

Mathematics Departments— Outreach to Local Schools

The hue and cry over reform in mathematics education at all levels has reached monumental proportions. Many mathematics departments are wondering whether or how they can help. Without attempting to issue yet another report, I will try to answer some of the main questions facing departments as they consider what role they might play in improving precollege education.

I. *Should mathematics departments get involved in the local schools?*

Not necessarily. First, the department as a whole must agree that this is an appropriate activity (one might encounter many dissenters). Next, several members of the department must make a direct commitment to such activity. Finally, questions II–V below must be answered in a satisfactory fashion. Of course, a departmental discussion will be much more focused if a concrete proposal for some particular project is on the table.

II. *Do the local schools want us?*

It depends. If we project ourselves as the saviors of education in mathematics, we will probably meet some resistance. If the teachers and administrators feel threatened, they are unlikely to give us a warm welcome. There is much that we have to offer if a relationship of mutual respect and trust is established.

III. *If they do want us, what do we have to offer?*

Plenty. We are the purveyors of mathematics. We should be able to communicate mathematical ideas to diverse groups of students, teachers, parents, administrators, legislators, business people, foundations, and other interested parties. This takes careful thought, planning, and preparation. Here are a few examples, some old, some new:

a) Run summer institutes for local teachers. Do mathematics that is directly related to their classroom teaching, but also discuss the conceptual framework underlying the mathematics. Maintain regular contact with the teachers who have participated in the institutes. (This is one of the distinct advantages of local programs.) Help the teachers to establish local networks among themselves. Peer interaction is an unusually effective device for maintaining teacher interest.

b) Establish a summer program for mathematically talented students. Cast the net wide and deep, and recruit females and minorities with determination. The criteria for admission should be the student's interest in mathematics and a willingness to work hard. A pyrotechnic display of mathematical precocity should not be a necessary condition. Start with students in the sixth or seventh grades and keep them in the program for five or six years or as long as they display interest and an ability to do mathematics at the level required by the program. Do not accelerate students through the standard school curriculum. Provide a rich and diverse experience in mathematics, computer science, physics, etc. Maintain contact with the students throughout the academic year.

c) Offer lectures about mathematics and mathematicians to the groups mentioned above and others. The mathematics behind the recent Fields Medals provides interesting and vital topics. The mathematics can be presented in a very intuitive way—the important thing is to convey the notion of mathematics as a living, breathing subject. People seem to relate better to geometric topics (pictures) as opposed to arithmetic or analytic topics (too many symbols)—for instance, knot theory, the

theory of surfaces, chaos and fractals, and even unsolved packing problems in two and three dimensions.

As mathematicians we have a very distinctive and valuable product to offer, that is, our understanding, intuition, and enthusiasm for mathematics.

IV. *What is the best way to approach the schools?*

Carefully. Through informal discussions with teachers and principals, you can determine their interest. Ask them to tell you what they would like, and then listen carefully to their responses. Offer them programs that do not disrupt the regular school day—for example, summer programs are a good place to begin. Treat the teachers as your colleagues. Many of them know their business quite well, and their insights can be of considerable value to you. They will respect your knowledge of mathematics, but it is likely that they will be skeptical about your ability to relate to precollege classrooms, especially elementary school classrooms. Form a partnership with the teachers and get started. They will let you know if your program is working well. It is helpful if you can offer course credit to teachers for their participation in summer institutes, but this is not a necessary condition.

V. *Will it cost money?*

You bet. This is an area in which considerable creativity is often required. If you run an effective outreach program, there will never be enough money to reward suitably the deserving. Some people must be paid in cash for their work, for example, undergraduate or graduate students who serve as counselors in summer programs. Stipends for participating teachers can provide useful motivation. Faculty members in mathematics departments can often be compensated by reducing their regular teaching load during the academic year. However, extra pay can also provide useful motivation for faculty. Some people actually are involved in outreach programs as volunteers.

Where can you find money to operate local outreach programs? One of the prime sources can be local businesses, corporations, and foundations. They like to see their money used to improve education in their home region. Some schools have staff development funds that can be tapped. States have some money for this purpose, but the competition and the politics are fierce. Then there are the national organizations: federal government (National Science Foundation, Department of Education, etc.), Ford Foundation, Carnegie Corporation, Carnegie Foundation, to mention only a few. Your program may be required to fit the guidelines issued by these funders. One very useful method of obtaining funding is to get your program up and running and then go looking for money. This will demonstrate your commitment and give the granting agency concrete evidence to consider.

It would be foolish to assert that every mathematician must contribute to improving school mathematics education. In truth, we mathematicians bear this responsibility collectively. Getting outreach programs started in our mathematics departments is a first step.

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