Education and Industry Outreach at DIMACS

Deborah Franzblau, Stephen Mahaney

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Abstract

DIMACS is a a Science and Technology Center of the National Science Foundation and as an Advance Technology Center of the New Jersey Commission on Science and Technology both of which have specific goals for outreach to industry and education sectors. Many of DIMACS' special year and workshop organizers have sought ideas for implementing this outreach mission in the context of their programs which usually begin from scientific goals and perspectives. This hastily thrown together article suggest ways to implement this outreach.

A number of DIMACS members are interested in having more impact on industry, on other scientific disciplines, and/or in education, but often lack the contacts, funding, or time to develop effective activities. Although there are members who believe that such activity takes away from the research programs, in fact, we have already begun to make such links successfully. Our experience has been that well planned initiatives do not detract from research programs; instead they enliven the research environment with exciting new research questions from industry or with interesting ideas for improving education. Contrary to the assumed "single-mindedness" of researchers, we find that most appreciate well planned introductions to other endeavors that will use their expertise.

We are not alone in this outreach endeavor: all 25 of the NSF's Science and Technology Centers share this goal and implement it in a variety of ways. Other prestigious research institutes, including the IAS and MSRI are actively enlarging and publicizing their education programs. And the NSF is increasingly attuned to the issues of human resources for science and engineering (ie the results of the educational system) as well as the shift from science oriented to defense to an industry, economic-competitiveness basis.

This is not just a nice idea. There is strong evidence that making a stronger, more visible outreach effort is not only good publicity, but may be essential to our survival as a research center. For the last few years, everyone involved in evaluating DIMACS, including our NSF program officer, site reviewers, and the external advisory board, has recommended strongly that we both improve our industrial outreach or "knowledge transfer" to other fields, and better connect our educational and industrial/scientific outreach activities with our ongoing research programs.

One of the reasons that such outreach activities are not included in Special-Year or workshop planning, is that no one suggests them in time. For example, it need not cost much to include an industry outreach or undergraduate education chair to a Special-Year organizing committee (just as we now have an Implementation Challenge chair, or publicity chair), who would be responsible for developing such activity.

The purpose of this guide is to provide ideas for relatively simple and inexpensive ways to include education and/or outreach components in workshops and special years, many based on past successful experiences. Certainly not all of these are appropriate for every Special Year or every workshop. However, we strongly encourage organizers to consider such activities that do fit well in their preliminary and ongoing plans. If the executive council approves, we plan to make additional funding available for such activities. Special Year and workshop organizers may consult the education coordinator (Debbie Franzblau) and the associate directors for education (Joe Rosenstein) and research (Steve Mahaney who is also the industry outreach coordinator for the center) for further ideas, contacts, and suggestions for funding sources.

1 Industry Focused Activities for Special Years

In each case, additional funding can be provided to a SY visitor to organize such industry outreach projects as those below that fit with the SY (e.g. partial salary to extend a sabbatical).

1. Form an Industrial Advisory Board of industry scientists who assist in identifying scientists who would be valuable as speakers or organizers.

2. Advise and assist workshop organizers to include an industry person on their committee; ask this person to organize an "industry session" or

recruit an industry speaker to present their perspective on the session topic.

3. Organize an industrial problem seminar or include an "industrial problem day" in an appropriate workshop,

4. Organize an industrial problem seminar recruiting industry scientists or engineers explain their real problems, and have time to talk to those in DM/TCS. Scientists who can give a long term view of challenging research issues (instead of pressing problems *du jour* are especially valuable to postdocs and younger scientists.

5. Co-sponsor a research/industry postdoc in an area related to the SY. (More expensive)

6. Interview or collaborate with CAIP or another research center to investigate their industrial outreach program and how successful it is, writing up the results as a report or article.

7. Host a "career fair" featuring presentations by graduate students and postdocs, focused on the SY area, and inviting representatives of relevant industries to sponsor it.

8. Evaluate (with the center) the results of these outreach activities and adjust plans.

2 Industry Focused Activities for Workshops

1. Incorporate an industry problems session (or a talk into each session) at a workshop. Seek speakers who will pose large, long-range research problems.

2. Invite industry participants who are likely to be actively interested in using research in their work.

3. Provide support for industrial use of Implementation Challenge Results, for example:

    - assist companies with using and adapting challenge codes;[how do you figure out who would use the code?]

- clean up ftp code and problem libraries and taking charge of explaining it for publication. [not sure what this means]
- contact and work with industry participants to find interesting and difficult problem instances for the challenges.

These might be valuable projects for graduate students or postdocs who are interested in careers in industry.

3 Education Focused Activities

1. Sponsor a workshop or symposium (preferably at a major conference) on an important educational issue related to the SY. For the Logic and Algorithms SY, there are now preliminary plans for a symposium on the teaching of logic in high school and college at the Federated Logic Conference in 1996.

   [Suggestion: Teachers of grades 4-12 want to know how to include probability and statistics in their curriculum; a Special Year or Focus Year on discrete probability could sponsor a special workshop at the AMS-MAA-SIAM joint meetings to develop or discuss recommendations.]

2. Include someone prominent with strong educational interests on the organizing committee, and ask them to organize such a workshop or symposium.

3. Invite interested SY participants, including postdocs and long term visitors to give a summer or weekend workshop, aimed at HS and/or college teachers. Or, invite them to speak at a leadership program or young scholars followup meeting.

   [Example: In 1994, R. Ravi taught a 3-day summer workshop on algorithms and biology to group of HS teachers in the summer; both Ravi and Dannie Durand gave talks on biology problems for the leadership program; Muthu volunteered to talk to HS students.]

4. Invite SY participants to work with undergraduates or HS students on summer research projects.

   [Example: Vineet Bafna will lead a small research project for HS students, and Martin Farach will work with an undergraduate on computational biology, in summer, 1995.]

5. Sponsor a Distinguished Lecturer series with SY visitors or workshop speakers aimed at a broader audience: undergraduates, teachers, or faculty in other sciences.

6. Develop an undergraduate and/or graduate student summer school (2-4 weeks) related to the SY topic. The Special Year on Molecular Biology had a three week tutorial program to introduce postdoctoral level attendees to molecular biology and mathematical problems related to it. The Special Year on Logic and Algorithms plans a three week tutorial for graduate students and researchers to introduce their research areas.

7. Sponsor an undergraduate implementation challenge related to the SY or the "senior" implementation challenge. [Suggestion: Data Structures might be a good topic to start with.]

8. Incorporate an REU (undergraduate research) program on the SY topic. [This might be very appropriate for a networks year.]

9. Connect the SY to a RIMS (Regional Institute in the Mathematical Sciences) program.

   [Example: Discussions are underway to sponsor a RIMS on computational biology in '97-98, in effect extending and broadening SY activities to a 3rd year. This might also make a lot of sense for the proposed special years on networks or discrete probability.]

10. Partially fund a sabbatical for a visitor (or released time for a local faculty member), who is involved in the SY (preferably on the organizing committee) to develop a course or text related to the SY.

    [Example:. perhaps someone should develop a new graduate course on CAV, or applied logic.]

11. Include a Saturday or evening event with (truly) expository talks for college and/or HS teachers and/or students, and/or hands-on activities, linked to a SY workshop.

    [Example–During the Combinatorial Optimization year, the workshop on "Solving hard optimization problems" could have been followed by a "Traveling Sales-Rep Day" for high school and college teachers.]

[Suggestion: For the network SY: a Saturday workshop on "how the internet works" (looking at protocols, routing ...) for undergraduates; a "Cryptography Day" for high school students.]