Department of Mathematical Sciences

To: Christa Slaton, Dean, Arts and Sciences
From: Joseph Lakey, Academic Department Head
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Subject: Department Summary

Mission Statement

The Department of Mathematical Sciences provides core education in mathematics and statistics that prepares graduate and undergraduate students to be knowledgeable and responsible citizens of the world. It does this by conducting research, scholarship, and teaching, including teaching service courses for other programs, to fulfill the land grant mission of the university.

Accomplishments

A subset of particular achievements is highlighted below.

Funded Activities. The faculty in the Department of Mathematical Sciences are involved in diverse, externally supported work. In several cases the work is interdisciplinary or multi-institutional or both. *Mathematically-Connected Communities* (MC^2), a professional development program for public school mathematics teachers and their administrators, was awarded funding from the NM Public Education Department for the 8th consecutive year, bringing its total funding to over $12M. MC^2 provides training for over 400 NM public school mathematics teachers and their districts' administrators. The sibling program *Leadership Institute for Teachers* (LIFT) provides ongoing education primarily for middle school teachers in Southern New Mexico. LIFT is funded by NSF through 2014 at $1M per year. Six faculty members from the Department of Mathematical Sciences—Ballyk, Kurtz, Morandi, Bruce and Maribeth Olberding, and Zimmerman—participate in the MC^2-LIFT program. Departmental faculty also participate in teaching related grants funded externally through the Park City Math Institute (Salamanca-Riba) and NSF, including interdisciplinary grants involving learning using primary historical sources (Lodder, Pengelley, and Bezhanishvili, in collaboration with the Computer Science department) and mentoring undergraduates studying mathematical biology (Ballyk, Barany, in conjunction with the Biology department). Erica Voges directed

the PreFreshman Engineering Program in the College of Engineering and Ted Stanford serves as the Math Content Specialist on the interdisciplinary NSF funded *Math Snacks*. In addition to external funding related to education programs, four faculty members—Finston, Giorgi, Ramras, Salamanca-Riba—had the NSF fund at least part of their research in 2011, Giorgi with a new three year award that also funds a PhD student. Bezhanishvili and Wang had external funding through competitive grant programs in Georgia and China, respectively. Louiza Fouli obtained funding from NSF to run the *Southwest Local Algebra Meeting* (SLAM) in March at NMSU and from NSA for future SLAM events. This conference will host several speakers of international prominence.

Research Activities. Math faculty were listed as authors twenty-six times on papers published in 2011. An additional twenty-six papers and one book were listed as accepted for publication or in press and many more papers have been submitted for publication. At least 44 presentations were made at conferences, colloquia, or workshops. One of these was an extended workshop and a second was an entire lecture series. Four faculty were on sabbatical leave in Spring 2011 and two faculty are on sabbatical leave in Fall 2011. At least ten tenure-track faculty gave invited presentations at international conferences or colloquia outside the US, including Bezhanishvili (Marseille), Finston (Dijon and Basel), Giorgi (Vancouver), Harding (London), Lakey (Overwolfach), Olberding (Rome and Padua), Ramras (Berlin and Heidelberg), Salamanca-Riba (Dubrovnik), Smits (Lisbon, 2), and Wang (Shaanxi, multiple). Most of our faculty also presented their work at national meetings, including a four-hour workshop at the Joint Math Meetings by Lodder and Pengelley. Faculty attended several other international conferences and co-organized a number of national and international conferences and workshops, including the SLAM event, which took place at NMSU March 4-5. In addition to these primarily creative activities, faculty were involved in a lot of professional service. Most faculty refereed papers for peer-reviewed journals. Bezhanishvili, Harding, Olberding, Staffeldt and Wang served on Editorial Boards or Advisory Boards of one or more research journals. Finston (2), Lakey, Olberding, Pengelley (2) and Wang served as external referees for tenure cases at nationally or internationally prominent universities. Pengelley also conducted a program review at a US college and served as a committee member for a dissertation defense at one of the University of Paris campuses. There was also a high level of activity of our faculty on scientific advisory boards and grant proposal review panels. Smits carried out collaborative research in Lisbon, funded by a Fulbright award over the summer.

University Service. Mathematical Sciences faculty engage in a lot of departmental service. In Fall 2010, Giorgi and B. Olberding proposed a number of austerity measures that might be taken in order to help the department to run more efficiently—given that there are now fewer faculty to carry out the regular work of administering departmental programs—without sacrificing the ability to pursue a

few reasonable initiatives. This led to several modest, but still significant, changes in the structure of some of our standing committees, and an identification of some previous responsibilities that were assigned to multi-person committees as now being assigned primarily to single persons. At the same time, there has been considerable turnover in departmental service to the College of Arts and Sciences. The department now has five members on Arts and Sciences standing committees: B. Olberding (Planning and Budget), Stanford (Improvement of Instruction), Giorgi (Curriculum and Educational Policies), Morandi (Awards), and Salamanca-Riba (Research Affairs). Kurtz serves on the A&S Colloquium Series Committee. There are two members of Faculty Senate (Train, representing College Faculty, and Lakey) and a member of the Graduate Council (Staffeldt). Lodder serves as the external member of the Journalism P&T committee. Pengelley serves on the STEP advisory board of the College of Engineering.

Outreach. Several members of Mathematical Sciences are involved in outreach. Maribeth Olberding put in a lot of hours as volunteer and coordinated several math activities at Sonoma Elementary. Harding spent most of his Sunday afternoons enriching math and science backgrounds of students from Las Cruces Academy and Sierra Middle School. White-Hosford conducted math activities at Columbia Elementary and also assisted Baggett in a workshop for Sierra Middle School students conducted at NMSU in January. Baggett also conducted another workshop for North Valley sixth graders in November and she participated in the Southern New Mexico Homeschool conference in April. Finston provided weekly math tutoring for the Las Cruces High School Soccer team. Several women mathematicians in the department (Baggett, Ballyk, Fouli, Giorgi, M. Olberding, and Salamanca-Riba) together conducted a Sonya Kovalevsky Day at NMSU in October, with about fifty girls from Las Cruces and Onate High Schools participating in a series of presentations and panels. Morandi and Pengelley gave a very well received combined lecture series at the Academy for Learning in Retirement in Las Cruces in March. The Mathematically Connected Communities program continues to host one and two-week academies for in-service teachers statewide. Mostafa judged multiple science fairs, among other broader involvement by our faculty in the community.

Programs

Graduate and Undergraduate Programs. Cognos lists 69 undergraduate majors and 46 Math graduate students. These numbers do not include supplemental majors or interdisciplinary students. Ten students earned a Bachelor of Science between Fall 2010 and Summer 2011 and eight earned Master's of Science degrees. Four earned PhDs in Math: Diaz (Staffeldt), Ncheuguim (Mariani), Ta'ani (Baggett and Pengelley), Varela (Barany) and Vivas-Mejia (Barany). Albehery (Wang) earned an interdisciplinary PhD. Those who sought tenure-track positions in the U.S. (Ncheuguim, Ta'ani and Vivas-Mejia) each succeeded.

Student Credit Hours and Instruction. Our classrooms are bursting at the seams. In several cases we had to bring in extra chairs and even perform classroom swaps to accommodate students. Except for courses specifically geared toward Education majors, virtually every section of lower division math was filled to near or even above capacity. The enrollment report dated August 31 lists 11743 SCHs taught in Math and Stat (versus 11396 in Fall 2010); 1329 upper division SCHs (versus 1200); and 543 graduate level SCH (versus 516). This represents a net increase of 3.8% in SCHs and continues the trend from 2010 in which approximately 2% more SCHs were taught than in 2009, a trend that continues back a few more years, and bucks the trend of a 2.8% overall decrease in A&S SCHs this fall. The increased workload has not always been distributed uniformly. In Math 210G and Math 142G we started in the fall semester teaching all sections in large lecture format. Last year, we had a mix of large and small sections. Three years ago we had no large lecture sections. The transition was made necessary by the need to accommodate students with limited numbers of faculty. To a question on our student evaluation form "what would you change about this class?" many Math 142G students responded, "have it taught in smaller sections." Through combinations of large lecture sections and overloads, several of our College Faculty members taught over 1000 student credit hours in 2011, including Fulte (1284), Mostafa (1404) and Zimmerman (1557). Before this year, no one had taught 1200 SCHs in Math, at least in recent history. The ratio of struggling students seems to increase with class size so that addressing their concerns by email and face-to-face for so many requires an unsustainable level of effort. Besides these phenomenal assignments, we have twelve sections of Math/Stat this fall taught by temporary instructors and eight of our regularized or budgeted college faculty are teaching overloads in the fall. Twenty-one sections are being taught by graduate assistants, including five sections of courses numbered above 250.

We have taken several steps to try to improve student placement and classroom instruction to address issues coming with changes just noted. The Math Placement Exam was overhauled for the first time in at least fifteen years in an attempt to match test questions more closely with skills needed to succeed in general education Math courses. With the increased number of graduate assistants teaching their own classes, we implemented a mandatory one- and a half-day training for new graduate assistants, addressing classroom preparation, assessment, coordination, good classroom and course management practices, and pitfalls to avoid. In Math 142, Hughes and Zimmerman implemented a new format, involving two hours of large lecture and two hours of lab per week. The labs were administered in smaller sections and involved students working on-line or in small groups solving problems.

Outcomes Assessment. The department began a new approach to undergraduate program assessment, concentrating on direct evidence of learning in a few of its upper level courses, in Fall 2010. We also began a new phase in assessing our general education courses, focusing particularly on whether students retain information from one semester to the next. A new approach to graduate program assessment will be implemented starting in Spring 2012.

Outlook

In July, four of our regularized College Faculty obtained funded lines at a total of 2.75 FTE (Bramlett, 0.5 FTE, Reece, 0.5 FTE, Train, 0.75 FTE and White-Hosford, 1.0 FTE). However, we lost the budgeted College line that Hughes vacated when he moved into the Math Success Center director position, and we lost Mariani's tenure-track line when she resigned in July. The total salary for the new lines is almost equal to the net salary of the two lines lost. Two of our most valued College Faculty, Maribeth Olberding and Debra Zarret, still are not permanently funded. David Pengelley will retire at the end of 2011, which will bring our tenured and tenure-track faculty numbers down to twenty-one. In comparison, we had twenty-nine such faculty listed in the 2005-2006 graduate catalog. While 2010 National Research Council rankings put our Department of Mathematical Sciences well within the top 100 nationally in terms of scholarship, and well within the top ten in terms of diversity, it will be difficult to maintain this reputation in coming years: we have lost six of the tenure track women faculty listed in our 2005-2006 catalog, adding only Fouli since. Most of the faculty we lost during this period had outstanding academic reputations.

Progress on Living the Vision Goals

The department did not submit a new set of goals for 2011, but instead chose to continue to monitor progress on strategic goals that were formulated in conjunction with the Living the Vision plan from a few years back. The department's goals, as listed on our strategic plan, were

1. The department will retain 5% more of its majors each year, by keeping them at NMSU, until its retention rate is 65% of existing majors.
2. The department will be at or above the median publication rate of the university's peer institutions.
3. To increase its visibility, the department will increase the number of internationally recognized visitors through invitations to give talks the department organizes.

It is worth recalling that the Living the Vision document states several institutional Goals and Objectives such as "Provide faculty in adequate numbers to assure quality teaching and academic support" that have not been realized due to the economic crunch and, consequently, which impact our ability to achieve goals that were formulated in anticipation that the parallel LTV goals would also be obtained.

For item 1, the number of Math majors held steady in the upper 60s over the past year. Ten students completed a BS degree between Fall 2010 and Summer 2011. We plan to continue to work to increase the visibility of our undergraduate emphases in 2012.
Several faculty members continue to work on curriculum of several math major classes, particularly those that lie at critical transition points, such as MATH 332, to help students make the transition from being good problem solvers to being good synthesizers of abstract concepts. Math 279 is another critical transition class that is being studied by our undergraduate committees. We held several social events for majors and prospective majors. These were not attended in great numbers, so we plan to use different strategies to get the word out on our undergraduate program in the coming year.

For item 2, publication rate, there is not any single obvious way in which to count publications. For mathematics, a common metric is the number of publications reviewed by Mathematical Reviews (MR), which provides reviews of all articles published in major mathematics journals. These were tallied for all of our peer institutions since 2006. For NMSU, 198 publications were reviewed by MR since 2006 (about 8 per faculty, if we averaged 25 tenured or tenure-track faculty during that period). The only peer institutions that exceeded this number were Kansas State (282, 34 faculty or 8.29/fac) and University of Arizona (349, but 62 faculty, so only 5.62/fac). Most other peer departments averaged about 5 pubs/fac or less (UNM had 65 MR publications during this period and has 27 tenured or tenure track faculty, so 2.4/fac). In all fairness, those departments have more applied faculty who might publish primarily in periodicals that are not reviewed by MR.

For item 3, the department continues to have a vibrant colloquium series. Seventeen colloquia were hosted by the Department of Mathematical Sciences in 2011, of which fifteen were speakers from outside New Mexico, including one by Carlos Bosch, a somewhat renowned sabbatical visitor in Fall 2011 from Instituto Tecnologico Autonoma de Mexico. As noted previously, NMSU also hosted the Southwest Local Analysis Meeting in March, which included about fifty participants from outside New Mexico. In the spirit of item 3, Bezhanishvili, Fouli, Giorgi, Harding, Ramras, and Wang each were involved as organizers of entire professional meetings or of focused workshops at larger professional meetings.

Departmental Goals for 2012

Teaching: In addition to course revisions discussed in the Department Summary, the course sequence Math 191G, 192G, 291G, 392G merits some discussion and action, including considering whether we wish to continue to use a dynamical systems approach in Math 392 and, if we make changes at this level, what changes also need to be made in prerequisite courses in order that students are adequately prepared when they get to Math 392. The goal is to make this whole sequence more attractive to a variety of students and possibly increase our number of majors as a result.

Research: Our departmental goal is to continue to maintain the high rate of publication in diverse areas of mathematics and mathematics education that the department has been able to achieve for the past several years. The challenge is that we have fewer faculty, so an output that represented one published paper per faculty member, on average, a few years ago now becomes four papers per every three tenured or tenure-track faculty member.

Service: The department has five of 21 tenure track faculty members on A&S standing committees. There is a total of 72 faculty (including ex-officio members, and deans) on standing committees in the college, out of about 248 tenure-track faculty in Arts and Sciences. For Mathematical Sciences to have more than our fair share of faculty on college committees, we should have one more member on a committee. The department thus will try to have one or two of its members elected to A&S standing committees.