Discussion of Various Approaches and Possible Adaptations
Chair: Paul Zeitz
12/16/04, 2:45-3:45 PM

Speakers: Harvey Keynes, Joe Gallian, Walter Mientka

Joe Gallian:
"Competitions are a great way to identify and develop talent." But to what end? To benefit society by making research mathematicians.

"Critical Transition Point" from college to grad school and from competition problems to research problems; REUs are a great way to bridge this gap

About 60 REU programs across nation, and REU-like programs like that at NSA. REUs take students from doing well in courses or contests to actually do research. This is an introduction to research mathematics, which students haven't seen in classes or contest. In REUs, you solve a problem, you pose other problems, write up a paper—Joe requires his students to write professional quality papers (occasionally referees make comments like "I would have had no idea this was written by an undergraduate), present paper (like at joint meetings, Joe is strongly against special session for undergraduates, his students should be in with the professional sessions in their field), and submit papers for publications (process is long and take many years, students don't know about this process).

Joe likes competition problems but isn't good at them. Competition problems are ends in themselves, and research problems are just the beginning. They make contributions to mathematical knowledge. Research problems are open ended. The ideal set-up is to say something like "see what you can do with this idea" without necessarily giving a specific problems. Joe gave David a problem and David phrased it as "my problem is to understand arc widths of graphs" which is just how students should think of problems.

So once the competitions are over, you should encourage students to participate in REUs and especially Joe's REU.

Harvey Keynes:

Project SEED (special education for the elementary disadvantaged)—Harvey taught in a fifth grade classroom for this program for a year. Joe imports people to Minnesota for the summer. Harvey exports students through his program.

University of Minnesota Talented Youth Mathematics Program (UMTYMP) History is develop of a program that in mathematics could deal with the educational inequity in Minnesota. Used to use SATs as a screener, but have now moved out of that.

They have 508 students from grades 5-12. 31% are female and it is hard to keep that number, but they do it. This is a program that admits students when they are ready to learn algebra and stay with them through college. One girl left the program with 162

credits toward a degree in Minnesota. She went on as a freshman to Caltech. Look at the education she gained. It isn't just a credit mill. Many students finish the five year program by the time they are sophomores. They then go to the University of Minnesota, where the program is really based. It took the university about 20 years to warm up to this. Then the university realized that it needs to treat these students well to keep them in Minnesota. The most popular schools our students go to are MIT, Caltech, Chicago and Stanford. The program is 5 courses, algebra I and II, geometry and analysis, and three courses in calculus. Very interconnected. Their calculus is very geometrically based. Calculus III includes vector analysis. Then there is an advanced topic course which is a transition into regular upper division coursework in college. It is supposed to introduce ideas of proof and rigor. Courses have been in graph theory, Combinatorics, probability, computational algebraic geometry. All of the courses emphasize concepts and formal reasoning, but it a challenge. The calculus I class this year has 88 students, 3 7th graders, 16 in 8th, 39 in 9th, 26 in 10th. There is a maturity issue to deal with. 85 of those 88 are going on to the second semester.

Classes are taught by faculty, postdocs, and graduate students. This is a great professional development opportunity and graduate students really like to get into this. Faculty don't necessarily know how to work with kids of this age.

Results: Students do well in competitions. In a local competition, ½ of the students who won were from their program.

They also try to make sure students understand that contests are not the end and that mathematicians do research.

These students have lots of accomplishments, for example in music. These kids are really overprogrammed. Can you be the greatest music, state athlete, and a mathematician? No. We have to deal with that.

In a survey of 500 alums in the past 16 years, of most recent 96, there were 45 different majors among students. On average, students had 1.3 science degrees per student. 32% of those students got majors in mathematics. Many are going onto graduate school. That's their real goal. Many alumns are in faculty positions now.

How do they get students? They just don't wait for people to come. To get demographics, they offer enrichment programs for grades 3-12. Research shows if you want the kid in 7th grade, get them in 3rd or 4th. There is a comprehensive program of Saturday programs for these kids, and is key to get females and underrepresented minorities.

This year they had a math seminar series, talks about real mathematics but as a level that students can understand. Nothing is just applied with the mathematics buried.

[website: www.itcep.umn.edu]

Walter Mientka:

In Oakland, this week, there is a meeting to close 7 schools. Students and parents protesting this were mostly minorities, and they need these schools.

Title: *Ontogeny Recapitulates Phylogeny*
The house fly had four wings, and though it now only has two, there are balances there in place of the former wings.

Overhead: list of mathematicians
Overhead: picture of David Hilbert
Overhead: Hilbert's problems

Hilbert gave us not only theorems, but also problems. Recently, there were the Clay problems. [Overhead: article about those]

There was great trepidation over sending a team from the US to the IMO.

Overhead: list of US IMO teams (3 overheads)
Overhead: list of rankings of US IMO teams

Here is an example of something that happened at the IMO in Hong Kong. This is to show how important writing is. [Overhead: problem and solutions from 94 IMO] It is very important as a first step in a training program to teach the students how to write.
[Overhead: results from 94 IMO]
[Overhead: cartoons (2)]

Slides: some pictures from IMOs
IMO is not just a competition, but a chance for students to meet other students.

I can't believe that we in our profession do so much on a volunteer basis. Things have changed so much because departments are recognizing this work.