described below: “I realized just how important chemistry is in our daily lives. I used to think it was just a bunch of old, white-haired scientists standing around looking at the periodic chart all day long. It wasn’t that way at all. Now I’m considering pursuing chemistry as a career.”

The Ambassador Program uses a team approach in planning sessions and implementation. Each team includes one or more industrial ambassadors, a high school teacher, and a chemistry faculty member from an area college. This industrial-academic partnership approach provides the necessary range of viewpoints, resource persons, and role models.

The most successful Ambassador programs conducted to date have used a holistic, multiphase model that includes a classroom seminar presented by the industrial ambassador; an industrial site visit or tour, in which students see technology at work; and a capstone laboratory experience based on the chemical technology of the sponsoring industry. These components are usually focused around a problem-solving scenario involving a situation that might be encountered in the workplace. The following section describes the first PACT Ambassador Program.

The Pilot Ambassador Program

The first PACT Ambassador Program was launched early in 1995 as a collaboration between the Quantum Chemical Corporation (Cincinnati, Ohio), Miami University Middletown (Middletown, Ohio), and William Mason High School (Mason, Ohio). The facilitating team chose the topic of polymer additive analysis with the goal of helping stu-

dents to learn about different types of polymer additives, the role each plays in a polymer, and the analytical methods used by Quantum for additive analysis. In order to make the laboratory component an effective learning experience, students were given a scenario that placed them in the role of a chemical technician to solve a realistic problem. A sample scenario is provided below. The ambassador team used the multiphase approach described above to facilitate learning for the 16 students involved in this program.

Sample Scenario

You are a chemical technician working in the Analytical Department of Finestkind Plastics, Inc. Finestkind manufactures a special type of polyethylene (plastic) that they use for a variety of products. This plastic contains a multicomponent additive package that combines the properties of good process stability, excellent longer-term stability, and ultraviolet stability for extended outdoor use. The polyethylene supplied to Finestkind Plastics must contain 1000 parts per million (ppm) of the following additives: Topanol CP, BHT, Isonox 129, Cyasorb UV531, Irganox 1010, and Tinuvin P.

One day, the technical operators on the fabrication floor began noticing that the plastic’s melt flow characteristics had changed. This new batch of polyethylene appeared to flow with greater difficulty, making it impossible for the technical operators to maintain their target production rate. A representative sample of the problem plastic was sent to you for an analysis of the additive package. As a chemical technician for Finestkind Plastics, Inc., you must determine the cause of the problem and report your results to the appropriate personnel.

Ambassador Seminars

The two Quantum Ambassadors gave separate one-hour seminars about a week apart. For each seminar, the high school teacher arranged an in-school “field trip” to the school library so the students could spend at least one hour listening to the presenters and asking questions. The first seminar introduced the students to Quantum’s role in the polymer industry; how plastics are processed into bottles, film, and injection-molded parts; and the concept of polymer additives. The roles of different types of polymer additives and specific applications of each were also discussed.

The second seminar focused on the topic of additive analysis. The ambassador stressed that knowing how to put additives in polymers is not enough—chemists must also be able to measure the level of additives in the final product. Students learned that HPLC was the method of choice for additive analysis in polyethylene and that additive analysis is important to the polymer industry for several reasons: the company must be able to determine additive levels in order to comply with product specifications, to distinguish their polymer from a competitor’s, to investigate manufacturing problems that arise from processing errors, and to identify additive formulations in competitive materials.

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Industrial Tour of the Allen Research Center

The next phase of the program involved a tour of Quantum's Allen Research Center in Cincinnati, Ohio. After signing in and being issued visitors' badges, the students watched a short video about safety in accordance with the facility's safety policy for visitors. Students then visited the Applied Research Laboratory, where they saw about 20 commercial or semicommercial-size plastics processing lines, additives being compounded into polymers, and an additive analysis that used robotics for extraction and HPLC for quantification.

After the tour, the students commented on how impressed they were with how the Quantum employees, including the Director of Research, treated them as welcome guests and how their preconceptions of the usefulness of science and scientists had changed. Many of the students couldn't get over the fact that "real people" do this kind of work for a living.

The Capstone Laboratory Experience

The capstone laboratory experience began at the high school, where the students extracted their ground polymer samples (provided by Quantum) with isopropanol and concentrated the extracts. The students then brought their extracts to Miami University Middletown, where they used a state-of-the-art HPLC provided by Hewlett Packard to analyze the polymer additives in their samples. The results of this laboratory experience provided clues necessary to solve the problems presented in the scenarios.

Follow-Up

One week after the capstone laboratory experience, each student team submitted two written reports discussing their findings based on their sample analysis, the Ambassadors' classroom seminars, literature research on polymer additives, and journal articles furnished by the Ambassadors. One letter was to be a response to the customer concerning the complaint mentioned in the groups scenario, and the other was an internal company report sent to the student team's fictional quality assurance supervisor. Both documents were to be written with the proper tone and point of view. The shortness of the resulting letters belied the amount of work that went into producing them. The high school teacher felt the letters to the fictitious supervisors were an excellent exercise in communicating technical results to others. A sample student letter responding to a customer concerning the specific complaint is shown below.

Sample Student Letter

Mr. James Anderson
Finestkind Plastics, Inc.

Dear Mr. Anderson:

We recently received a sample of our plastic from you that was defective. The plastic's melt flow characteristics had altered, which caused it to degrade. A team of our professionally trained scientists ran extensive tests on the plastic. Our tests consisted of diluting the sample with 25 mL of isopropyl alcohol to extract the additives from the polyethylene. We then performed an HPLC (high performance liquid chromatography) test on the alcohol solution to identify the additives and their amounts. The additives we found in the solution were: TOPANOL CP, BHT, ISONOX 129, CYASORB UV531, and IRGANOX 1010. After multiple tests we have found that there is a low amount of Isonox 129 in the plastic that you purchased. The accepted sample contains only 150 ppm of this additive.

Isonox 129 is an antioxidant for polymers and materials sub-

ject to thermal oxidative degradation. Therefore a deficient amount of this additive would cause difficulty in the plastic's melt flow characteristics. We have found that the statistics of this additive are:

Mean: 153 ppm
Standard deviation: 2.71 ppm
Relative Standard Deviation: 1.77%

We are very sorry for this inconvenience that our product has brought to your company. We hope that you will continue to be a customer in the future.

Sincerely,
Jodmel Waton
Chemical Technician

Growing from the Challenge

Evaluation of the pilot program was most positive. All participating parties reported enthusiasm and excitement about being involved. In addition to observing increases in students' content knowledge and insights into the application of chemistry and technology in the workplace, the high school teacher noted that some of the lower-achieving students, who had to be coerced into attending weekly chemistry "help sessions" and lab makeups before the Ambassador program, were proactive in meeting the requirements of the Ambassador program. The teacher summarized, "Quite frankly, from my view the students were having fun working at something that was anything but easy."

Students were not the only ones to benefit from this and subsequent Ambassador programs. Industry has also benefited by improving public relations, gaining more credibility in the community, giving local citizens a better understanding of the technological problems that industry faces, having a large base of informed students to recruit, satisfying Responsible Care initiatives, and gaining a better appreciation for the concerns of teachers. As one recruiting manager for P&G stated, "Programs like the Ambassador Program not only take the 'abstractness' out of academic science, but also influence our ability to fill the pipeline with students who may not have otherwise had interest in a career in science."

To Learn More

Since the pilot program, several other industries and schools have partnered and carried out Ambassador programs of their own, including some with college students. Readers who are interested in learning more about PACT, about other Ambassador programs that have been conducted to date, or about how to set up an Ambassador program of their own are encouraged to contact the authors.

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