Meeting of VIGRE sites in the West and Southwest
University of Washington, 12 April 2003

Loyce Adams, University of Washington
Al Boggess, Texas A& M
James Curry, University of Colorado
Nicholas Ercolani, University of Arizona
Anne Greenbaum, University of Washington
Robert Greene, UCLA
Randall Leveque, University of Washington
Douglas Lind, University of Washington (co-organizer)
William McCallum, University of Arizona (co-organizer)
Richard Millman, NSF Graeme Milton, University of Utah
Bruce Palka, University of Texas John Rice, UC Berkeley
Christoph Thiele, UCLA Abigail Thompson, UC Davis
Peter Trombi, University of Utah
Selim Tuncel, University of Washington

April 18, 2003

1 Reports from VIGRE sites

Representatives from 9 VIGRE sites were at the meeting: University of Arizona, UC Berkeley (Statistics), UC Davis, University of Colorado, UCLA, University of Texas, Texas A&M, University of Utah, and University of Washington. In the morning, each group made a presentation of problems and successes with their VIGRE program. Highlights of this discussion:

- pleasant surprise at the participation of faculty in undergraduate research programs, but faculty did not always know how to handle these initially
- participation of undergraduates is disappointing in some cases, and there can be problems with undergraduates making the transition from REUs to difficult courses in the math major
- problems with the construction of truly vertically integrated seminars—there is a danger that these degenerate into ordinary research seminars dominated by one group

- inability to fund masters students can be a problem
- VIGRE has caused fundamental changes in many departments, in courses, qualifying exams, and attitude to mentoring of both graduate students and postdocs
- travel money for graduate students is beneficial
- many departments are hitting a ceiling of faculty workload on VIGRE
- postdoc hiring has been difficult in some cases
- having students compete for VIGRE funding using a competitive grant proposal process provides opportunities for mentoring, gives students professional experience, produces useful reports on the VIGRE program, and encourages students to think about and move forward in their degrees
- getting faculty buy-in has been difficult, and in grants involving more than one department, communication between the departments can be a problem
- it would be useful if VIGRE postdocs had the option of getting all their salary in nine months, and be free to apply for grant funding during the summer
- some departments felt that job prospects for people getting interdisciplinary degrees are perceived by students as not very good (this is not the case, however, in Statistics).

2 Report from NSF

Richard Millman, VIGRE program director at the National Science Foundation gave an informal presentation. He emphasized that he was willing to discuss details with any institution with which he did not have a conflict of interest. This includes efforts to be flexible on issues such as vertical integration (is it always necessary that all four groups be included?) and funding of masters students.

He said that overall VIGRE has had a positive effect: many departments have implemented changes in their curriculum and have thought deeply about broadening their activities in the mathematical sciences and about broadening the education of their graduate students. This effect has been evident even on departments which have not received VIGRE grants. Many sites have increased the number of graduate students who are U.S. citizens, and also the number of female graduate students. However, there has been no progress on the number of minority students, and he urged everybody to think of creative ways to handle that issue, perhaps using NSF programs such as LSAMP and AGEP.

He concluded with a brief description of a proposed new announcement for VIGRE, emphasizing that it had yet been approved, so that the current announcement was still in effect. He described two potential new programs, one on Research Training Groups, and the other on Critical Transition Points, which are still being formulated. The official announcement should be made at "Reston II" in May.

3 Taxonomy of VIGRE programs

This section is the text of a presentation by William McCallum.

For five years mathematics departments have been struggling with how to decrease the stratification of graduate programs into hermetic layers of undergraduates, graduate students, postdocs and faculty.

Two (at least) models have emerged for these. One is a strongly vertically integrated model that I will call the *tetrahedral* model. The other is a more layered model that I will call the *braid* model.

3.1 The tetrahedral model

This is named after the Colorado model, which forms tetrahedral research groups (the four points of the tetrahedron being undergrads, grads, postdocs and faculty). The geometric metaphor implies an attempt to thoroughly dissolve the stratification and arrange direct and equal contact between each pair of groups. At its best this arrangement puts each group continually in mind of the need to talk to and learn from the others; advanced researchers try to crystallize and simplify their work in ways that beginners can learn, and beginners struggle to enter productively into the world of advanced research.

The model can also degenerate into "VIGRE seminars", in which the four groups sit side by side but do not interact, and where the tone is set by the most advanced group.

3.2 The braid model

This approach sees each level following a time-line, and finds points where the time-lines knit together. At one point a postdoc might be supervising an undergraduate research project; at another, postdocs, advanced graduate students, and faculty might be collaborating in running a topics seminar; at another, faculty might be giving a series of introductory talks for beginning graduate students; at another, advanced graduate students might be preparing beginning graduate students for qualifying exams. Full vertical integration of all four groups might never occur at the same moment, but over time the strands knit together producing a vertically integrated career path for each group.

The danger of this model is that it can become so diffuse as to be chaotic, so that nobody knows what they are supposed to be doing or why they are doing it.

3.3 The sink-or-swim model

I don't intend to be entirely facetious in suggesting this model. It is the model practiced at some of the best graduate schools and copes with integration between the different levels by making sure that those at each level either disappear or rise to the next (and by attempting to recruit graduate students who will do the latter). It works very well for the best students, probably better than any other approach, but it can produce a lot of wastage; students who drop out either do not reenter the field or their graduation is delayed while they find a suitable school. However, perhaps the good features of this model could be combined with an attentive and efficient advising system that rapidly recognized and placed students who would be more successful elsewhere.

3.4 Are we missing the forest for the trees?

Perhaps all this focus on groups is misguided: perhaps we should focus on transitions between the groups, not the groups themselves. We sometimes forget that the different groups being vertically integrated (undergrads, grads, postdocs, and faculties) are fluid: we expect people to move from one to the next.

4 Recommendations to NSF

The meeting concluded with a discussion of the future of VIGRE. The group had the following recommendations for NSF:

- Greater flexibility in the VIGRE program is much to be desired; the group was very much in favor of awards on smaller scale than whole departments.
- The group also strongly approved of the new focus on key transition points and pipeline issues.
- Although many departments have been willing and able to provide the mentoring and broadening opportunities required by VIGRE within their current capacity, and indeed it has been a benefit of VIGRE funding to challenge departments to do this, nonetheless NSF funding for faculty salary or release time would have a valuable multiplier effect by widening that capacity.
- Travel money for graduates and undergraduates should represent an integral part of this program.
- DMS should write a report on how VIGRE has evolved over the past five years, providing data for example on how VIGRE fellowships have been used (multi-year commitments? recruiting?).
- Provide a more formal way for the mathematical community to be consulted on future directions of VIGRE.