Workshop Report

Research Training Groups in the Mathematical Sciences (RTG)
Program Meeting
November 1-2, 2018

Steering Committee:
Jim Brown, Occidental College
Matthew Kahle, Ohio State University
William Kath, Northwestern University
Stephan Stolz, University of Notre Dame

Overview

Over 50 people attended a 2-day RTG Program meeting in Alexandria. This group included current and previous RTG PIs and Co-PIs. Panel discussions and breakout groups covered the RTG solicitation's four main topics: broadening participation, vertical integration, sustainability, and innovations. The goal of the meeting was the assessment of the current state of the RTG program and to collect recommendations for changes that would lead to improved outcomes.

There was a wide consensus among all participants that the RTG Program is a transformative, flexible, and highly valuable program. The focus on vertical integration has made undergraduates stronger researchers and better prepared for graduate school. Some departments have started postdoctoral programs for the first time because of the RTG. Graduate students and postdoctoral fellows have been able to pursue high quality research while receiving training in mentoring and other skills that have better prepared them for their subsequent careers. The program has helped nourish quality environments in a wide variety of settings. Of course, non-funded students also benefit from funded activities, such as regional workshops and bringing in high quality speakers. Overall, participants felt that the RTG program is more than just providing additional graduate or postdoctoral fellowships; it is more than the sum of its parts and there are special benefits arising from the critical mass of activity that is generated by an RTG.

Below we summarize the main discussion points from the two-day meeting.

Broadening Participation

Participants agreed that it is important to broaden who participates in math. They also felt that it is important to broaden what math participates in. Outreach to and collaboration with other departments and disciplines is beneficial, as is outreach to high school/middle school students and teachers.

Undergraduate Students:

For some large public schools that serve a population with a large minority component, there is often a lack of funding opportunities that keeps them from developing programs for talented but underprepared students to put them in a better position to be accepted to and succeed in graduate programs.

On the panel, Felice Manganiello talked about the pREU (preparation for REU) program that provides five rising sophomores or juniors a significant five-week summer program aimed at helping them transition from classroom learning.

Michael Wolf described “Term-Time Research Experiences for Low-Income Students” at Rice University whose goal is to attract and retain lower income undergraduates in STEM via the opportunity for authentic research.

Matt Gursky talked about the “Notre Dame Math Exchange” which involves visits to schools with significant enrollments of underrepresented groups (especially focusing on HBCUs) with the goal of recruiting students to the one-week workshop at Notre Dame.

John Etnyre talked about “Vertical Integration and Community Outreach” at the Georgia Institute of Technology consisting of organizing DRPs & REUs and outreach to local universities serving underrepresented groups in math.

Paul Bendich described the “Data+ Program: Bringing Every Major to the Table” at Duke University, which is a 10-week summer research experience that welcomes 75 Duke undergraduates interested in exploring new data-driven approaches to interdisciplinary challenges.

Being accepted into and succeeding in graduate school is a big barrier for many talented undergraduates who attend small colleges which might not offer “proof-based” math classes. It was felt by the participants that building programs that help with that transition are critical to funnel talented but underprepared undergraduates into

mathematics graduate schools, and that it is reasonable for such components to be included in RTG programs.

Graduate Students:

For many graduate programs it is difficult to attract minority or female graduate students. While outreach might help to increase the number of these applicants, a number of participants felt that the current students are the best ambassadors for a graduate program.

For example, reaching gender parity in a graduate program tends to lead to a supportive environment for female graduate students. Spreading word of this situation leads to more female applicants and to a higher percentage of admitted female applicants choosing this school. This positive (or negative) feedback loop means that paying close attention to this is critical.

The difficulty in attracting female graduate students in mathematics is in stark contrast to the situation in other subjects, e.g., biology. It was noted that the number of female math majors does not seem to have changed significantly over the years, just fewer of them go on to graduate school in mathematics. The Association for Women in Mathematics plays a crucial role in encouraging women to pursue a career in mathematics. Ezra Getzler, one of the panelists, talked about their RTG program GROW (Graduate Research Opportunity for Women) which brings 80 women undergraduates from across the country to Northwestern University for a weekend.

It is important to address populations that come from colleges that do not focus on preparing their students for graduate school. These students often struggle to pass qualifying exams within a year. One possible remedy is to have two separate tracks for graduate students. Underprepared students are not put in the more intensive graduate courses during their first year and are given an extra year to pass prelims. These separate tracks are similar to what is done for undergraduates with the traditional track as well as the honors track. In fact, the honors undergraduate courses can be used as first year courses for underprepared graduate students. Another possibility is to use masters level classes as a similar bridging program. A similar idea is to let undergraduates stay an extra year to take these courses as a bridge to the PhD program. Transition and bridge programs also help with the problem of underprepared students. These types of programs can (and sometimes are) part of RTG programs.

Vertical Integration

Vertical integration is one of the main goals of the RTG program. There was broad consensus among the PI's on the utility of vertical integration, and the conversation focused on innovations in implementing it, and on challenges.

One general theme that emerged from the conversation was that social opportunities and creating a congenial atmosphere can be some of the best supports for vertical integration.

- Several PI's mentioned the value of undergraduate math clubs. Many of these clubs are run by the undergraduates, often with a faculty sponsor for a little direction (and perhaps pizza money). Sometimes the undergraduates invite graduate students, postdocs, or faculty to give accessible talks about their research. A math club can also be a good place to advertise opportunities such as REU's, or GRE study groups.

- Math clubs and REU's can often benefit from an absence of faculty. Some undergraduate students find faculty intimidating and it is easier for them to relate with graduate students or postdocs.

- Some universities have a one-day "splash program" for local high school students. Often there are activities organized or short talks given by participants at all levels. Organizing something like a splash program takes a big group, but when successful and cohesive, it gives participants at all levels a chance to collaborate on a meaningful project.

- One PI mentioned regular brown-bag lunches with graduate students and faculty. The conversations covered at such lunches could cover many topics, including how to be an effective Directed Reading Program (DRP) mentor, or how to make the most of the mentoring relationship with your advisor.

- Some PI's described their experience with the value of holding a "pre-seminar" with background material before a research seminar talk. These are sometimes informal, giving students more of a chance to interact with the speaker. They could be 15 minutes, or an hour. Sometimes faculty are not invited, and this can encourage students to feel more comfortable asking questions.

- Graduate student seminars, run by graduate students and with graduate students giving talks to other students, can also be valuable. These are a big part of the

culture in many mathematics departments. It gives valuable practice time with presenting difficult concepts, and it also builds a sense of community.

Strategies for finding research projects that undergraduates could meaningfully participate in were also discussed. Some groups focus on projects involving a significant computational aspect.

One PI suggested that reading an older mathematics paper (for example, a topology paper from the 1950's) is something that is often doable for a strong undergraduate, and that they can write an expository account as a meaningful project. It is a service to the community, since it is often helpful to have a classical argument recast in modern terminology. The undergraduate learns a lot of good math along the way.

One of the challenges discussed was how to train students and postdocs for mentoring. Even robust TA training programs, for example, do not necessarily prepare a graduate student for mentoring undergraduates. DRP's can give a graduate student direct experience with mentoring in a one-on-one setting.

More training can be helpful, especially for difficult situations, such as handling students who are depressed, or for issues around inclusion. Such issues can be challenging in teaching situations, but they can be especially intense in the context of mentoring. The National Center for Faculty Development & Diversity was mentioned as one possible resource for diversity training for participating institutions. More mentor-training resources would be helpful.

One other concern was whether expecting early-career RTG participants to engage with mentoring puts undue stress on them. Strategies discussed included paying them extra and reducing teaching. In many cases, participation was voluntary and postdocs as well as graduate students engaged enthusiastically. Anecdotally, having mentoring experiences benefits postdocs on the job market.

Sustainability

The sustainability of RTG programs and activities formed an important part of the workshop. There was a panel consisting of faculty that have been successful in sustaining aspects of their RTG program post-funding. The panel discussed specific programs that have endured post-funding as well as strategies for how this was achieved. Examples ranged from pre-award negotiations with deans to seeking industry sponsors to continue the programs. After a question and answer session with the panel, the conference participants broke into two groups for Break-Out sessions to continue to discuss successes and challenges of the sustainability of RTG benefits. The list below summarizes some of aspects of these Break-Out session discussions.

- The assembled group felt that it is not realistic to expect every department to be able to maintain the funding level that has been provided by the RTG grant. For example, programs with heavy teaching responsibilities that rely on this funding to reduce teaching loads for graduate students and RTG funded postdocs may not have the resources to maintain these program aspects. There were reports of some success in pre-award negotiations with administration to secure funds to continue supporting postdocs and graduate students for a short time post RTG grant.

- There was considerable discussion about requiring institutions to provide funding to maintain some aspects of the program post-RTG for a fixed time. Consensus was not reached on this idea as it was felt that many institutions' administrations would be unable or unwilling to promise such funds and that this would therefore limit the departments that could apply. The current (somewhat imprecise) language that the grant must address post-funding sustainability was deemed to be sufficient for allowing the required flexibility to maximize the ability of institutions to submit proposals independent of the degree of financial buy-in by their administration.

- One strategy for mitigating the harmful aspects of an abrupt drop in funding for graduate students and postdocs that can be felt by a department when the RTG ends is to plan to wind the program down gradually. The NSF has been very generous with no-cost extensions and these can be taken advantage of for this gradual wind-down.

- Numerous activities were discussed that RTG funds can be used to seed with the expectation the institution will pick up funding once it is clear that they are low cost and high impact activities. Some examples are:

- An RTG funded a prelim exam preparation course taught by an RTG graduate student. This was only for one prelim, but graduate students quickly demanded these for other prelims as well and now the department funds these programs for all prelims.

- The RTG funds are particularly useful at invigorating graduate student- and postdoc-run seminars. The enthusiasm for these can be sustained without substantial funding. It is also possible that the interest in these seminars will spill over into research areas not aligned with RTG funding.

- The cohesion built between undergraduates, graduate students, postdocs, and faculty is sustainable without requiring funding. The RTG also does an excellent job of providing a broader identity to research groups as the grant often involves faculty in areas that would not normally interact regularly through seminars and research projects. RTG graduate students often receive training in more than one area represented by the RTG and can provide the glue between the faculty in the different research areas.

- Boot camps for entering graduate students, especially those who are underprepared, are activities that one can reasonably expect departments to support. RTG funds can be used to develop the programs and demonstrate their impact so that when RTG funds are no longer available the department feels it is worth continuing to fund these activities. Similarly, talks by graduate students about what you will be expected to know in first-year courses and what to expect in graduate school fall under the same umbrella of activities seeded by the RTG grant that are then picked up by the department.

- The most sustainable part of the RTG program is the culture change that it can bring about. In this context, when we refer to culture change we are referring to measurable outcomes. By contrast, while there may be a cultural change in terms of collegiality in the department and these are certainly positive sustainable outcomes, since we cannot measure such changes we do not focus on those. On the other hand, aspects such as increased attendance at graduate student seminars, directed reading programs that persist after the RTG ends, and other programs that do not require substantial funding can persist after the program. The RTG program also creates enthusiasm for the aligned research areas and allows one to start programs that otherwise might not have had enough enthusiasm to get off the ground.

Innovations

As part of the program meeting, a number of institutions contributed short “lightning” talks, sharing some examples of best practices from components of their RTG programs.

- The University of Utah discussed their Mathematical Biology RTG that consists of different groups each centered around an area of biology and that emphasizes unifying principles between the different areas. A combined journal club and shared common space where students, postdoctoral fellows and faculty can interact are some of the elements used to build cohesion. Visits from and collaborations with past trainees are also used to emphasize common themes. These interactions help address the challenges of recruiting students interested in applications into a rigorous mathematics program, to balance modeling with applied math, address the data science revolution and involve students in “big science” without losing a mathematical identity.

- A talk by Rensselaer University discussed their use of innovative internships to build depth in applying mathematics to biological applications. Trainees, including postdoctoral fellows, go for extended visits (3-4 months) to laboratories. For postdocs, the extended visits were over the summer because of teaching duties. It was explained that in biology it is absolutely essential for substantial, successful collaborations that trainees develop a good understanding of the biology.

- Clemson University shared the results of developing a general education course in cryptography to help generate students’ interest in the mathematics major. In addition to teaching students the mathematical aspects of cryptography, relevant societal issues such as data security, digital cash and privacy are also discussed. This course was designed to count as a “Science and Technology in Society” course so that it will fulfill a requirement even for non-math majors.

- Northwestern University shared their use of modules in applied undergraduate courses as a mechanism to improve pedagogical training of graduate students and postdocs. Trainees work with faculty to develop and teach modules related to their research in undergraduate courses. Trainees review learning objectives for the courses and the diagnostic assessment of students, and then select an example from their own research that can be developed into a classroom module, teaching the mathematics and the application in a setting supervised by a faculty member. Finally, trainees help with a formative assessment of learning. These applied modules also serve as a way to recruit students into undergraduate research.

- The University of Chicago described the development and growth of their Directed Reading Program (DRP) in mathematics, which pairs undergraduate students with graduate student and junior faculty mentors to undertake independent study projects of various sizes and scopes. Each project concludes with a presentation. Undergraduates learn to work independently on a topic of their choice and also receive personal attention from the mentors. This program initially involved only local students, but has grown to almost 100 students after outside students have been allowed to apply. It was emphasized throughout the two-day meeting that the DRP has been adopted by a number of other institutions.

- The Stony Brook RTG in Geometry described Stony Brook Math Day, a one-day festival for all undergraduate math majors. Students hear talks by distinguished speakers, take part in math-related activities (such as learning at breakfast how to cut a bagel so that the two pieces are joined), and connect with faculty and students over lunch and tea.

- Cornell University described their efforts aimed at improving the communication skills of mathematical scientists. They are partnering with the Alan Alda Center for Communicating Science at Stony Brook. One skill mentioned as key for giving a good mathematics talk includes the ability to read an audience, and it was suggested that learning improv might be a way for mathematicians to acquire this skill.

- The University of Illinois at Chicago discussed their use of workshops as a mechanism for improving graduate and postdoctoral training. They host several large workshops per year that integrate participants at all levels. A streamlined framework has been developed for this that maximizes regional and national impact. The program initially started with postdoctoral fellows, but graduate students quickly asked to organize their own events. These workshops promote connections to senior researchers and integration with the broader research community, build connections to junior researchers as potential collaborators and future colleagues, and develop organizational experience.

Recommendations to NSF

The participants of this 2-day RTG PI meeting feel the RTG program is incredibly successful and should be continued. They universally commended the NSF on the flexibility of the program to be able to fit the diverse scope of institutions and research groups that have received these grants. The following are suggestions that participants feel could improve this program.

- The current limit that an RTG postdoc must be within two years of receiving her/his doctoral degree is too restrictive and should be removed. It is noted that one can apply for exceptions, but the feeling is it would be better to remove this limitation entirely. This limitation has proven to make hiring postdocs difficult for some institutions. There are applicants that may already completed one postdoc or went into industry that are well-suited to programs and would make valuable RTG postdocs. It is recommended that a person is eligible for only one RTG postdoc. It is also recommended that language be softened to encourage the practice of hiring recent PhDs, but that programs have flexibility to act differently if they feel it is necessary to do so.

- It is recommended the limit on hiring an RTG postdoc for a duration of three years be lifted as well. There have been instances of promising candidates being offered four-year non-RTG postdocs and taking those instead of an RTG postdoc. Faculty would prefer to be able to decide on their own the duration for which they hire a postdoc.

- The development of a wiki, blog or curated website where RTG faculty can post best practices would be helpful for current RTG faculty, future RTG faculty, as well as the mathematical community at large. It is recommended the NSF fund a supplemental grant for a current RTG faculty, or an unsolicited grant from another group, to develop and deploy this resource. Once it is constructed, all RTG faculty (past and present) should have the ability to contribute. Effort should be made to ensure the resource continues for the duration of the RTG program.

- It would be beneficial to organize special sessions at professional meetings such as the AMS-MAA Joint Math Meetings that focus on RTG activities. This would be beneficial to faculty interested in applying for RTG grants in the future. In addition, many of these successful activities which do not require funding could be adopted at institutions not eligible to apply for an RTG, thereby increasing the overall impact on the mathematical community at large.

- The language that the RTG be centered around a theme was viewed as potentially limiting. Some people read this as it is required that the RTG be in a particular discipline. Language that makes it clear this is not necessarily the case would be beneficial. For instance, instead of a “theme” the RTG could be organized around a “unifying vision” or form a “coherent program.” This would be particularly helpful for smaller departments where there may not be a sufficient number of faculty to form an RTG in a particular research discipline.

- While it is recognized that the RTG program solicitation is for training for careers in the mathematical sciences, it seems there is fairly widespread confusion that this exclusively means the focus is on training for academic employment. The NSF is encouraged to add language in the solicitation in the sections that discuss training that makes it much clearer that jobs outside of academics but within mathematical sciences are a desired byproduct of RTG funding. It is important to have a broad definition of workforce to take into account the current job market.

- It could be helpful to expand vertical integration to create a broader pipeline of talent. If the definition of vertical integration was modified to include middle and high school students, this would encourage more outreach activities to this important population of future math students and potential future mathematicians.

- It should be more explicitly stated that socioeconomic background is a type of diversity recognized, and desired, by the NSF.

- The current model is essentially all or nothing. It would be good if there were an opportunity for smaller scale grants to smaller institutions. Alternatively, allowing smaller or non-graduate degree institutions to collaborate with larger institutions on an RTG grant would greatly expand the talent pool of faculty and students.

- Participants expressed broad interest in seeing a group funded to collect RTG information program-wide and disseminate best practices through a website or other means. This should include information about bridge programs for underrepresented groups. It would also be good if they could collect information about statistics of RTG programs so that evaluation could be done more systematically.

- It was universally acknowledged that the administration of the RTG program takes a tremendous amount of time and effort. While some faculty felt that the increased quality of graduate students and postdocs made the effort worth it, others felt that there should be increased opportunities for salary for the faculty included in the

grant. Consensus was not reached on this topic, and it was acknowledged that this would take funds away from other valuable programs.

- One participant felt strongly that the NSF program "Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS)" was extremely effective in recruiting underrepresented minority students. The NSF could explore incorporating aspects of this program into the RTG program.

- This RTG PI workshop was an extremely effective way for RTG faculty to share ideas that worked particularly well. It was also useful to discuss problems that have arisen in the programs. The NSF is encouraged to solicit and fund such a workshop every five years, or more frequently if possible. This program meeting could be expanded to more substantially include trainees. Ideally participants could take part in two of these workshops. The first time would be during their RTG to get ideas and discuss current issues with other current RTG faculty as well faculty that had an RTG in the past. The second visit would be after RTG funding had expired. This would allow the faculty to provide guidance to those that are still running an RTG as well as to talk about sustainability of RTG activities.

NSF RTG Program Meeting Agenda

*Unless otherwise specified, all plenary sessions will take place in the Edison Ballroom

Thursday, November 1, 2018*		
8:00 am - 9:00 am	Registration and Breakfast (Foyer)	
9:00 am - 9:15 am	Welcome from DMS and Steering Committee	
9:15 am - 9:35 am	Background and Program Overview: Goals, Outcomes	
9:40 am - 10:40 am	Plenary Panel: **Vertical Integration** Panelists: Ricardo Cortez; Miranda Holmes-Cerfon; J. Peter May; Stephan Stolz; Marina Vannucci; Guenther Walther	
10:40 am - 11:00 am	Coffee Break	
11:00 am - 11:50 am	Vertical Integration Discussion 1 (Wright Room)	Vertical Integration Discussion 2 (Banneker Room)
11:50 am - 1:10 pm	Working Lunch – Presenters: Andrea Bertozzi and Jonathan Rubin	
1:15 pm - 2:15 pm	Plenary Panel: **Broadening Participation** Panelists: Paul Bendich; John Etnyre; Ezra Getzler; Matt Gursky; Felice Manganiello; Michael Wolf	
2:20 pm - 3:10 pm	Broadening Participation Discussion 1 (Wright Room)	Broadening Participation Discussion 2 (Banneker Room)
3:10 pm - 3:30 pm	Coffee Break	
3:30 pm - 4:45 pm	Innovation Strikes: **RTG Innovations** Lightning Talks (w/ NSF staff)	
4:45 pm - 6:00 pm	Light refreshments with program directors and NSF staff	
Friday, November 2, 2018*		
8:00 am - 9:00 am	Breakfast	
9:00 am - 9:10 am	Overview of Day 2	
9:10 am - 9:50 am	Day 1 Breakout Session Share Out	
9:55 am - 10:45 am	Plenary Panel: **Post-Grant Sustainability** Panelists: Paul Bendich; Alla Borisyuk; Jonathan Rubin; Ralf Spatzier	
10:45 am - 11:00 am	Coffee Break	
11:00 am - 11:50 am	Post-Grant Sustainability Discussion 1 (Wright Room)	Post-Grant Sustainability Discussion 2 (Banneker Room)
11:50 am - 1:00 pm	Working Lunch - Topic: **Evaluation of Impact** – Facilitated Discussion	
1:10 pm - 2:10 pm	Formalizing Recommendations and Next Steps - Small Breakout Discussions	
	Wright Room / Banneker Room / Bell Room / Edison Ballroom	
2:15 pm - 3:00 pm	Report Out and Wrap Up	

Plenary Speakers

Creating and Maintaining a Pipeline for Training in Computational and Applied Mathematics

Andrea Bertozzi, University of California, Los Angeles

This talk will review efforts at and around UCLA to create and maintain the pipeline for training in computational and applied math, from mid-career undergraduates to mentoring of junior faculty. Topics will include financial costs of training at different levels, mentoring successes and challenges, outreach, and issues related to diversity. It will also review our experience with different NSF training grant funding mechanisms including VIGRE, RTG, REU sites, NRT, and the unsolicited WORKFORCE proposal program.

Bio: Andrea Bertozzi is a Distinguished Professor of Mathematics and Mechanical and Aerospace Engineering at UCLA. She holds the Betsy Wood Knapp Chair for Innovation and Creativity and is Director of the Applied Mathematics program. Bertozzi is a member of the US National Academy of Sciences and a Fellow of AMS, SIAM, APS and the American Academy of Arts and Sciences. She has served as PI or coPI on NSF funded workforce programs at Duke and UCLA for almost two decades.

Complex Biological Systems Group at University of Pittsburgh

Jonathan Rubin, University of Pittsburgh

An NSF RTG award helped support the Complex Biological Systems Group at the University of Pittsburgh from 2008-2013. This talk will give an overview of group activities during that time, including how well various components did or did not work and what sustainable impacts have ensued from the award.

Bio: Jonathan Rubin is a Professor and Chair of the Department of Mathematics at Pitt, with research activities in mathematical biology and dynamical systems. In addition to the mathematical biology group at Pitt, he is part of the Center for the Neural Basis of Cognition, the Center for Neuroscience at Pitt, the Computational Biology program, the Program in Neural Computation, and the McGowan Institute for Regenerative Medicine.

Plenary Panels

Vertical Integration Plenary Panel

The Tulane Experience with Research Groups Involving Undergraduates, Graduate Students, Postdocs and Faculty

Ricardo Cortez, Tulane University

At Tulane University we involve undergraduates in authentic research projects. The process includes group meetings for debriefing and adjustment. Each student owns and is responsible for some aspect of the project. Postdocs keep track of the big picture and promote collaboration. The pace of progress can be challenging.

Some Experiments in Vertical Integration at Courant

Miranda Holmes-Cerfon, New York University

I will talk about several of the activities we have developed at Courant, through the RTG, designed to have graduate students, postdocs, and faculty work together in more focused settings.

VIGRE and RTG Outcomes

J. Peter May, The University of Chicago

At Chicago, using VIGRE and RTG, vertical integration has become a reality rather than a slogan. The closeness among undergraduates, graduate students, and postdocs has in particular been one major factor in a huge increase of popularity of the undergraduate Mathematics major, which is now second only to Economics.

Notre Dame's Directed Readings: Connecting Undergraduate and Graduate Students

Stephan Stolz, University of Notre Dame

The Directed Reading program connects undergraduates interested in particular mathematical topics with graduate student mentors. These pairs meet weekly during the semester to go over the material in the book they picked.

The Rice University Data Science Summer Program (RUDSSP)

Marina Vannucci, Rice University

At Rice University a diverse group of eleven undergraduates eager for cross-training in statistics and computer science took part in the 2018 Rice University Data Science Summer Program (RUDSSP). The goal of the program was to pair up graduate and undergraduate students and give everyone a chance to do work together. Students were given the chance to work on real-world problems, supervised by postdoctoral fellows and faculty. The students worked on three projects proposed by NASA Johnson Space Center and two from researchers at Rice. The diverse set of projects included detecting fake news and trying to replicate controversial results from a recently published scientific paper.

Preparing Undergraduates in a Small University for a Graduate Program in Statistics

Guenther Walther, Stanford University

The field of statistics is special in that degree programs mostly focus on the graduate level. While large universities have statistics undergraduate majors, this has historically not been practical at smaller institutions. This talk will discuss ways to get undergraduates interested and prepared for graduate work in statistics.

Broadening Participation Plenary Panel

The Data+ Program: Bringing Every Major to the Table

Paul Bendich, Duke University

Duke's RTG kickstarted an enormous program called Data+, which is a 10-week summer research experience that welcomes Duke undergraduates interested in exploring new data-driven approaches to interdisciplinary challenges. Now in its fifth summer, the 75 students each year represent every major at Duke, and the population (both participants and applicant pool) has consistently been over 50% female. We discuss how we have done this.

Vertical Integration and Community Outreach

John Etnyre, Georgia Institute of Technology

Two of the ways the Georgia Tech RTG is trying to broaden participation is by vertical integration of the educational experience (DRP, REU, etc.) and outreach to local universities serving underrepresented groups in math (contact with chairs, flyers, personal contact, etc).

GROW - Helping Women Undergraduates into Graduate Programs in the Mathematical Sciences

Ezra Getzler, Northwestern University

The RTG provided seed money for a program at Northwestern which brings 80 women (and women identifying) undergraduates from across the country to Northwestern for a weekend in October. The program has panels on graduate school (what it is and what to expect), research mathematics talks, and plenty of time for mentoring and networking. After three years at Northwestern, this program migrates to Michigan in 2018.

NDmix: Making Connections, But How Do We Keep Them?

Matt Gursky, University of Notre Dame

I will give a very quick overview of the "Notre Dame Math Exchange", in which we make visits to schools with significant enrollments of underrepresented groups (especially focusing on HBCUs), and recruit students to our week-long summer workshop. The goal is to get students to our campus to be exposed to some advanced topics, interact with faculty members, learn about graduate programs in the mathematical sciences, and do some low-level mentoring. But I also want to acknowledge the need to find paths for students who are inspired by the experience to be competitive when applying; e.g. how to enhance their training.

Preparation for REU

Felice Manganiello, Clemson University

The pREU provides five students a significant five-week summer program aimed at helping them transition from classroom learning. The primary audience for this program are students that have just finished their freshmen or sophomore year at a school that does not typically provide research experiences for undergraduates.

Term-Time Research Experiences for Low-Income Students

Michael Wolf, Rice University

A well-known best practice to attract and retain undergraduates in STEM is authentic research experiences. Lower income students face a number of obstructions, idiosyncratic to their background, to their participation in these activities. We describe some background to the problem, some related experience at Rice, and a low-cost intervention we are initiating this fall.

Post-Grant Sustainability Plenary Panel

The Data+ Program: From RTG Seed Funds to a Vibrant and Permanent Undergraduate Research Program

Paul Bendich, Duke University

Now in its fifth summer, Duke's Data+ program involves 75 undergraduate students from across the university, each of whom receives a $5K stipend, with funding coming from industry, permanent contributions from over 15 academic departments, and alumni donations. We discuss how we made this happen and lessons learned for replicating it elsewhere.

Graduate Award from a Local Company

Alla Borisyuk, University of Utah

We will share our program's success in making connections with a local company through a long history of alumni employment, resulting in establishment of a graduate scholarship in our program. The award is funded by the company, but largely free of obligations on the research direction of the awardee.

Negotiate for Lasting Benefits

Jonathan Rubin, University of Pittsburgh

Our experience shows that a productive path to sustainability is to make requests of the administration before applying for external funding. Planting ideas in this way improves the chances that successful funding will be met with lasting administrative support. I will present several examples to flesh out this concept. I will also talk about undergraduate research sustainability, which does not necessarily fit this framework.

Geometry, Topology, and Dynamics RTG Grant at Michigan

Ralf Spatzier, University of Michigan

I will discuss impact of the RTG on the program at Michigan. Crucial points are huge productivity in terms of papers written and PhD theses defended, postdocs trained both in the discipline and the profession. Also, many lecture series and workshops were held of impact both locally, regionally and even nationally. These workshops specifically targeted junior mathematicians. The lecture series brought in superb mathematicians for a short period which then could interact with our students and postdocs. Some features survive. In particular, we are continuing a weekly discussion seminar on topics of current interest, with junior mathematicians as their prime audience.

Innovation Strikes: RTG Innovations Lightning Talks

Success and Challenge of an Interdisciplinary Program

Fred Adler, University of Utah

Interdisciplinary programs like mathematical biology face the challenge of giving students breadth without sacrificing depth. We will discuss how our flexible program and interactive community have succeeded, and some of the difficulties faced in maintaining cohesion among students with very different backgrounds and goals.

Innovative Internships

Mark Holmes, Rensselaer Polytechnic Institute

As stated in our proposal: An important goal of our RTG program is that our students are knowledgeable of contemporary experimental research and interact with those doing the experiments. Consequently, through our research collaborations with experimentalists, we will use RTG funding to provide internships at such institutions as Los Alamos, Woods Hole, and Albany Medical College.

Introduction to Cryptography: Attracting Math Majors

Kevin James, Clemson University

Many potential math majors are lost to other disciplines because the only mathematics they see during their first two years is calculus and they wrongly believe there is nothing else to mathematics. This course has minimal prerequisites and seeks to enroll students that might otherwise go into engineering, business, or other natural sciences.

Realizing Multiple Objectives with Instructional Materials Development

William L Kath, Northwestern University

Private universities don't often use graduate students to teach undergraduate math courses. I'll discuss how we've used instructional materials development and co-teaching in applied mathematics courses to mentor trainees across the full teaching spectrum. Trainees take pleasure in drawing upon their own research to personalize their course offerings.

Chicago's REU

J. Peter May, The University of Chicago

Using RTG, Chicago's monstrous REU, now 90 undergraduate participants, has been opened up to participants from outside the University of Chicago. The number of outside applicants doubled from 225 in 2017 to 450 in 2018. It has blended with workshops of both the Chicago and Notre Dame geometry and topology RTGs.

Stony Brook Math Day

Christian Schnell, Stony Brook University

One element of the RTG at Stony Brook is "Math Day", a one-day festival for math majors from the greater New York area, featuring talks and math-related activities.

Math Communication Seminar

Steven Strogatz, Cornell University

I'll discuss a new communication seminar we're developing to help our faculty and trainees improve their written and spoken communication with fellow mathematicians, scientists in other fields, and the public.

Successful Postdocs and Graduate Student Workshops

Kevin Tucker, University of Illinois at Chicago

We discuss successful strategies for running effective graduate student workshops with a view towards maximizing participant involvement, long term impact, and mentoring postdoctoral researchers.

NSF RTG Program Meeting (Nov. 1-2, 2018): Participant List			
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