

Department of Mathematical Sciences



To: Greg Fant, Interim Dean, Arts and Sciences
From: Patrick Morandi, Academic Department Head
Date: 11 January 2008
Subject: Summary of the department's activities for 2007

The members of the Department of Mathematical Sciences worked extremely hard in 2007 and were productive in many ways. I will outline some of its primary achievements for the year.

Grants and Awards

Several faculty members were nominated for the Arts and Sciences Faculty Outstanding Achievement Awards, and three, John Harding, Joe Lakey, and David Pengelley, received the awards. In addition, Mary Ballyk was nominated for the Patricia Christmore Teaching Award.

Late in 2006, the department received \$600,000 in funding for Project MESH (Mathematics, Engineering, Science Hybrids). David Finston is the project manager and Caroline Sweezy is one of the key personnel on the project. This three year project will improve recruitment and retention of minority students by developing introductory web-based courses which combine mathematics and science aimed at students who have completed mathematics through high school Algebra II. It will also increase retention and success in engineering calculus courses through the development of a required 1 credit recitation section for Math 191 and Math 192 which will reinforce the connections between mathematics and science and engineering applications. In Spring 2007 we implemented recitation sections in Math 192, and in Fall 2007 we implemented the sections in Math 191. Two summer workshops were run for high school students.

The department does a great deal of work with public school teachers. Mary Ballyk, Larry Hughes, Doug Kurtz, Pat Morandi, Bruce Olberding, Ted Stanford, Tony Wang, and Linda Zimmerman, along with several members of the College of Education, through the large, collaborative state-funded grant, Mathematically Connected Communities (MCC), lead a nationally recognized, statewide effort to improve middle school mathematics education in New Mexico. Mathematics faculty work with educators to design and conduct intensive summer academies for middle school teachers, and we continue to work with these teachers closely throughout the year. This grant has been funded by the New Mexico Public Education Department, receiving over \$2,500,000 for the past three years. Its

support was renewed in 2007 with a total of nearly \$3,500,000 in funding for the next three years. In addition, members of the College of Education recently received funding to perform a research study on the effectiveness of the MCC project.

Susana Salamanca-Riba is the PI for a \$200,000 Mathematical Sciences Partnership award from the Institute for Advanced Study/Park City Mathematics Institute to help Las Cruces and Gadsden middle and high school teachers improve their mathematical knowledge and study the effect of their teaching practices on student learning. The program also provides funds for teachers to attend a three-week summer workshop in Park City.

Guram Bezhanishvili, Jerry Lodder, and David Pengelley are collaborating with faculty from Computer Science on a National Science Foundation (NSF) funded grant to implement student projects for active learning from primary historical sources in several undergraduate courses for majors in Mathematics, Computer Science, and Secondary Mathematics Education. We are a national leader in the use of historical sources in teaching mathematics. These projects provide increased motivation and enhance the ability of students with diverse learning styles to succeed. The group had previously received NSF funding, and in 2007 received a \$434,000 grant to continue their work.

Individual faculty members continued to receive external funding to support their research, which has become extremely difficult to obtain. Jens Funke, Tiziana Giorgi, Martin Krupa, and Susana Salamanca-Riba were supported with funding from the NSF. Robert Smits was supported by the National Security Agency. Joe Lakey and Hung Nguyen were supported by the Los Alamos National Labs. Mary Ballyk, Elizabeth Gasparim, Tiziana Giorgi, and Christina Mariani were supported by NSF-ADVANCE grants. Martin Krupa received funding from the Dutch Science Foundation to support his leave.

Personnel Developments

Several faculty members were promoted or tenured this past year. Caroline Sweezy and Tony Wang were promoted to Professor and Amal Mostafa was promoted to College Associate Professor. Guram Bezhanishvili was awarded tenure. The department recommended Mary Ballyk and Jens Funke for promotion to Associate Professor and tenure and Christina Mariani for Professor. We hired Larry Hughes as a College Assistant Professor before the start of the spring semester. Elaine Cohen, Marta Reece, and Laura White-Hosford were appointed to regularized non-budgeted positions. Min Li resigned from his position as Computer Specialist. After a couple difficult months without any computer support, we hired Mark Leisher as Computer Manager, who has settled into the position well and is providing excellent service to the department, and is also helping the Department of Psychology.

There were many faculty members on leave in 2007. Ted Stanford was on sabbatical leave in the spring and Tony Wang in the fall. David Pengelley was on medical leave in the spring, and Marcus Cohen in the fall. Mai Gehrke, Martin Krupa, Elizabeth Gasparim, Sue Schibel, and Adam Sikora were on professional leave all year, and Jens Funke was on

leave in the fall. Mai Gehrke spent the spring semester working with Hilary Priestley of Oxford University. Martin Krupa was funded on a grant from the Dutch equivalent of the NSF. Elizabeth Gasparim spent the year at the University of Edinburgh, Scotland. Sue Schibel spent the semester working on her Ph.D. in Engineering. Adam Sikora was a visiting Research Fellow of the Australian National University. Jens Funke took leave in the fall to work at the Max Plank Institute in Bonn, Germany.

In Fall 2006 the Provost approved a position in Mathematics Education to be shared between the department and the Department of Curriculum and Instruction. After an inadequate pool of candidates from the first job posting, a second posting with a deadline in November was made, and the two departments have come up with a short list of candidates, and will start interviews at the beginning of the spring semester. Any candidate hired will start in August 2008.

Research and Creative Activities

Members of the department were very productive researchers in 2007. The tenure track faculty had a total of 50 papers published, 39 papers accepted, and 32 papers submitted. In addition, one textbook written by faculty members was published and 2 were accepted for publication. Faculty members gave over 70 talks at conferences or other universities. The number of invitations to speak indicates the national and international reputation of the faculty.

Many faculty received travel money to support their research. Adam Sikora was funded to work with Derek Robinson of the Australian National University and Tom ter Elst of the University of Auckland. Jens Funke was supported by the Forschungsinstitut für Mathematik for two one-week visits to the Swiss Federal Institute of Technology in Zurich, and received funding to visit the University of Maryland and the University of Cologne. He was also funded by the Max Planck Institute for the fall semester. Guram Bezhanishvili received support from the University of Amsterdam, and the Georgian Academy of Sciences to conduct research in modal logic. Elizabeth Gasparim received support for summer visits to Stanford University and the University of Münster. Lolina Alvarez was supported by the Sociedad Matematica Mexicana to give an invited talk to the annual meeting of the Sociedad Matematica Mexicana.

Several faculty members are involved in organizing research conferences. Mai Gehrke co-organized a conference in Oxford, UK, in Summer 2007 and was on the program committee for a conference held at Vanderbilt University in Summer 2007. David Pengelley was a co-organizer of the international conference on complex cobordism in homotopy theory, held in March 2007 at the Johns Hopkins University. Guram Bezhanishvili was chair of the program committee of the Oxford conference. Hung Nguyen was on the program committee for six international conferences, held in Canada, France, the United Kingdom, Taiwan, and China.

The department sponsors a weekly colloquium and several weekly seminars. The colloquium series included 23 lectures, presented by 18 visitors to NMSU and 5 speakers from NMSU. Most of the speakers from other institutions visit the department to collaborate with our faculty on their research. Speakers from NMSU came from the Departments of Astronomy, Computer Science, Psychology, and Physics. The department runs seminars in algebra, analysis, applied mathematics, lattice theory, statistics, and topology. Two students have organized a seminar given by and for graduate students. Most faculty and many graduate students attend at least one of the seminars.

There are several faculty who do research on interdisciplinary projects. Ernie Barany and Mary Ballyk are working with a group in the Biology department to develop undergraduate research opportunities and a program of study at the interface of the mathematical and life sciences. Mai Gehrke collaborates with others at the intersection of mathematics and computer science and, along with Hung Nguyen, is working with Jack Wright of the Geography Department on a LANL-funded project. Martin Krupa works with bioengineers at the University of Twente and a neuroscience research lab in the Netherlands. Joe Lakey is working with faculty in the Electrical and Computer Engineering Department on his DARPA grant through LANL. Christina Mariani collaborates with faculty in Computer Science, Finance, Industrial Engineering, and Physics, on a variety of problems. Finally, a large group of faculty are working with the College of Education on several projects involving both teacher training and education of elementary school students.

Curricular Activities

The department has made several changes to its course offerings to increase student credit hour production. We have recently added supplemental instruction sections for Math 120 and Math 121. Through the MESH grant, we have added recitation sections in Math 191 and Math 192, the engineering and science calculus courses. These sections are effectively supplemental instruction sections. In spring we introduced large lecture format courses in Math 210G, Mathematics Appreciation. Through these efforts the department increased its SCH production from 2005-2006 to 2006-2007, and it will also increase from 2006-2007 to 2007-2008. In addition, we have greatly increased the number of students in our graduate programs, and we currently have approximately 60 graduate students. We have also introduced emphases in our major, and besides the general emphasis, which is our standard degree, we have emphases in applied mathematics and actuarial science and insurance. We expect to attract more students to the major through making our program more flexible, allowing students to obtain a program of study better connected to their interests.

The department has put a great deal of effort into revamping the precalculus courses, Math 115, 180, 185, converting them into the sequence Math 120, 121, 190, intermediate algebra, college algebra, and pre-calculus. Work on revising these courses began several years ago, and in Fall 2006, we taught Math 120, 121, and 190 each for the first time. The

courses are running moderately smoothly. However, we are continuing to make changes in the courses to serve students as best we can.

The department, through the hard work of Maria Christina Mariani, aided by Lolina Alvarez, is developing a professional Master's degree program in financial mathematics. This program is a collaboration between us and the Department of Finance. It is aimed at attracting a new group of students to our department. The students in this program will need a background in calculus, linear algebra, statistics, and probability. They will take 10 courses, 3 finance courses, and 7 mathematics and statistics courses. Of these, 5 are long existing courses in our department, and 2 are courses in Financial Mathematics, Math 521 and Math 522, created by Maria Christina Mariani, which have been taught already with good sized audiences. The program has been approved by all necessary NMSU organizations, and will be sent to the Higher Education Department for consideration. Hopefully the program will be approved soon.

Over the last several years, our department has designed and offered courses for an online Master's of Arts in Teaching Mathematics degree, in collaboration with the College of Education, designed for middle school teachers. Dave Finston, Doug Kurtz, Tony Wang, and Linda Zimmerman have each taught a course in this program. Due to low enrollments, we have not offered any of these courses for the past couple semesters. In the fall Doug Kurtz, Pat Morandi, Bruce Olberding, and Ted Stanford began to work with members of the College of Education to revise this program, to both improve it and to make it more attractive to teachers, to get higher enrollments. We intend to look for grant funding to carry out the program revision.

In the fall, through requests from faculty in the Colleges of Business and Agriculture, members of the department have been working to create an upper division course in applied mathematics for students in these colleges. Lolina Alvarez, Christina Mariani, and Amal Mostafa met with members of the two client colleges to design the course to satisfy the needs of their students. Their efforts resulted in the creation of *Business Applications*, Math 375/475, which will run for the first time in Fall 2008. Because of changes in part due to common core, Business students do not need Math 230, and it looks like there is no longer sufficient interest to run the course. Introducing Math 375/475 will help us to continue serving Business majors.

In Fall 2007 the department had 64 mathematics majors and 27 supplementary majors. Our major is overseen by the department's Majors and Minors Committee, headed by Lolina Alvarez. The committee conducts student advising and supervises our course offerings. In addition, it recommends students for departmental scholarships. The department contacts students performing well in classes to encourage them to become mathematics majors. They receive letters encouraging them to discuss the major with Pat Morandi. Furthermore, to further encourage students to consider a mathematics major, we give complimentary copies of general audience mathematics books to encourage their interest in mathematics and to show our interest in their education. The department supports a chapter of the national mathematics honor society, Pi Mu Epsilon. It organizes meetings of the group for interested students to encourage students to consider our major.

For the last two years, we have obtained private funding from Harris Corporation to sponsor a Mathematics Modeling team to compete in the two COMAP competitions. Tiziana Giorgi and Mary Ballyk organized the teams.

Enrollment in our graduate program reached 60 students, thanks to a large group of approximately 20 entering graduate students in each of the past two fall semesters. Because of efforts by David Finston, we are one of only two universities in the nation to obtain a commitment from the Sloan Foundation to fund fellowships for minority mathematics graduate students. Currently we have 2 graduate students who have received this highly prestigious \$30,000 Sloan Foundation award. In addition, we have one student supported through the Bridge to the Doctorate Fellowship. The graduate program is overseen by the department's Graduate Committee, previously headed by John Harding and now run by Christina Mariani. The duties of the committee include making recommendations on admissions and the granting of graduate assistantships, organizing the comprehensive examinations, and advising. John has worked enormous hours on this committee, and has instituted several good changes, some of which have resulted in the department doing better advising, and predicting which graduate courses will have sufficient enrollment.

Student advising is organized by three departmental committees. Undergraduate mathematics majors, minors, and supplementary majors in the past were advised by members of the Majors and Minors Committee. A change this year spread advising across a wider spectrum of the faculty, with the intent that changes to the committee membership would not require changing a student's advisor, thus giving more continuity to advising. The committee also nominates mathematics majors for scholarships and awards, and informs them about study and career opportunities. Graduate students in the department are initially advised by members of the Graduate Committee before they choose an advisor related to their research interests. Finally, members of the department advise unclassified students through the Arts and Sciences Advising Center.

Service Activities

The department provides service to the university, the state, and the mathematical community in several ways. Lolina Alvarez serves on the Steering Committee of NM-AGEP, the Recruitment Committee for the NSF-ADVANCE program, the Faculty Affairs Committee, and the committee to oversee and coordinate the first year experience at NMSU. Christina Mariani is a member of the Faculty Senate and the Graduate Council. John Harding is a member of the College Curriculum and Education Policies Committee. Doug Kurtz was on the College Planning and Budget Committee, the Ralph B. Crouch Memorial Board Committee, and the Foundations of Excellence Philosophy Team. Joe Lakey is on the Faculty Salary Appeals Board and was recently appointed to the University Appeals Board. Bruce Olberding sat on the Selection Committee for the College's Faculty Achievement Awards. Robert Smits was a member of the Foundations of Excellence Diversity Committee. Caroline Sweezy served on the College Improvement of Instruction and Student Relations Committee. Pat Baggett, Dave Finston, Doug Kurtz, and Hung

Nguyen each serve as an outside member of the Tenure and Promotion Committee for an Arts and Sciences department. Several faculty, including Lolina Alvarez, Doug Kurtz, and Pat Morandi, are mentors for the NSF-Advance mentoring program, and several departmental members participate as mentees.

Faculty members contribute to the profession in many ways. Ted Stanford serves on The New Mexico Mathematics and Science Advisory Council and the Mathematics Planning Committee of the New Mexico Public Education Department. Lolina Alvarez, Guram Bezhanishvili, John Harding, Christina Mariani, and Ross Staffeldt are all editors of research journals. Robert Smits is the department's liaison to the Mathematical Association of America and is the representative to the Rocky Mountain Mathematics Consortium. Lolina Alvarez, Pat Morandi, and Tony Wang were judges for the NMSU Graduate Research Symposium in the spring.

The department puts a great deal of effort into outreach. Pat Baggett is working with members of the Science Education Alliance to initiate a program of student outreach in schools for mathematics, similar to one for science. The program will have undergraduates volunteer to help in mathematics classes in the Las Cruces public schools. This will give teachers additional help in their classrooms and give students experience in working with children on mathematics. Several faculty members work with students in local schools. Dave Finston organizes and runs a weekly mathematics club for 6th, 7th, and 8th graders at the Las Cruces Catholic School. Robert Smits gave a presentation of his research and of the mathematics major to a group of more than 100 high school students from El Paso. In addition, he teaches a weekly mathematics class at Hillrise Elementary School. In spring, Ted Stanford taught a weekly math lesson for the 3rd and the 5th grade class at Hillrise Elementary, and in fall, he is teaching a weekly math lesson for the 4th grade at Hillrise. Several faculty served as judges for various contests. Lolina Alvarez was head judge in the Southwestern NM regional science and engineering fair. Christina Mariani, Pat Morandi, and Tony Wang each judged for the Graduate Research and Arts Symposium. Christina also judged at the New Mexico Mesa Competition. Elizabeth Gasparim coordinated presentations about the department by faculty and students to high school students on visitor's day. Susana Salamanca-Riba works with a group of teachers from Gadsden, Oñate, and LC High School on the program *Lesson Study*. Teachers get together to design a lesson which will help them reflect on their classroom practices, focussing on student thinking and understanding of the mathematics. They observe one of the teachers teach the lesson, then get together to revise the lesson. They then observe another teacher teach it, and then revise it and write it up as a resource for other teachers. Ted Stanford participated in the New Mexico mathematics textbook adoption meetings in June, to help schools with the selection of classroom materials. He also works regularly with middle school teachers, and conducts enrichment workshops, as part of his work on the Mathematically Connected Communities project. He is also serving on the New Mexico Mathematics and Science Advisory Council to work with the New Mexico Public Education Department to implement recommendations which came out of a town hall meeting in November 2005.