

Department of Mathematical Sciences

Annual Report for 1999

November 20, 1999

Overview

This was an excellent year for research, outreach, teaching improvement, and graduate recruitment in the Department of Mathematical Sciences. Faculty members were extremely successful at creating and publishing research mathematics, and attracted funding from national and state agencies to support efforts in research and education. For the second consecutive year a Mathematical Sciences faculty member's teaching accomplishments was recognized with the award for distinguished teaching by the El Paso Energy Foundation (**Lolina Alvarez**, 1998, **Frank Williams**, 1999). **Caroline Sweezy** received the Department of Mathematical Sciences Summer Research Award. The department hosted the twenty-third Holiday Symposium on "Algebraic Structures for Logic", with main speakers **Bjarni Jonsson**, Vanderbilt University, and **Willem Blok**, University of Illinois, Chicago. An international group of researchers spent time at New Mexico State University, collaborating with members of the department and presenting talks in colloquia and seminars.

The department conducted several exciting student-oriented and other outreach programs, all of which have attracted external funding. **Reinhard Laubenbacher** and **Ross Staffeldt** completed their NSF sponsored participation in the Southwest Regional Institute in the Mathematical Sciences (SWRIMS), working with high school teachers and graduate, undergraduate and high schools students on mathematical cryptography. **Alyne Fulte** directed the local Proyecto Access Las Cruces PREP program with funding from the National Aeronautics and Space Administration, Intel, and others, to encourage disadvantaged middle school students to study mathematics and science. **Sandy Geiger** continued to direct the Mathematics Accessible to the Visually Impaired Student (MAVIS) program, taking a leadership role on campus initiating work on a program to braille mathematics text for visually impaired students. MAVIS staff member **Chris Weaver** was recognized for his achievements with an award presented at the International Conference on Technology in San Francisco. **Pat Baggett** and **David Finston** had funding from CHE and the New Mexico Eisenhower Foundation to conduct teacher enhancement activities at the elementary and secondary levels respectively. Several faculty members developed a strong interest in the education of future teachers. **Pat Morandi** is newly active in this area; he and **Pat Baggett** will present their work at a national conference. The Supplementary Major in Applied Mathematics received final approval.

The department played an important role providing service to the mathematics community, the state of New Mexico and the university. Faculty members served on society committees, journal editorial boards and conference organizing committees. **Kitty Berver** co-chairs the New Mexico Higher Education Mathematics Articulation Task Force. She also was a panelist at a national conference. Many faculty interacted with the Las Cruces Public Schools. Faculty members participated on most university and college committees and the faculty senate.

Personnel Changes	Curricular Activities	Research Activities
Professional Service Contributions	Community Relations	Outcomes Assessment Activities
Department Self-Study	Computing Facilities	Advanced Degrees Awarded

Personnel Changes

Two tenure track faculty members, [John Harding](#) and [Susana Salamanca Riba](#), were promoted to Associate Professor. [Susana Salamanca Riba](#) was also awarded tenure. Two College faculty members were promoted: [Alyne Fulte](#) to College Assistant Professor and [Barbara Sallach](#) to College Associate Professor. [Robert Wisner](#) retired in 1999, and [Frank Williams](#) announced his retirement for Summer 2000, both after more than 30 years of distinguished service at NMSU. In anticipation of a large turnover in tenure track faculty through retirements and resignations, the department is actively developing a long-term hiring plan.

The department was fortunate to have Prof. [Bodo Pareigis](#), University of Munich, and Prof. [Maria Alicia Aviño Diaz](#), Mexican National Autonomous University, as visiting researchers to teach advanced topics as well as calculus, and to support research efforts in the department. Prof. [Don Trim](#), University of Manitoba, is spending his sabbatical year here to teach calculus and General Education courses while learning about our teaching methods. Prof. [Reinhold Hübl](#), University of Regensburg, spent three months at NMSU as an Adjunct Professor to conduct joint research and lecture on his research specialty.

Curricular Activities

The department designed new programs to enable students in other disciplines to acquire a mathematics major and conducted outreach to better serve students in client departments. The department's proposal for a Supplementary Major in Applied Mathematics was finalized and approved at all levels. Faculty members worked with representatives of the College of Engineering, College of Business Administration, Computer Science Department, Biology Department, and Physics Department in developing programs of study for the supplementary major. Faculty worked with members of the Department of Psychology on statistics courses. Teaching exchanges were conducted with the Physics Department, and joint mathematics and physics courses were offered by [Joseph Zund](#) and [Reinhard Laubenbacher](#). The MAVIS program in the department took a leadership role in addressing the needs of visually impaired students.

One of the department's major curricular efforts involved development of course materials using mathematical software and the internet to improve courses taken by mathematics, science, engineering, and education majors. New texts emphasizing the use of mathematical software and graphing calculators are used in calculus and differential equations courses. The faculty have expanded their use of the computer in the classroom, making extensive use of the portable computer/overhead projector combination for classroom demonstrations. The acquisition in 1999 of 20 new computers for the SH 118 laboratory was essential for our increased emphasis on computation in courses.

Developing new programs and courses is an important activity in the department, in order to introduce students to important new mathematics and to better meet their programmatic needs. Mathematical Sciences faculty and faculty from the Department of Electrical Engineering continue work on the design of a five-year program on communications science, leading to both bachelor's and master's degrees. Two of them co-taught a special topics course during the summer on the interface of new developments in mathematics and signal analysis. Faculty members received funding from the National Science Foundation to write a textbook of annotated original historical sources for a capstone course based on the Hon/Math 411G course, "Great Theorems: the Art of Mathematics." Faculty members offered special topics undergraduate- and graduate-level courses on recent developments in pure mathematics, ways to incorporate new mathematics content in high school courses, and on the use of advanced technology in the elementary and middle school classroom.

A member of this department taught special topics courses on relativistic astrophysics and black holes for the Department of Physics, another taught an interdisciplinary course on nonlinear dynamics. A research visitor taught a topics course on the relatively new mathematical area known as "Quantum Groups."

Sandy Geiger is assigned as Special Students Program Coordinator to monitor students who are handicapped, have learning disabilities, or are experiencing great difficulties in their classes. She monitors students repeating a Mathematics Learning Center class more than one time and Native American students, and she acts as liaison with the American Indian Program Office and Student Support Services. She is also the departmental Americans with Disabilities Act (ADA) contact.

Student advising is handled by special departmental committees. Undergraduate mathematics majors are advised by members of the Undergraduate Majors/Minors Committee. This committee nominates mathematics majors for scholarships and awards and informs them about study and career opportunities. The Undergraduate Curriculum Committee coordinates the update of our course offerings, syllabi, and information provided to instructors. The committee will continue to actively assist the College of Engineering with their preparations for next year's ABET accreditation visit. Advising of graduate students is coordinated by the Graduate Studies Committee, which also makes recommendations for graduate assistant appointments, coordinates comprehensive exam preparation and grading, and updates our graduate course offerings. Members of the department advise for both the Advising Center and the Honors program.

The department participates actively in the Honors and General Education programs. Faculty members routinely teach the Honors courses "Spirit and Evolution of Mathematics" and "Great Theorems: The Art of Mathematics." Honors courses on mathematics appreciation and number theory have been developed. Gabriel Lampert offered an Honors course on Jewish literature. In addition to the Honors courses, the department offers an array of courses approved for General Education, including courses on mathematics for elementary education, business calculus, and mathematics appreciation. An alternate means of meeting the General Education requirement in mathematics is to take six credits of mathematics that require Math 115.

The department awarded three doctoral and four master's degrees during the year. It had 37 mathematics graduate students enrolled this year. The department continues to successfully attract both women and minorities. A multi-faceted recruiting effort led to the enrollment of a record number (14) of first year graduate students in 1999, four of them members of ethnic minority groups. Our recruiting efforts in the minority community and in area colleges and universities continue. A proposal to the Sloan Foundation to increase the presence of minority graduate students is near completion. The department offers a seminar designed specifically for graduate students, introducing them to areas of contemporary mathematics suitable for thesis topics.

The department has been developing a doctoral program in mathematics education. Requirements for comprehensive examinations and course work have been drafted, and currently they are being discussed and revised. We have begun a search for a new faculty member in mathematics education to support this program.

Cooperative and research opportunities for our graduate students have expanded. A cooperative arrangement with Mackichan software was piloted this year, and plans are being made for its continuation. Several graduate students were supported during the academic year and summer by research grants made to PSL.

Teaching Improvement

The Teaching Committee oversees the coordination of multi-section courses and classroom observations of faculty members and graduate student teaching assistants. The committee drafted plans for a longitudinal study of student performance, to assess the efficacy of current mathematics preparation for courses with

mathematics prerequisites. We are seeking funds for release time for **Gabriel Lampert** to collect and analyze the appropriate data.

Faculty members are using advanced technology, including mathematical software and the internet, in significant ways in their teaching. **Pat Baggett** is offering a new course on the use of technology for elementary school teachers, and **Ross Staffeldt** has developed programs used by several faculty to aid students in visualization of various structures of geometric significance in calculus and differential equations courses. **Pat Morandi** has developed programs for use in graduate modern algebra courses and uses internet sites in courses for prospective teachers. **Doug Kurtz** and **Dave Finston** used the internet and software developed by our system manager, **John Pierce**, in their combined Math 210G/401/501 course. **Bill Julian** uses the graphing calculator in innovative ways in graduate and undergraduate courses.

A major strength of the department's educational program is the participation of graduate students and talented undergraduates as tutors and graders in the Mathematics Learning Center. This provides a history of experience with the peer-tutoring aspect of learning, which is inherent in the cooperative learning projects now taking place in many other classes. It creates a valuable training program for new graduate assistants, introducing them to educational issues under close supervision by experienced educators.

Several faculty members developed a new interest in the mathematical education of prospective teachers. One of them, **Pat Morandi**, will present two talks with **Patricia Baggett** about their work in this area at the national meeting of the Mathematical Association of America in January, 2000. Two faculty members worked on updating the mathematics competencies for the teacher preparation program, and two faculty members attended the New Mexico Roundtable discussions on the preparation of future teachers.

Other work with undergraduate students includes coaching and other preparation of students for the prestigious Putnam competition. **Caroline Sweezy** has conducted these activities.

Outreach

The department engages in outreach activities both within and external to the university. The Liaison Committee was established in 1997 to contact faculty members from client departments and contact mathematics departments at branch campuses for their feedback concerning the content of mathematics courses. In 1999 we worked with Psychology faculty members to improve the new statistics course the department developed to support their major.

The department continues its teaching exchange with the Department of Physics. **Joseph Zund** offered an advanced graduate-level course on relativity in the Department of Physics, while Profs. **Robert Armstrong** and **Sid Coon** taught mathematics courses in exchange. Mathematics Learning Center faculty members work closely with faculty at the Doña Ana Branch Community College.

One highlight of 1999 was the final approval of the Supplementary Major in Applied Mathematics. Mathematical Sciences faculty members, in collaboration with colleagues from Engineering, Business Administration and Economics, Physics, and Computer Science designed this new degree program.

Educational outreach activities included visits to area public, elementary, middle, and high schools to speak to students, externally funded programs to improve mathematics teaching at these levels, and an enrichment program for talented high school mathematics students. The department hosted the Diné College Science Honors program in Summers 1998 and 1999.

Research Activities

The productivity of our research program continued a growth trend begun in 1992, as did the number of faculty members supported by outside funds. Faculty members spoke at numerous conferences and universities. Interdisciplinary research remained an important part of our research effort. The department hosted the twenty-third Holiday Symposium in January. The Summer Research Award funded one faculty member this year.

Members of the department were productive researchers. **Caroline Sweezy** received Department of Mathematical Sciences Summer Research Awards, funded by an anonymous donation to the NMSU Foundation. Twenty of the tenure-track faculty members had a total of forty six papers appear in print in 1999. Seventeen faculty members had a total of forty papers accepted for publication, and twenty five faculty submitted forty seven papers for publication. A faculty member published an invited book chapter, and two books authored by faculty members went into their second editions. Faculty members are currently writing textbooks on mathematics appreciation, undergraduate textbooks on wavelet theory, introductory analysis, and original mathematical sources. One mathematical biography is in progress. One member of the department was commissioned by Oxford University Press to write biographies for the American Council of Learned Societies' multi-volume work, *The American National Biography*; he has written 67 biographies and three commentaries on the work of a mathematical physicist. Faculty members delivered dozens of talks on their research at conferences and at other universities. One faculty member presented a workshop on a workshop on computational algebraic geometry, and another presented workshops on mathematics education.

Faculty members continued to receive external funding to support their research. Nine faculty members conducted mathematics research with funding from the National Science Foundation, the National Security Agency, Sandia National Laboratory, Los Alamos National Laboratory, the Army Research Office, and the Astrophysics Research Lab (through PSL). Eight faculty members conducted funded educational research work on nine projects during the past year; some of these projects involved joint work with the high schools in Las Cruces. Support came from the National Science Foundation, the National Aeronautics and Space Administration, the New Mexico State Department of Education, the New Mexico Commission on Higher Education, the New Mexico Eisenhower Foundation, and the Intel Corporation.

Members of the department conduct joint research with mathematicians at other institutions. **Arkady Vaintrob** had funding from the Swedish Academy of Science to conduct research in that country and also conducted research at the Max Planck-Institut für Mathematik. **Ross Staffeldt** was supported by the Max Planck society during his visit there. **Irena Swanson** conducts joint research projects with faculty in Italy and Germany, among others, and used her NSF support and support of the Italian Research Council to visit her co-workers. **Hung Nguyen** was a Senior Research Fellow of the ASEE/NAVY Summer Faculty Research Program in San Diego, California, and **Joseph Zund** was a visiting researcher at the California Institute of Technology. **Susana Salamanca Riba** is on sabbatical leave at the University of Maryland. **Reinhard Laubenbacher** conducts joint research with staff at Los Alamos National Laboratory, Arizona State University, and PSL, and **Bill Julian** conducts research with Astronomy faculty at the University of Arizona.

The twenty-third Holiday Symposium on "Algebraic Structures for Logic" convened from January 3-7 with 70 participants. The main speakers, Professors **Jonsson** and **Blok**, presented five lectures each on topics in logic and algebra, some with applications to theoretical computer science. There were sessions for contributed talks by an international array of mathematicians.

The department sponsors a weekly colloquium and several weekly seminars. The colloquium series included 41 lectures during the year, presented by 27 visitors and 14 speakers from NMSU. Most of the speakers from other institutions visit the department to collaborate with our faculty on their research. Seven of the talks were presented by members of other departments on campus, explaining how they use mathematics in their research. The seminars specialize in algebra, analysis, cryptography, historical sources, lattice theory, statistics, and topology. One research seminar is run by graduate students. The "Basic Notions" is a more

informal, general interest seminar. Almost all faculty members and many graduate students attend the seminars.

Faculty members participate in interdisciplinary research. **Ernie Barany** is conducting joint research with faculty members in the College of Engineering and staff of PSL on externally funded projects. Statisticians **Hung Nguyen** and **Tony Wang** consult with researchers around campus. **Reinhard Laubenbacher** and **Mai Gehrke** are also working with the Physical Sciences Laboratory on funded projects. Our new faculty member, **Nhu Nguyen** has established a research program with an Electrical Engineering faculty member at Duke University. Together with Associate Dean Dasenbrock, **Ray Mines** is studying the mathematics in James Joyce's works.

Professional Service Contributions

The department provided service for the mathematical community and the university. It was an institutional member of several professional organizations and a sponsor of one journal. Faculty members worked on committees and conferences for these organizations. They served as journal editors and referees of research articles and grant proposals. For the University, faculty members were members of most university and college committees, and were outside representatives on tenure and promotions committees for nine departments. The department is represented in the faculty senate by **Doug Kurtz**.

Members of the department play an important service role in the mathematical community. The department is an institutional member of the American Mathematical Society, the Mathematical Association of America, the Society for Industrial and Applied Mathematics, the American Mathematical Association of Two-year Colleges and the Association for Women in Mathematics. It is an institutional sponsor of the *Pacific Journal of Mathematics* and a member of the Rocky Mountain Mathematics Consortium. Twenty members of the department served as referees for journals and books, reviewers for the two major mathematical abstract journals, and referees for grant proposals to the National Science Foundation, the National Security Agency and the Texas Advanced Research Program. Faculty members took part on conference organizing committees and organized special sessions at national and international conferences sponsored by professional societies. **Richard Bagby**, **Pat Baggett**, **Kitty Berver**, **Hung Nguyen**, **David Pengelley**, and **Joe Zund** served on editorial boards of professional journals. **Reinhard Laubenbacher** was the department's representative to the Rocky Mountain Mathematics Consortium and co-edited a special issue of the *Journal of Symbolic Computation*. **Ray Mines** served as the department's representative to the Mathematical Association of America and as a member of the board of directors of the *Pacific Journal of Mathematics*. **Hung Nguyen** was a member of the International Program Committee for the IEEE Conference on Fuzzy Systems. **David Pengelley** was a member of two MAA committees, and **Lolina Alvarez** was a member of the American Mathematical Society Committee on Committees. **Joe Zund** was a member of one Special Commission and two Special Committees of the International Association of Geodesy, and the chair of one Special Subcommission. He served on one committee of the American Geophysical Union.

Members of the department help to meet the university's service mission. Members of the department served on the Disability Resource Advisory Board, the Educational Diagnostician Advisory Council, the Faculty Senate and its Library Committee and ad hoc Committee on Admissions, two General Education Committees, an Outcomes Assessment Committees, and the Westhafer Award Committee. One faculty member serves on the Publications Board for the ASNMSU. The department provided advice and assistance to the College of Arts and Sciences with representatives on the Curriculum and Educational Policies, Faculty Affairs, Research Affairs Committees, and on the College Council. Faculty members served as outside members on tenure and promotions committees for the Departments of Astronomy, Chemistry, Computer Science, Government, History, Physics, Philosophy, and Psychology. Faculty members also served as advisors in the College of Arts and Sciences Advising Center and as advisors to several student

organizations. All department faculty members participated in committee work within the department.

Community Relations

Working with groups and agencies outside the university is important to the department. Several faculty members worked with Las Cruces Public School students and teachers. The Las Cruces PREP continues to thrive and provides mathematics enrichment for middle and high school students. SWRIMS introduced high school students and teachers to mathematical cryptography.

The department has been involved in the New Mexico Commission on Higher Education Mathematics Articulation Task Force, which coordinates the transfer of credits for mathematics courses among the institutions of higher learning in the state. Currently, **Kitty Berver** is cochair of the task force. She is responsible for maintaining the internet-accessible database that articulates transfer credits. She was also external evaluator of the lower division mathematics program at Eastern New Mexico University.

The department has increased and improved its interactions with local public schools. **Pat Baggett** reorganized her Math 111 (Fundamentals of Elementary Mathematics I) and Math 112 (Fundamentals of Elementary Mathematics II) classes to run concurrently with special topics Math 301 and Math 501 courses for pre and in-service teachers. Elementary education majors in these courses are paired with practicing teachers enrolled in the concurrent graduate course, who act as mentors to the pre-service teachers, allowing them to observe, co-teach, and finally teach alone, in their classrooms. She has developed a new course on technology for the classroom based on this model. Several other Math 111 and Math 112 instructors had their students observe public school classes. The in-service teachers received free tuition with funds provided by a grant from the New Mexico Commission on Higher Education. The administration of the Las Cruces Public Schools and, in particular, the Teachers' Center have been highly supportive of this initiative, which has led to several joint interactions involving the department, the public schools, and the College of Education. With funding from the New Mexico Eisenhower Foundation, **David Finston** developed a program to introduce new mathematical content into high school mathematics courses. The program included a combined Math 210G/401/501 course for NMSU undergraduates, pre-service teachers, and in-service teachers as well as Mathematical Sciences graduate students to develop classroom materials in English and Spanish for teachers' use.

Prof. **Pat Baggett** continues her practice of teaching a class a week in elementary and middle schools, presenting workshops, and addressing the LCPS School Cabinet. Several other faculty members are frequent visitors to area schools.

Alyne Fulte's PREP program continues to grow. It had financial support from National Aeronautics and Space Administration, Intel, and local companies. The 1999 program brought 200 sixth through tenth grade students to NMSU over the summer to learn mathematics, science and engineering. It seeks to intervene with minority students early in their public school careers, give them the encouragement and educational background necessary to keep them in school, and affords them the opportunity to pursue scientific and technological careers.

The NSF-funded SWRIMS, focused on the study of cryptography, was a research-based program involved graduate students, undergraduate students, high school teachers and high school students in the study of cryptography. This year was the last for this highly successful program.

The department maintains several display cases in public areas in Science Hall, in the classroom wing and near the department office. These help to introduce visitors to the members of the department and to give timely information about mathematical topics of current interest.

Three faculty members serve on a joint committee with members of the Doña Ana Branch Community College mathematics faculty. Their activities include working to develop a smooth transition from branch college to main campus mathematics courses, arranging mini-conferences involving members of both faculties at the beginning of each semester, and sponsoring the "After Math" contest in the student newspaper.

The department supports university and state activities by providing space for organizations on campus. It has housed the university's Women's Studies Program for ten years, as the university refuses to provide space for this recognized program. It converted a seminar room into the office of the southern coordinator for the New Mexico MESA (Mathematics Science Engineering Achievement) program and provides office space for the PREP director and secretary.

Outcomes Assessment Activities

Undergraduate Outcomes Assessment Activities

The department's undergraduate program evaluation includes a survey for graduates of the undergraduate program and exit interviews with graduating seniors. The survey was devised by members of the Undergraduate Majors/Minors Committee and the university's Institutional Research office.

Members of the Undergraduate Majors/Minors Committee interviewed several graduating seniors, asking the following questions:

1. What are you hoping to do eventually with your major in mathematics? What are your plans for next year?
2. What were the best aspects of your mathematics major program?
3. What were the worst aspects of your mathematics major program? What changes would you suggest to improve the mathematics program?
4. Has your mathematics major program enabled you to: identify a mathematics problem? characterize solutions to it? develop procedures for arriving at solutions? possess the technical skills to carry out a solution?
5. Has your mathematics major program enabled you to: read and understand mathematical writing? write and communicate mathematics in clear and understandable fashion? Has your mathematics major program enabled you to understand proofs of correctness of mathematical results?

In addition to these activities, the department has begun to develop a WorldWideWeb page that will be used to both inform our alumni about the department and allow the department to find out about our alumni and their careers.

Results of Assessment Activities

Interviews with graduating majors documented that students learn in many different ways, so it is important to offer a variety of approaches to any subject to enhance individual achievement. Two important factors in learning mathematics that were identified are motivation and using reasoning to solve meaningful problems. The department has made the use of applications of mathematics and technology more pervasive in its classes. We continue to encourage our majors to participate in national competitions, such as the Putnam Examination and the COMAP Modelling Contest.

In previous years, students suggested that a senior-seminar course would be a valuable addition to our undergraduate program. In response to this, the department proposed and the university approved the course. However the loss of two faculty positions in 1998 prevented its offering. Plans are underway offer a revised

version of a seminar course that will expose students to topics in contemporary mathematics, prepare them for their post NMSU mathematical life, and provide a captive audience for exit interviews.

General Education Assessment Activities

The goals of General Education Assessment are not completely clear at the present time. The department head and associate head Bagby met with Vice President Franco to discuss Gen Ed Assessment. We agreed to assist the Vice President in developing an assessment strategy. It should be noted that coordinators of the General Education mathematics courses 112G, 142G, and 210G have been collecting samples of student work as well as instructor guidelines and syllabi.

Graduate Outcomes Assessment Activities

The assessment of our graduate program includes a survey of graduates with advanced degrees and evaluation of the performance of our graduate students on master's and doctoral examinations. In 1999 we instituted a questionnaire administered to the chairs of graduate examining committees for the oral comprehensive exams and final orals for the master's and doctorate. The intent is to assess whether the examinee demonstrates mathematical breadth and content specific knowledge appropriate to his or her level. It should be noted that four students passed their master's examinations, three successfully defended the doctoral thesis and the questionnaires were administered at these exams.

Results of Assessment Activities

The information we have received from our established assessment activities does not warrant making further changes to our programs. In preparation for the Sloan Foundation proposal mentioned above, Rebecca Sellars of the NMSU Foundation administered a survey to recent, but not necessarily new, NMSU Ph.D.s about their experience in the program and how it prepared them for their present positions. One suggestion that emerged from this activity was that we could do a better job of preparing graduate students who enter academia for their academic responsibilities by devoting some time to issues like committee work, developing a long-term research program, grant application, etc. It seems as though this sort of assessment is valuable, and that we ought to do a better job of preparing our graduate students for the post NMSU mathematical lives.

Research Outcomes Assessment Activities

The proposal to assess the research program incorporated the university's mission with proposals from the American Mathematical Society, and involved the research production of faculty members and participation of graduate and undergraduate students in research and creative activities. The research production of the faculty is assessed by the percentage of the tenure-track faculty members who publish research results during each three-year period. This percentage should be at or above the average for Carnegie I Research Universities, which was 84% for the fall of 1994.

Results of our Assessment Activities

Over 90% of the tenure-track faculty members published research results during the past three years. During 1997, faculty members offered special-topics courses in pure and applied mathematics and mathematics education to both undergraduate and graduate students, introducing them to ideas at the cutting edge of these fields. The department offered special topics courses in the spring, summer, and fall, including advanced courses in mathematical physics and mathematics applied to signal analysis.. The majority of the faculty use problem-solving and writing assignments in their classes. Our students continue to participate in national mathematics competitions, and are often acknowledged for their performances. They competed in the Putnam

Examination and the Mathematics Modeling Contest. Graduate and undergraduate students are involved in mathematical research in the NSF-funded SWRIMS, NSF funded faculty research projects, externally funded programs in mathematics education, and on a research projects funded by the Physical Sciences Laboratory.

Department Self-Study

Part of the university's review process is university-wide self-studies, which began in spring, 1995. The department volunteered to be one of the first in the College of Arts and Sciences to perform a self-study. As the follow-up to the self-study, we proposed the following three activities:

1. Develop a research program in mathematics education.
2. Receive permission to hire visiting faculty members beginning in March for the following academic year.
3. Increase the number of minority students in our graduate program.

Over the past four years our success on items 1 and 3 are significant. The program in mathematics education is clearly defined and active. We are presently conducting a search for our second faculty member with primary research interest in mathematics education. Our graduate recruiting efforts resulted in 4 new students of minority heritage, and we have developed a program to funnel talented minority mathematics majors nationwide to our graduate program. Funding to sustain this effort is pending from the Sloan Foundation. Item 2 remains a problem. Faculty will continue to request leave without pay, and the temporary vacancies these leaves create give us an opportunity to get talented mathematicians as visitors. Early approval for visiting faculty will enable us to get the best fit for the department in terms of teaching needs and research compatibility.

Computing Facilities

The department made several significant advances in its computing facilities this year. The acquisition of 20 computers for the SH 118 computer laboratory and changes in service made by the department's Computer Operations Group have increased its flexibility for use by students and instructors. Networking changes make our portable machines usable in all of our classrooms. Networking upgrades to Science Hall and Walden Hall represent an improvement, but some trouble spots still remain. The operating system on the math network was upgraded to *Solaris*, with a resulting increase in security and availability of software. All math PC's have been tested for Y2K compliance, and math should not experience major hardware or software problems. The changes to the operating system necessitated the purchase of four new *Sun* machines, and two new faculty members were each provided with *Sun* computers. The department currently has twenty two *Sun* computers, including three *Sun* servers, ninety nine *IBM* compatible PC's, seven of which run *Linux/NT*, fifteen *Power Macintoshes*, seventeen printers, and an assortment of terminals. Additionally, there are two PC/overhead projector combinations used for instructional purposes. These machines are used by faculty members and graduate students for research and for the preparation of teaching materials and the handling of student grade records.

The department maintains three computer labs incorporating state-of-the-art equipment and software. The undergraduate lab houses twenty-five networked personal computers, equipped with the mathematics word processing and computing software, *Scientific WorkPlace*, designed by Adjunct Professor Roger Hunter, and the symbolic computing software, *Maple*. This lab has been used for students in calculus, linear algebra and several graduate-level courses. The graduate students' lab is equipped with 7 UNIX machines and two personal computers. The mathematics education computer lab houses eight *Power Macintoshes*. Although this lab is used for a variety of teacher education activities, it is inadequately equipped. Internal and external

funds are being sought to upgrade the equipment. An estimate for a BRR projects to make this space more usable for its intended purpose has been requested. Three 286-based PC's, provided with educational software that addresses the development of skills in algebra and trigonometry, are being used by students in the Mathematics Learning Center. The department has an ongoing need for advanced software for educational uses.

Advanced Degrees Awarded in 1999

Name	Advisor	Degree
Gary Hartshorn	Ray Mines	Master's
Rumiya Masagutova	Ross Staffeldt	Master's
Peter Manchev	Reinhard Laubenbacher	Master's
Wei Xiong	Hung Nguyen	Master's
Kristofer Jorgenson	David Finston	Ph.D.
Douglas Larmour	Pat Morandi	Ph.D.
Guo Wei	Hung Nguyen	Ph.D.

Departmental Colloquia in 1999

- **Department Colloquia for 1999.**
- Anna Guerrieri, Università di L'Aquila, Italy, *Primary Decomposition, Hyperdeterminants and Jacobian Ideals of Trilinear Forms*, January 19, 1999.
- Zhenyuan Wang, Mathematical Sciences, New Mexico State University, *The Theory of Nonadditive Set Functions and its Application in Information Fusion and Data Mining*, January 21, 1999.
- Janet Heine Barnett, University of Southern Colorado, *Forcing Mathematical Truth: Cohen's Method of Set Theoretical Forcing*, January 26, 1999.
- Susanne Pumpluen, Mathematical Sciences, New Mexico State University, *Composition Algebras Over Elliptic Curves*, January 28, 1999.
- Paul Gross, Mathematical Sciences Research Institute, Berkeley and Hewlett-Packard, Palo Alto, California, *Symbolic Dynamics in Analysis and Design of Nonlinear Systems*, January 28, 1999 (Special Lecture Series with Physical Science Laboratory and Electrical and Computer Engineering).
- Paul Gross, Mathematical Sciences Research Institute, Berkeley and Hewlett-Packard, Palo Alto, California, *Topology and Algorithms for 3-D Computational Magnetism*, January 29, 1999. (Special Lecture Series with Physical Science Laboratory and Electrical and Computer Engineering).
- Tonghui Wang, Mathematical Sciences, New Mexico State University, *Estimation in Multivariate Elliptically Contoured Distributions*, February 4, 1999.
- Yimin Xiao, University of Utah, *Packing Dimension and Fractal Properties of Stochastic Processes*, February 23, 1999.
- Vaidyanathan Sundarapandian, Washington University, *Local Asymptotic Stabilization and Observer Design for Nonlinear Control Systems*, February 26, 1999.
- Jorge Hounie, Universidade Federal de Sao Carlos, Brazil, *A Generalized Similarity Principle for Complex Vector Fields and Applications*, March 4, 1999.
- Martin Krupa, Technical University, Vienna, *Oscillations in Singularly Perturbed Systems*, March 5, 1999.
- Nhu T. Nguyen, University of Texas at El Paso, *Probabilistic Inference and Limit Laws in the Framework of Chu Spaces*, March 8, 1999.

- Phillip D. Straffin, Jr., Beloit College, *Liu Hui: The Beginning of Theoretical Mathematics in China*, March 11, 1999.
- John McCleary, Vassar College, Poughkeepsie, New York, *On the Origins of Spectral Sequences*, March 16, 1999.
- Michael O'Neill, University of Texas at El Paso, *Harmonic Measure and a Problem of J. E. McMillan*, March 18, 1999.
- John Fauvel, The Open University, United Kingdom, *Scenes From the Prehistory of Chaos Theory: Newton, Raphson and Other Problem-solvers Down the Ages*, March 22, 1999.
- Qing Huo Liu, Klipsch School of Electrical and Computer Engineering, New Mexico State University, *Applications of Mathematics in Computational Electromagnetics and Acoustics for Subsurface Remote Sensing*, April 8, 1999.
- Bernd Sturmfels, University of California, Berkeley, *Cellular Resolutions in Combinatorial Commutative Algebra*, April 9, 1999 (Special Lecture Series with Physical Science Laboratory).
- B. K. Sinha, University of Maryland, Baltimore County, *Meta Analysis: Combination of Polls*, April 15, 1999.
- Chris Weaver and Brendan Berver, Mathematics Accessible to Visually Impaired Students, New Mexico State University, *And now...Backwards!*, April 22, 1999 (Joint colloquium with Computer Sciences).
- Art Karshmer, Computer Science, New Mexico State University, *International Efforts in the Domain of Assistive Technologies*, April 22, 1999 (Joint colloquium with Computer Science).
- William Julian, Mathematical Sciences, New Mexico State University, *An Overview of the Calculators TI-89 and TI-92 PLUS*, April 22, 1999.
- Mary Ballyk, (affiliation unknown), *A Model of Microbial Competition for Nutrient in a Plug Flow Reactor With Wall Growth*, April 29, 1999.
- A. M. Mathai, McGill University and University of Texas at El Paso, *Distributions of Random Volumes*, May 6, 1999.
- Reinhold Huebl, University of Regensburg, Germany, *Geometric Applications of the Residue Theorem*, September 2, 1999.
- Arkady Vaintrob, Mathematical Sciences, New Mexico State University, *Moduli Spaces of Algebraic Curves, Cohomological Field Theories, and Integrable Differential Equations*, September 9, 1999.
- Bodo Pareigis, Mathematical Sciences, University of Munich and New Mexico State University, *Braids and Braided Categories*, September 16, 1999.
- Patrick Morandi, Mathematical Sciences, New Mexico State University, *Setting Up, Working With, and Creating Web Pages*, September 23, 1999.
- Luis Valdez-Sanchez, University of Texas at El Paso, *Surgery on Knots and Links in the 3-sphere*, October 7, 1999.
- Hanfeng Chen, Bowling Green State University, Ohio, *Tests for Homogeneity in Finite Mixture Models*, October 21, 1999.
- Tian-You Hu, University of Wisconsin-Green Bay, *Some Open Questions Related to Probability, Fractals, Wavelet and Tiling*, October 28, 1999.
- Takis Sakkalis, Agricultural University of Athens, *Piecewise Linear Approximation of Curves and Surfaces via Delaunay Triangulations*, November 4, 1999.
- Vladimir Hinich, University of Haifa, Israel, and Mathematical Sciences Research Institute, Berkeley, *Operads, Lie Algebras and Knot Invariants*, November 9, 1999.
- Michael O'Neill, University of Texas at El Paso, *McMillan's Area Problem*, November 11, 1999.
- Ezra Miller, University of California, Berkeley, *Equivariant K-theory of Flag Manifolds, Gröbner Bases and Alexander Duality*, November 12, 1999.
- Brook Milligan, Biology, New Mexico State University, *Understanding Biology Through Mathematics: Genealogical Models in Evolutionary Biology*, November 18, 1999.
- Serge Tabachnikov, University of Arkansas, (Title TBA), December 2, 1999.

Refereed Faculty Publications and Books Appearing in 1999

Josefina Alvarez

- Alvarez, J: "Spectra of pseudo-differential operators in the Hormander class," in "*Analysis of Divergence: Control and Management of Divergent Processes*". Birkhauser (1999) 187-199.
- Alvarez, J. & Carton-LeBrun, C.: "Optimal spaces for the for the S'-convolution with the Marcel Riesz kernels and the n-dimensional Hilbert kernel," in "*Analysis of Divergence: Control and Management of Divergent Processes*". Birkhauser (1999) 233-248.
- Alvarez, J. & Hounie, J.: "An oscillatory singular integral operator with polynomial phase." *Studia Mathematica* 133 (1999) 1-18.
- Alvarez, J.: *Mathematics Appreciation*, a book chapter in "*Inspiring Students: Case studies in motivating the learner*". Kogan Page, London (1999) 1-18.

Ernest Barany

- Colbaugh, R., Glass, K. & Barany, E.: "Adaptive control of nonholonomic robotic systems for waste management applications," *International Journal of Environmentally Conscious Design and Manufacturing*, Vol. 8 , No. 3, 1999.
- Colbaugh, R., Barany, E., & Trabatti : "Control of nonholonomic mechanical systems using reduction and adaptation," *Robotica* 17 (1999).
- Colbaugh, R., Barany, E., & Glass, K.: "Identification of SCADA systems: Case studies" *Proc. 38th IEEE Conference on Decision and Control*, Phoenix, AZ, December, 1999.
- Barany, E. & Colbaugh, R.: "Identification in the presence of symmetry: Oscillator Networks", *Proc. 38th IEEE Conference on Decision and Control*, Phoenix, AZ, December, 1999.
- Barany, E. & Colbaugh, R.: "Control of symmetric mechanical systems with incomplete model information using reduction , dynamic feedback, and flatness", *Proc. 1999 American Control Conference*, San Diego CA, June 1999. (Invited paper).
- Barany, E. & Colbaugh, R.: "Identification of symmetric dynamical systems: Preliminary study", *Proc. 1999 American Control Conference*, San Diego CA, June 1999.

Marcus Cohen

- M. Cohen, "Chiral Unification of Electroweak and Gravitational Interactions", *International Journal of Modern Physics*, D. **8**, 417-458, (refereed).
- M. Cohen, *Cosmological Determination of the Weinberg Angle*, in "The Photon: Old Problems in the Light of New Ideas", ed. V. Dvoeglazov, Nova, 1999, (Invited contribution-refereed).
- M. Cohen, *A Nonlinear Twist on Inertia gives Unified electroweak-gravitation*, in "Fragments in Science - a Festschrift for Mendel Sachs", ed. M. Ram, World Scientific, 1999. (Conference Proceedings).

David Finston

- Deveney, J.K. & Finston, D.R., "Determining local triviality of G_a actions," *Communications in Algebra* 27 (1999) 3031-3039.
- Deveney, J.K. & Finston, D.R., "Local triviality of proper G_a actions," *Journal of Algebra* 221 (1999) 692-704.

Mai Gehrke

Gehrke, M., Walker, C., & Walker, E.: "Algebraic aspects of fuzzy sets and fuzzy logic", *Proceedings of the First International Workshop on Current Trends and Developments in Fuzzy Logic*, (1999) 101-170.

Gehrke, M.: "A note on negations and nilpotent t-norms", *International Journal of Approximate Reasoning* 21 (1999) 137-155.

Bouchon-Meunier, B., Gehrke, M., & Kreinovich, V.: "Propositional fuzzy logics: Decidable for some (algebraic operators, undecidable for more complicated ones)", *Journal of Intelligent Systems* 14 (1999).

John Harding

Harding, J., "The axioms of an experimental system", *The International Journal of Theoretical Physics* 38 (1999) 1643-1675.

Susan Hermiller

Hermiller, S. & Meier, J., "Artin groups, rewriting systems, and 3-manifolds", *J. Pure and Applied Algebra* 136 (1999) 141-156.

Hermiller, S. & Shapiro, M. : "Rewriting systems and geometric 3-manifolds", *Geometrica Dedicata* 76 (1999) 211-228.

Hermiller, H., Kramer, X., & Laubenbacher, R.: "Monomial orders, rewriting systems, and Grobner bases for the commutator ideal of a free algebra", *J. Symbolic Computation* 27 (1999) 133-141.

Martin Krupa

Chossat, P., Krupa, M., Melbourne, I., & Scheel, A.: "Magnetic dynamos in rotating convection - a dynamical systems approach", *Proceedings of the Conference on Differential Equations and Dynamical Systems*, special issue of *Dynamics of Continuous, Discrete, and Impulsive Systems* (1998).

Joseph Lakey

Hogan, J. & Lakey, J.: "Sharp embeddings for modulation spaces and the Poisson summation formula" in *Sampling Theory and its Applications*, Norwegian Univ. Sci. and Tech (1999).

Lakey, J.: "Constructive decomposition of functions of finite central mean oscillation", *Proc. Amer. Math. Soc.* 127 (1999) 2375-2384.

Reinhard Laubenbacher

Hermiller, H., Kramer, X., & Laubenbacher, R.: "Monomial orders, rewriting systems, and Grobner bases for the commutator ideal of a free algebra", *J. Symbolic Computation* 27 (1999) 133-141.

Patrick Morandi

Morandi, P.: "Lie algebras, composition algebras, and the existence of cross products on finite dimensional vector spaces" *Expositiones Mathematicae* 17 (1999) 63-74.

Hung T. Nguyen

Kreinovich, V. & Nguyen, N.: "How to divide a territory? A new and simple differential formalism for optimization of set-functions", *International Journal of Intelligent Systems* 14 (1999) 223-251.

Kreinovich, V., Nguyen, H., & Wu, B. : "Chu spaces- A new approach to diagnostic information fusion", *Proceedings of the Second International Conference on Information Fusion*, Vol. I (1999) 323-330.

Kreinovich, V., Nguyen, H., & Wu, B.: "Justification of heuristic methods in data processing", *IEEE International Fuzzy Conference Proceedings II* (1999) 113101136.

Kreinovich, V., Nguyen, H., & Yam, Y.: "Multi-resolution techniques in the rule-based intelligent control systems: A universal approximation result", *Proceedings of the IEEE International Symposium on Intelligent Control*, Cambridge, MA (1999) 213-218.

Nguyen, H. & Walker, E.: *A First Course in Fuzzy Logic* (Second Edition) Chapman and Hall (1999).

Nhu Nguyen

Liu, Q.H. & Nguyen, N.: "Regular Fourier matrices and nonuniform fast Fourier transform", *Siam J. Sci. Comp.* 21 (1999) 283-293.

David Pengelley

Bisson, T., Pengelley, D., & Williams, F.: "Stabilizing the lower operations for mod 2 cohomology", in *Homotopy Invariant Algebraic Structures*, Contemporary Math. 239, American Mathematical Society (1999) 39-47.

Arkady Vaintrob

Malikov, F., Schechtman, V., & Vaintrob A.: "Chiral De Rham complex", *Communications in Mathematical Physics* 204 (1999) 439-473.

Tony Wang

He, R. & Wang, T.: "An alternative proof for a version of Cochran's theorem under elliptical settings", *Communications in Statistics* 28 (1999) 1133-1144.

Frank Williams

Bisson, T., Pengelley, D., & Williams, F.: "Stabilizing the lower operations for mod 2 cohomology", in *Homotopy Invariant Algebraic Structures*, Contemporary Math. 239, American Mathematical Society (1999) 39-47.

Joseph Zund

Zund, J.: "An essay on the foundations of Gaussian differential geometry -III: Sphere geometry", *Bolletino di Geodesia e Scienze Affini*, anno LVII (1998) 309-321.

Zund, J.: "Tensorial methods in classical differential geometry- V: Invariant theory and projective geometry", *Tensor new series* 58 (1997) 143-148.

Summary of Grants Active in 1999

Faculty Member(s)	Grant title	Agency
Josefina Alvarez	" $S^{\mathbb{C}}$ -Convolution & the Helmholtz Equation"	NMSU: Arts and Sciences Research Center Minigrant
Pat Baggett	A Proposed New Mathematics Course for Prospective and Practicing K-8 Teachers: Elementary Mathematics with Technology	NMCHE: New Mexico Commission on Higher Education
	Collaborative for Excellence in Teacher	

Pat Baggett	Preparation	National Science Foundation
Ernie Barany et al	Modelling, Simulations and Identification of SCADA systems: Proof of Process	Dept of Defense/NMSU Physical Science Laboratory
Alyne Fulte	PREP	Intel Foundation
Alyne Fulte	PREP	New Mexico Summer Food Service
Mai Gehrke	Canonical Extensions of Bounded Distributive Lattices with Additional Operations	NMSU: Arts and Sciences Research Center Minigrant
Sandy Geiger	MAVIS	NSF
Sandy Geiger	MAVIS	Duxbury Systems
Susan Hermiller	Rewriting systems and geometric group theory	National Science Foundation
Joseph Lakey	Divergence free multiwavelets	Sandia National Laboratories
Reinhard Laubenbacher	Polynomial System Solving	American Mathematical Society/ Society for Industrial and Applied Mathematics
R. Laubenbacher	The Amazing World of Cryptography	Los Alamos National Laboratory
R. Laubenbacher	SWRIMS	National Science Foundation
R. Laubenbacher	Theoretical Foundations of Computer Simulation	Los Alamos National Laboratories
J. Lodder, R. Laubenbacher, A. Knoebel, D. Pengelley	A Capstone Course: Learning Mathematics Through Original Sources	National Science Foundation
Jerry Lodder	"Leibniz Cohomology, Differential Geometry and Foliations"	National Science Foundation
Susana Salamanca-Riba	Unitary Representations & Zuckerman modules	National Science Foundation
Irena Swanson	Powers of Ideals	National Science Foundation
Irena Swanson	Professori Visitatori	GNSAGA-CNR