Turning Numbers into Pictures in the Elementary Classroom

"I am glad jat you got to be her [I am glad that you got to be here]." The words were carefully printed by an eight-year-old girl on pink notebook paper and handed to me after I finished a lesson on making graphs. There were hugs and thank-you's and lots of smiles. After a math lesson, you ask? Yes, after a math lesson.

I began the morning with the first of the three third-grade classes by printing my name across the chalkboard, introducing myself, and telling the students where I worked and what I do in my job. After a few minutes, I directed the topic to the subject of the day's math lesson: graphs. As part of my work in the Engineering Economic Evaluations Group at Oak Ridge National Laboratory (ORNL), I generate a variety of charts and graphs.

Holding up a newspaper, I asked the students, "Does anyone read the newspaper?" Nearly all students raised their hands, so I continued, "What is your favorite section?" I called on eight to ten students, who described favorite sections. I then held the newspaper up again, fully open so everyone could see the entire front page, and asked, "What portion of this page is the most interesting?" Every student I called on mentioned one of the photographs on the front, so I then asked, "Which draws your attention more? Pictures or words?" "Pictures!" they all answered at once (momentarily forgetting to raise their hands and be called on). Now it was time to tell the students the lesson's objective: "Today, we're going to turn numbers into pictures."

I showed several examples of tables of numbers and graphs from the newspaper and from my office. "Which is more interesting?" "Which is easier to understand?" The graphs, of course. Ten minutes had passed since I had written my name on the chalkboard. Now we were ready to work.

As I talked with the students about how useful graphs were in a variety of situations, I walked up and down the rows of desks handing out copies of a worksheet I had made. On the sheet were rows of empty boxes with an axis label printed across one side of the paper. I continued talking and explaining the task at hand as I passed out snack-sized bags of M&Ms [NOTE: Before passing out any food products, check with the teacher and students for food allergies or restrictions!]. Less than fifteen minutes later, twenty-six color-coded bar graphs were finished. The classroom teacher and I checked each graph before the student was allowed to "consume the data."

The students were visibly proud of their graphs. My instructions for completing the task had been minimal: I showed them a completed worksheet that I had done from my own bag of M&Ms, and I asked them to count their M&Ms and color their bar graphs with crayons that matched the colors of the candy. The students used a variety of approaches to sorting, counting, and recording—but that's *good*. These students learned much more than how to count M&Ms and color in a bar graph. Each student had the chance to analyze a problem, develop an approach to solving it, and evaluate his or her results. Every student had a chance to contribute and ask questions, and every student left the classroom having experienced "success" in math class that day.

Today's students have difficulty with problem-solving in science and math. Beginning in the middle grades, when students are asked to apply basic principles to abstract situations, there is a sharp decline in standardized test scores. Students find their interest and enthusiasm bounded by their lack of a solid foundation in fundamental skills. There is little understanding of how math becomes the language of science, or how fundamental science and math skills figure in everyday life and careers. Putting scientists, engineers, and technicians in the classroom provides the answer to every student's question, "Why do I need to learn those multiplication tables?"

In January 1991, the Engineering Technology Division (ETD) of ORNL decided to develop an organized science and math education support program. An initial interest survey identified personnel who wanted to contribute to the program. This group of more than 40 employees became the Division's Education Team. A planning meeting was held to find out what education activities the members were involved in, what new activities should be considered, and what general education philosophies should guide decisions. A data sheet of the meeting's discussion became a second interest survey that was completed by all team members. The tabulated results indicated that members felt comfortable giving presentations, wanted to be a presence in a single school (adopt-a-school), and wanted to encourage and motivate curiosity in science and math.

Meetings with Division management and school administrators were held to select an elementary school and target grade level. The program was to begin its first school year with weekly presentations to all third-grade classes. Topics for presentations that would supplement the present curriculum were selected by the classroom teachers and became sign-up sheets at the next team meeting. In addition, team members would serve as technical judges for the school-wide science fair and provide information and support to other teachers, as requested. At the end of this first year, the program would be evaluated, modified, and expanded to include presentations for the fourth grade.

Lesson evaluation forms for each presentation were completed by the classroom teacher. The team coordinator led a wrap-up session with students to query their impressions of science as a whole, their likes and dislikes about the program, and their "wish list" for next year's presentations. This information was coupled with discussions with teachers, school administrators, and team members in making changes and improvements in ETD's program. As a result, the number of lessons in the third grade are now fewer, topics for the fourth grade are more complex than originally planned, and the team is looking at ways to include parents as we expand the program into the fifth grade in the coming school year.

Are industry-led education support programs effective? Comparing standardized test scores may be tempting, but it is important to remember that those tests may not reflect the broader applications and dynamic concepts presented. High school dropout rates and numbers of students enrolling in high school elective science and math courses are values more likely to reflect the positive impact of the education support program. Industry may need to rely on less formal measures of success:

The Education Exchange highlights the experiences of scientists and engineers with local schools, along with helpful hints and resources. If you would like to share your own involvement in science education, contact Finley Shapiro, Department of Electrical and Computer Engineering, Drexel University, Philadelphia, PA 19104, U.S.A.
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positive comments from teachers and students, presenters who feel that they reached the students, and administrators from industry and education who want to continue the program.

Students need a reason to learn. Schools need to see what a valuable resource their local technical community can be. Industry needs to see how easy it is to help. And to the little girl who wrote "I am glad jat you got to be her"—*I* am glad I got to be there too!

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***Catherine Wagner** holds a degree in Education and is the Precollege Education Coordinator for the Engineering Technology Division (ETD) at Oak Ridge National Laboratory.* Technology in Education: A Guidebook for Developing a Science and Math Education Support Program, *ORNL TM-12145, details ETD's education program and serves as an easy-to-use guide for any technical organization or school that would like to develop an individualized science and math education support program. Limited copies are available by writing to Catherine Wagner, Oak Ridge National Laboratory, Building 9102-1/MS 8038, P. O. Box 2009, Oak Ridge, Tennessee 37831-8038.* □

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