

# FINDING AND KEEPING GRADUATE STUDENTS IN THE MATHEMATICAL SCIENCES, II

organized by  
Amy Cohen-Corwin, Abbe Herzig, and David Manderscheid

## Workshop Summary

### **Purpose**

This workshop was designed to provide information, guidance, and – most importantly structured time – for the participant teams to draw up carefully considered plans to help their home departments achieve better outcomes for their doctoral programs in the areas of recruitment, retention, completion, professional development, and job placement. The focus was on students who did their undergraduate work in the U.S., and particularly on women and members of under-represented groups. Nonetheless, there is evidence that what is good for these groups is also good for all graduate students.

### **Organizers and Support**

The organizing committee consisted of Amy Cohen (Rutgers University), Abbe Herzig (University at Albany), David Manderscheid (University of Nebraska-Lincoln), Brian Conrey (AIM), David Farmer (AIM), and Brianna Donaldson (AIM). The organizers gratefully acknowledge the support of AIM and the NSF (DMS#...)

### **Participants and Schedule**

Participant teams of three members each represented the graduate programs in mathematics from seven universities:

Arizona State University	Georgia Tech
Iowa State University	Texas A&M University
University of Oklahoma	University of Maryland at Baltimore County
University of Texas at Arlington	

The list of team members is appended.

Participants arrived on Sunday afternoon 2 August. The workshop opened with a banquet followed by a key note address by Professor Bill Velez of the University of Arizona. This opening event allow participants to meet and converse informally before the working sessions began. The keynote address reinforced the urgency of the issues of diversity, recruitment, and mentoring – issues that were themes for the rest of the sessions.

On Monday, Tuesday, and Wednesday the working sessions ran for seven hours each day with time out for brief breaks and lunch. On Thursday the workshop adjourned at noon to allow organizers and participants to reach home or the MAA summer meeting by evening. Each day had its theme:

Monday - “how to keep the graduate students we have”

Tuesday - “how to find and recruit the graduate students we want”

Wednesday - “how to graduate the best mathematical professionals we can”

Thursday - how to implement sustainable change.

During the mornings panel discussions alternated with full group discussions. Afternoons were devoted to working sessions during which teams concentrated on identifying their most important issues, and drawing up plans to address those issues. Organizers and presenters circulated among the teams to answer questions, and offer guidance. Late in the afternoon there was a period devoted to “friendly critique” in pairs or triples of teams. Each team would present its plans and get feedback. This session was followed by a short full group discussion and a “happy hour” which saw continued informal discussions.

## Summary of presentations

### *Day 1 Keeping the students you have.*

Abbe Herzig reported on research identifying circumstances which enhance the likelihood that grad students in mathematics will successfully complete their doctoral studies. She recommended seeing graduate study as a kind of apprenticeship to the craft (or profession) of mathematics in which students learn to do the work of the profession, learn to act as professionals, and learn to identify themselves with the profession. Further, graduate students should engage progressively deeply in the authentic work of the profession – talking about new mathematics, teaching the full range of mathematics, reading research literature as well as textbooks, and working on open problems as well as traditional exercises. The formation of peer groups that mix social and intellectual activity tends to reduce attrition by giving members access to a broader range of experience, support, and resources to cope with non-academic challenges.

John Meakin discussed the importance of departmental policies and procedures that value graduate students as people as well as learners. He stressed the importance of a departmental culture of high expectations for student success together with structures to support student achievement. He also stressed the importance of departmental leadership in valuing diversity and acting energetically to achieve and sustain diversity among faculty and graduate students both.

Ulrica Wilson, as someone closer in age to graduate students than others on the panel, spoke about the student point of view. She described the importance of having one or more communities of support to ease the transition from undergraduate work to graduate work, especially for students who come from smaller departments and those who may encounter hostile stereotyping.

The second morning session focused more sharply on strategies that have proved their value in fostering better retention. Loek Helminck reported on the REG program at NCState, a program that pays a summer stipend for grad students at the end of their first academic year to support research in a faculty members research group. REG students have all passed their exams on time; many have found a thesis topic and an adviser; they develop a sense of engagement in the profession and enthusiasm for it. Jim Lin of UCSD talked about the benefits of “town meetings” with his departments grad students. Organized peer study groups for qualifying exams (led by paid advanced grad students) led to students taking their exams earlier and more successfully.

### *Day 2: Getting the Best Students for your Program*

Yi Li, Chair at the University of Iowa, discusses his departments collaboration with a consortium of Historically Black Colleges and Universities which have increased the number of African-American graduate students in his program. Pairing US and international students as “study buddies” has helped overcome weaknesses in preparation in English and/or in mathematics. Yi also described an arrangement in which the University of North Iowa enroll students whose achievement may not match their ambition for graduate work for a Masters Program leading (upon successful completion) to transfer to a doctoral program at Iowa.

David Manderscheid, Dean of Arts and Sciences at Nebraska, discussed the variety of ways the grad program at Nebraska encourages women in mathematics: flexibility in hiring, the IMMERSE program, mentoring programs, and the Nebraska Conference for Undergraduate Women in Mathematics. While some of these activities were initiated with a focus on women, their effects have benefited the program generally with higher quality applicants and higher completion rates. Ongoing relationships with sending colleges are valuable even if they dont produce a successful applicant each year – they allow the undergrad department to advise more effectively and allow the grad program to develop a sense of trust in letters of recommendation.

Steve Campbell of NC State described the REU-Plus program at NC State. This is an enhancement of their national REU site project. It allows them to bring students from non-traditional sending colleges to campus before the REU begins – and to bring as well a faculty member from each sending school as well. The program allows the student to “catch up” on preparation so he or she will fit in more easily once the general REU begins. The faculty member eases the students transition to an unfamiliar campus, but also learns more of what is required by way of mathematical preparation for advanced work. In the long run, REU-Plus has led to curricular changes as well as to enhanced collegiality across institutions.

Loek Helminck talked about the revision of admissions criteria and about the modifications made at NC State in their qualifying exam system. Recognizing that mathematics now covers a very wide range of specialties, his department has increased the range of options for exams. This serves the educational needs of students preparing to work in corporate or governmental research as well as those preparing for a wide variety of academic positions.

Bill Velez talked about ways that undergraduate programs can recruit for majors and indirectly for graduate programs.

Ulrica Wilson talked about her work with EDGE and the variety of issues students from smaller colleges may face in making the transition to research universities. They usually need to improve their proof-writing techniques and their ability to read technical material on their own or with peer groups rather than in classes. They need to address explicitly issues of confidence and to acquire ways to cope with cultural shocks and even hostile stereotypes. Despite conscientious advising some students find themselves in doctoral programs which are not good fits. Grad programs might do well to recruit selectively from the “transfer students” population.

### *Day 3: Graduating the Best Mathematicians Possible*

*Amy Cohen* called for more explicit attention to developing communication skills valuable in all kinds of mathematical employment: oral presentations at meetings and within research groups as well as in the classroom, refereeing, proposal writing as well as writing research papers, and letters of recommendation. *Abbe Herzig* spoke about mentoring,

peer study groups, authentic practices in math. *Steven Campbell* talked about preparing students for jobs in industry and government. *Bill Velez* spoke of the importance of introducing students to the work and opportunities in the various professional societies, with particular attention to the work of NAM and SACNAS. *Jim Lin* spoke of the benefits to his department from a chapter of the Association for Women in Mathematics.

*Day 4:* The morning reviewed some of the basic strategic considerations in working to get initiatives enacted and sustained. AIM staff discussed web resources available to the workshop participants. There was discussion of a listserv for general discussion and a way to encourage invited undergrads to post their vitas to indicate their interest in being recruited for grad schools.

### **Evaluation**

Most participants were generally pleased with the presentations. There were a few criticisms with useful suggestions for improvement. These will be incorporated in any future Finding and Keeping workshops. We need to pay more attention to concrete advice for improved recruitment in less familiar venues, e.g., undergraduate colleges with strong math programs, minority serving institutions. We need to ensure that facilitators understand their role of listening and answering questions briefly. We need to coach presenters more carefully on ways to show how other schools might adapt presenters successful initiatives. .See Appendix 4 for detail.

### **Follow-up**

The organizers will communicate with each participant team approximately six months after the workshop to find out which departments would be interested in follow-up consulting visits and to find out what projects moving forward. We intend to get preliminary reports on progress at this time.

Based on our experience with the first Finding and Keeping workshop, we understand that there may be little to report by February 2010. We will again ask for reports on plans and progress in the summer of 2010 – by which time we expect that there will be more substance to report.

We have submitted a proposal to NSF for two more FK workshops and one workshop focused on collecting and consolidating information about recruitment strategies to support increased diversity in the US population pursuing doctoral degrees in mathematics.

Submitted on Oct 18, 2009

Amy Cohen

## Schedule for Finding and Keeping-09

### Sunday, August 2

- 6 pm** Dinner  
**6:45pm** Keynote talk by Bill Velez

### Monday, August 3

- 9:00 am** First Session starts  
 Welcome from AIM, Estelle Basor  
 Overview of Workshop and days schedule, Amy Cohen  
 Brief introductions of everyone
- 9:30 am** Panel 1a: Keeping the Students You Have [moderator = Amy]  
*Abbe Herzig* – Research results on persistence to degree.  
*John Meakin* – Students as people and as learners.  
*Ulrica Wilson* – Issues from students point of view
- 10:15 am** General Discussion on issues raised in Panel 1a
- 10:45 am** Break
- 11:15 am** Panel 1b: Timely completion of requirements,  
 Strategies for retention (modified exam structures,  
 a course that enhances proof writing, study groups for exams,  
 finding advisors, accommodating health and family crises, civility)  
 [Moderator = David Manderscheid]  
*John Meakin; Loek Helminck ; Jim Lin*
- noon** General Discussion on issues from Panel 1b
- 12:30 pm** Announcements for afternoon work
- 12:35 pm** Lunch and informal discussions
- 2:30pm** Charge to teams for the afternoon  
 Teams work individually on Worksheet 1, Facilitators circulate
- 3:45 pm** Teams in pairs or triples for Friendly Critique
- 4:30 pm** Teams submit worksheets; reports from teams, short discussion
- 5 pm** Happy Hour
- 6 pm** Dinner; No formal evening program

### Tuesday, August 4

- 9:00 am** Morning Session Starts; Overview of days work, Amy
- 9:05 am** Panel 2a: Getting the Best Students for your Program  
(finding applicants, adjusting admissions criteria, recruiting for “yield”.)  
(connecting with REUs and with Enrichment programs)  
(issues of financial support) [Moderator = Amy]  
*Yi Li*: National Alliance, regional universities, admissions issues.  
*David Manderscheid*: women; Heartland Alliance, GAANN;  
*Steve Campbell*: REU-Plus, REG, morale
- 9:50 am** General Discussion on issues raised in Panel 2a
- 10:35 am** Break
- 11:00 am** Panel 2b More on Getting the Best Students for your Program  
(attention not only to recruiting for diversity by racial/gender/ethnic types of students, but also on recruiting from types on institutions picked because they have demographics you want.) [Moderator = Abbe]  
*Loek Helminck*: alternate admissions criteria;  
*Bill Velez*: Arizona Alliance; what is adequate preparation?  
*Ulrica Wilson* on EDGE & Transfers for a better “fit”
- 11:45 am** General Discussion
- 12:30 pm** Reminders about afternoon work; Lunch and informal discussions
- 2:30pm** Charge to teams for the afternoon  
Teams work individually on Worksheet 2, Facilitators circulate
- 3:45 pm** Teams in pairs or triples for Friendly Critique
- 4:30 pm** Teams submit worksheets; Reports from teams; General discussion
- 5 pm** Happy Hour
- 6 pm** Dinner; No formal evening program

**Wednesday, August 5**

- 9:00 am** Morning Session starts; Overview of days schedule
- 9:05 am** Panel 3a: Graduating the Best Mathematicians Possible  
(preparing for the full range of mathematical careers, research, communication, service)[Moderator = Bill Velez]  
*Amy Cohen:* Communication, Teaching, but not Just Teaching.  
*Abbe Herzig:* Mentoring, peer study groups, authentic practices in math.  
*Steven Campbell:* Jobs in industry and government
- 9:50 am** General Discussion on issues raised in Panel 3a
- 10:35 am** Break
- 11:00 am** Panel 3b: Building Engagement in the Department and the Profession [Moderator = Loek Helminck]  
*Yi Li:* benefits from interactions of US and international students.  
*Bill Velez:* Professional Societies, general and special;  
*Jim Lin:* AWM; graduate student associations, liaison committees
- 11:45 am** General Discussion on issues of Panels 3a,b
- 12:30 pm** Reminders about afternoon work; Lunch and informal discussions
- 2:30pm** Charge to teams for the afternoon  
Teams work individually on Worksheet 3, Facilitators circulate
- 3:45 pm** Teams in pairs or triples for Friendly Critique
- 4:30 pm** Teams submit worksheets; General discussion
- 5 pm** Happy Hour
- 6 pm** Dinner; No formal evening program

#### Thursday, August 6

- 9:00 am** Morning Session starts; Overview of days work schedule
- 9:05 am** Panel 4a: Implementing and sustaining change (Presenting ideas to colleagues, administrators, students, recruits)(Resources: money, space, people) [Moderator = Jim Lin]  
*Amy Cohen:* general considerations money and other resources.  
*Loek Helminck:* NCState as example.  
*Yi Li:* Iowa as an example
- 9:50 am** General Discussion on issues raised in Panel 4a
- 10:35 am** Break
- 11:00 am** Panel 4b and Discussion: Plans for future cooperation [Brianna Donaldson = moderator]  
*Abbe Herzig* on Special Sessions at JMM;  
*Amy Cohen* on GEMSTONES-II;  
*David Farmer* on GEMSTONES website and listserv
- Noon** Workshop Ends