Calculus in the New Millennium
A blended first semester Calculus with collaborative groups, on-line homework and multimedia aids.
Transforming Course Design, Category: Demonstration

SAN FRANCISCO STATE UNIVERSITY

Project leaders:

Arek Goetz, Associate Professor of Mathematics, San Francisco State University
Eric Hsu, Associate Professor of Mathematics, San Francisco State University

Potential number of students if the pilot project is successfully adopted: 800 annually.

Amount requested: $24,578

Team members:

Eric Hayashi, Acting Chair of Mathematics

[Additional instructors to be selected for Spring 2008]

Advisory Committee:

David Bao, incoming Chair of Mathematics (currently at University of Houston)
Linda Buckley: Associate Vice President for Academic Planning and Educational Effectiveness
David Ellis, Professor of Mathematics, Director, SF State LSAMP Program
Maggie Beers: Director of Academic Technology
David Meredith, Professor of Mathematics, past Chair of Mathematics and current Chair of the SF State Academic Senate.
Pamela Vaughn, Associate Dean, Center for Teaching and Faculty Development

Factors Contributing to Successful Projects in Transforming Course Design

(from the Transforming Course Design website):

1. There has to be strong leadership and a strong commitment on the part of the department or program to do the project, to ensure sustainability. It cannot be the domain or idea of a single faculty member or group of faculty members.

   • The two project leaders are experts in complementary instructional methods (Goetz: on-line instruction and Hsu: collaborative group instruction and training of instructors).

   • They have the backing of the current and future Department Chairs and College Dean (see letters).

   • There is an Advisory Committee comprised of senior faculty and key campus officials
concerned with technology, assessment and faculty development.

2. There needs to be buy-in to the project from all the major contributors to the project, e.g., Library, Assessment, Faculty Development, Information Technology.

   • The Mathematics Department leadership strongly supports the project and the department has sufficient technological resources to support the on-line components.

   • Academic Technology provides a stable, Moodle-based learning management system (iLearn) and adequate network resources.

   • The SF State Office of Academic Planning and Educational Effectiveness and the Center for Teaching and Faculty Development (CTFD) will assist with developing assessment rubrics and faculty training workshops.

   • The Advisory Committee includes leaders from the CTFD, Academic Planning and Academic Technology.

3. There needs to be an institutionalized mechanism within the program or course to seek and measure student and faculty feedback, and there needs to be the flexibility in the plan to be able to make changes to the redesign and course materials where appropriate.

   • While the course is being offered the instructors and the Advisory Committee will meet biweekly to review student progress as shown by homework and exams. Having most student assessment on-line will make it possible to collect fine-grained statistics about student success on individual tasks.

   • The syllabus for the classes will be sufficiently flexible to allow changes in response to patterns of student learning (or not learning).

4. There needs to be a good model and good method of assessing outcomes. This should not rely too much on "horse-race" like comparisons between a treatment course and a control course, as these methods are not always feasible or reliable. Departments and institutions need to develop a range of effective and efficient assessment models.

   • Assessment will be made for all objectives, both mathematical and affective.

   • Homework and exams will be keyed to learning objectives and results collected in the same way. The department currently has a common final for each of the first-year calculus courses, which will allow us to compare test performance between project and non-project classes.

   • We will also track changes in student attitudes and community building. Not only is it our hypothesis that increased student engagement will lead to improved learning, but ultimately the course will be successful only if students leave it believing that they can use mathematics and that they want to use mathematics in their future studies and careers. We will make use of frequent, brief internet surveys of student opinion about the class to adjust our methods to keep students interested, engaged and motivated. More ambitiously, the US Dept of Education has funded a FIPSE project creating video case studies of college teaching. The researchers (Prof. Hauk at U. Northern Colorado and others) have expressed interest in collecting video data and analyzing it for qualitative evidence of engagement and community.

5. The technical infrastructure needs to be in place to support any provision of online materials.
• SF State has an exceptionally robust, Moodle-based learning management system (iLearn) backed by extensive training opportunities for faculty and staff. All participants in the project are experienced users of learning management systems. Maggie Beers, the Director of Academic Technology (which houses iLearn), is a member of the project Advisory Committee.

• The Department of Mathematics has long managed its own servers for internal applications. Dr. Goetz has used extensive on-line components in his calculus courses for many years, and in spring 2007 he is teaching a calculus class entirely on-line supported by Math Department servers.

6. Similarly, technical and faculty development support is a key variable and is a crucial element of success. We cannot assume that faculty has the experience necessary to implement the changes required, and they need support in order to be able to make these changes. Faculty development support is needed to help faculty develop new pedagogical strategies to improve learning and student success.

• Dr. Hsu is a nationally-known mathematics educator specializing in university-level math education. He currently holds an NSF CAREER award. He has successfully taught three semesters of calculus at SFSU driven primarily through challenging group work, and spent several years before that in leadership roles with the nationally-influential Treisman calculus workshops at UC Berkeley and UT Austin. He has for several years taught a course (Math 700) to prepare Graduate Teaching Associates to teach in the math remedial program as well as other courses and seminars for teachers and pre-teachers. He is widely respected in the Department as a pedagogical innovator, and we believe that he will lead a transformation of teaching methods for calculus.

• Dr. Goetz has a long history of innovation through on-line methods in his teaching. He is currently teaching a section of Calculus I entirely on-line (see http://calculus.sfsu.edu/).

• Additional training resources will be made available through the SF State Center for Teaching and Faculty Development and Academic Technology.

Current Campus Projects or Plans Related to CSU Transforming Course Design

Our campus is undertaking this project as our first venture in Transforming Course Design; consequently, how we handle this course redesign will be critical to our future endeavors. We will learn from and build on the success of this project to develop models that can be used for a second round of course transformation. Among the courses that we would be considering are MATH 124, Elementary Statistics (GE); ECON 100, Introduction to Macroeconomic Analysis (GE); and BUS 360, Business Communication. All of these courses have a high failure or repetition rate among students, and the Business course in particular is required for 20% of our undergraduate population.

Description of the need or issue addressed by the proposal.

Whether we look across the United States or just at San Francisco State University, the lack of student success in calculus courses is deplorable. All students majoring in Chemistry, Computer Science, Economics, Engineering, Geology, Meteorology, Oceanography and Physics must take Calculus I, as well as about half of the Biology majors. This amounts to about 800 students a year. Yet in a typical semester (Fall 2006) at SF State, only 30% of registered students in Calculus I earned a grade of B- or better, and only 50% earned a grade of C or better and qualified to continue to Calculus II. According to reports shared in Fall 2005 by CSU Math Chairs, success rates are about as low at many other CSU campuses. Calculus is a gatekeeper to entry into most science majors, so improving the success rate in calculus could well allow more students to succeed in the sciences.
Two primary reasons for failure stand out: poor preparation and lack of student engagement. Many students lack prerequisite skills in algebra, trigonometry and logical reasoning, and the same students find it difficult to learn calculus in the present lecture format. This is not to blame the students, many of whom spend hours each week struggling to read their book and do their homework. They just lack the strategies to learn calculus without additional support.

Experience in the Mathematics Department at CSU, Los Angeles (verbal communication from Chair Pudakkhottai Subramanian) has demonstrated that providing two additional hours a week of carefully designed supplemental instruction and practice for students has increased the success rate in calculus by more than 20 percentage points.

We believe that calculus instruction at SF State fails to engage a large proportion of the students. They do not learn effectively from current textbooks, lectures and problem sets, and their demeanor in class (when they bother to come) indicates that they have little hope of doing better. This project is designed to provide calculus students with additional support in a cost-effective manner through the utilization of on-line, interactive curricular materials and classroom instruction based on the principles of active and collaborative learning. The key concept is interactive, because interactivity is the component that is missing from current calculus instruction.

Descriptive of project objectives and milestones.

The project has three objectives:

1. Improve student success in Calculus 1.

2. Improve student experience in Calculus 1 by making it a more engaging and rewarding class.

3. Reduce the cost per student of Calculus 1.

The first objective seems obvious, but it needs to be clarified with a definition of "student success." We aim to improve student performance on homework and exams by more intentionally coordinating learning objectives with teaching methods. The crude measure of our progress will be increasing the number of students who pass the class satisfactorily; a more detailed assessment will come out of analyzing student success at meeting the learning objectives.

The second objective, improving student experience, is in some ways the most important for two reasons. First, it is our hypothesis that poor student performance and negative student attitudes towards calculus are mutually reinforcing. We want to move students into a different feedback loop where good performance and positive attitudes sustain each other. Second, the long-range goal of calculus is not to teach students to pass a final exam. It is to send them away capable of using mathematical methods and eager to apply them to their future studies and careers. For both these reasons, improving student attitudes toward calculus and towards their calculus class will be key components of our project.

Finally, the SF State Math Department, like every unit within CSU, lacks the resources needed to perform all the tasks set for it. Improving the efficiency of Calculus I, in particular extending the reach of the senior faculty through the effective use of on-line resources and trained Lecturers and Graduate Teaching Assistants, will free resources for richer major and graduate programs in the Department.

The per-student cost of Calculus I classes at SF State is approximately $317; the direct teaching cost of the project will be about $250 per student. While these values depend to some extent on accounting conventions used at the SF State campus (for example, they do not include benefits), the ratio should not change much no matter how costs are measured. We believe that the methods proposed in this
project could save in excess of 20% compared to current methods.

**What are the milestones for the project?** By the middle of fall semester 2007 we should have completed detailed specifications for Calculus I including weekly learning objectives for students and rubrics for assessment. By the end of fall semester instructors should be initiated into the methods and objectives of this project course, and all course materials should be in place. Our minimal goal at the end of spring semester 2008 is for 65% of enrolled students to show adequate learning and be ready for Calculus II.

The funded component of the project will have a one-year duration, although we expect the project to continue with both regular state funding and external seed funding as needed into future years. The expected cost efficiency of the program will make continuation of its basic structure affordable for the SF State Math Department past the initial year.

**An outline of the methods and activities for the project, including assessment of outcomes.**

The goal of this project is to design and offer a Calculus I class that effectively combines the capabilities of on-line interactive learning systems with classroom teachers using the principles of active learning to instruct students in collaborative groups.

**Course Design**

Students will receive four units of academic credit for the class, the same as is now awarded for Calculus I at SF State.

1. Calculus concepts and methods will be introduced through a weekly two hour on-line calculus lesson interspersed at regular intervals of no more than ten minutes with interactive activities. The activities must be successfully completed to continue the lesson, and the system has the capability of tracking student participation.

2. Concepts and methods will be reinforced in classes meeting three hours each week under the guidance of an instructor trained in collaborative group, active learning methods and following a carefully prepared syllabus.

During the first pilot semester, Spring 2008, three sections of Math 226 (Calculus I) will be taught, one by a GTA alone with occasional visits by the Project Directors, and two by a team consisting of one Project Director and one GTA. In two sections the Project Directors will observe directly how students react to the course materials and how instructors use their training; the third section will help directors determine how to support a GTA leading the class primarily on their own. This will set the groundwork for future scaling of the project by incorporating more graduate instructors and Lecturers.

Students will be assigned homework of two types. Most of the homework will be delivered by an on-line homework system. This system will provide instant feedback to students as well as detailed assessment of student progress to instructors. Such systems have proven successful in many trials nationwide; one such system, WebWork, is currently used in several classes at CSU, Northridge and CSU, Long Beach. There are over 100 institutions in the US who have adopted WebWork or similar online homework systems.

Six times each semester students will be asked to write a literate answer to a problem. They will state in complete sentences what the problem asks, how they found their answer, and what their answer means. These papers are usually little more than one page long, but that is more formal writing than most calculus courses require. We believe that even occasional writing shows students the thought processes they should employ when solving problems and prepares them for more advanced work in mathematics. These solutions will be graded by the classroom instructors.
Fifty-minute examinations will be held at key points during the semester, and a 2.5 hour final will be administered at the end of the class. The SF State Math Department uses a common calculus final, and students in the project course will take it with the other calculus students.

**Expected Improvements Over Typical Calculus Lecture Courses**

1. Students will be more mentally active and engaged.

2. Instead of reading a text or listening to a lecture, students will interact with on-line multi-media lessons interspersed with questions that they are required to answer correctly before proceeding.

3. Instead of waiting a week or two for homework corrections, students will do homework in an environment that provides immediate feedback.

4. Instead of passively sitting in class, students will spend their class time working in collaborative groups and using methods of active learning to reinforce concepts introduced in the reading and homework. By meeting for three hours each week, these classes will provide ample opportunity to review forgotten techniques from algebra and trigonometry. Instructors will be trained in leading collaborative groups and the principles of active learning.

Furthermore, instructors will be more engaged:

1. Instead of waiting for students to turn in a weekly homework or quiz, instructors will interact with students in class as problem-solvers, and will immediately have a better sense of their strengths and weaknesses, both collectively and individually.

2. Instead of waiting to see aggregate results of homework/quizzes, or more belatedly, exams, professors can see student performance on the instantly-graded online homework, to better adjust the focus of the contact hours.

**Assessing Outcomes**

We will assess two kinds of student outcomes: content learning outcomes and affective outcomes. First, we will prepare a list of learning objectives based on the standard calculus syllabus, and assess student performance using homework (written and electronic) and exam performance data. The use of a common final will allow us to compare performance across project and non-project classes. We also hope to see improvement in attitude and persistence. At the start and at the end of class, we will give a survey to students about their attitude towards math and science, their understanding of the nature of scientific and mathematical inquiry, and their opinion of the effectiveness of different program components. We will also track student performance in all calculus sections for the following two years to see their persistence and performance in science/math classes.

**A time-line for planned activities, including the final report on the project.**

*Fall Semester 2007*

- Ongoing: Bi-weekly meetings of the Project Leaders and Advisory Committee to review progress.

- October 1: Prepare overall course outline including schedule of exams and general order of topics.

- October 15: Complete weekly learning objectives for the course including assessment rubrics.
October 30: Select three instructors (GTAs or Lecturers) to work in the 30-student classes that will be part of this pilot. Begin training them in collaborative group instruction methods and weekly learning objectives for the course.

December 15: Complete design of 30 hours of interactive on-line instruction covering Calculus I. The basis for these materials will come from Dr. Goetz' distance learning calculus class, which is already in operation.

December 15: Complete design of fifteen interactive on-line homework assignments for the entire course and supplemental on-line course materials. Complete design of six written assignments.

December 15: Complete design of 45 hours of classroom instruction.

December 15: Complete training of instructors.

Spring Semester 2008

Ongoing: Enroll and teach 90 students divided into three sections of Calculus I (Math 226).

Ongoing: Hold bi-weekly meetings of the instructors and the Advisory Committee to prepare examinations, review student progress and record desired changes in course materials and methods.

Ongoing: Design, administer and analyze bi-weekly student opinion surveys about the course and their own learning.

Ongoing: Cooperate with FIPSE video case study project.

June 30: Complete final report of project including a detailed assessment of student learning and a full cost-accounting.

Expected results and how these results will be used on the campus and/or within the CSU.

We expect to pilot a form of calculus course that teaches more effectively than the current methods while costing less. We will be successful if more students successfully complete the course, if more topics are mastered, if more students earn A's and B's, and if students prefer the new format to the old one. If we are successful, we expect to increase the size of the pilot group during AY 2008-09, and if the larger pilot is successful all Calculus I classes at SF State could use the new format in AY 2009-10.

Outcomes of the project will be disseminated through the CSU portal ELIXR, the national portal MERLOT, and conferences and journals devoted to university teaching of mathematics. A full report will be made to the CSU Math Chairs Council, which meets twice yearly. Course materials will be available for testing at other CSU campuses, and if there is sufficient interest Project Leaders will organize workshops on the methods developed in this project.

Resources requested, and a description of other campus resources committed to the project.

We request a total of $24,578

Budget

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<th>CSU</th>
<th>SF State Teaching Cost</th>
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<td>Arek Goetz</td>
<td>3 wtu fall</td>
<td>$4,516</td>
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Budget Notes

1. Replacement cost for faculty prorated from a full-time annual cost $45,156 as recommended by John Kim, Acting Associate VP for Academic Resources.

2. During fall semester Goetz and Hayashi will each receive 3 WTU released time for development work, paid by the grant. Goetz will develop 30 hours of on-line, interactive lessons while Hayashi writes learning objectives, assessment rubrics and homework.

3. During spring semester Dr. Goetz will receive 3 WTU of assigned time from the grant to maintain the on-line materials for the course. Dr. Hsu will receive 3 WTU for training and supervising three GTAs.

4. During spring semester the grant will pay for one WTU for each of the three GTAs. Normally, a GTA receives one WTU for helping with calculus. Since they are teaching a three-hour activity session each week we wish to pay them for two WTU.

5. SF State will pay Goetz and Hsu each 3 WTU for teaching the 4-unit calculus class of 90 students.

6. SF State will pay each of three GTAs one WTU for assisting with the calculus class.

7. CSU will pay for up to $2,000 in supplies and services, including copying costs and any software licenses that may be required for the project.

Qualifications of Project Leaders

Arek Goetz

Besides his NSF supported research in dynamical systems, Dr. Arek Goetz has been active in using
cutting edge technology in teaching Calculus for the last 11 years. He taught calculus in almost all settings at the University of Illinois at Chicago, at Boston University, and at San Francisco State University. At Boston University, the classes reached 150 students, at San Francisco State University they vary between 30 and 100 students. He developed a sequence of dynamic applets that elucidate concepts pertaining to motion, introduced Mathematica to curriculum, advocated student active participation in class in groups. Perhaps, the most significant endeavor related to this project, has been the development of the STREAM infrastructure (stream.sfsu.edu). This hardware/software infrastructure enables the instructor to seamlessly record, stream, archive mathematics lectures. During this process he has gained not only the technical experience in internet video recording, streaming and archiving, but has also gained a valuable experience as the person being recorded. A careful balance of cutting edge technology with traditional tested pedagogical ideas has been consistently recorded in favorable student evaluations.

**Eric Hsu**

Dr. Eric Hsu is a nationally known mathematics educator specializing in university-level math education. He currently holds an NSF CAREER award, studying teacher communities and their influence on practice. He has successfully taught three semesters of calculus at SFSU driven primarily through challenging group work, and spent several years before that in leadership roles with the nationally-influential Treisman calculus workshops at UC Berkeley and UT Austin. He has for several years taught a course (Math 700) to prepare Graduate Teaching Associates to teach in the math remedial program as well as other courses and seminars for teachers and pre-teachers. Since 2002, he has been the Secretary for the MAA Special Interest Group on Research on Undergraduate Math Education. In the electronic/Internet realm, he is known nationally for two web databases at betterfilecabinet.com (1) a web-based database of hundreds of calculus problems and best teaching practices, with special focus on pedagogy for new leaders of Treisman-style intensive workshops for women and minorities, and (2) a web-based database of nearly two thousand papers on math education and statistics education. From 1999-2001, he led the design team for a web site for the AP Equity Initiative (a joint project of the College Board, the University of Texas, and Cogito Multimedia) delivering large-scale online professional development for Texas AP Calculus teachers and rigorous content support for students.

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**AREK GOETZ -- Vitae**
dynamics.sfsu.edu/goetz
calculus.sfsu.edu
stream.sfsu.edu

**A. EDUCATION**
1990-96 University of Illinois at Chicago,  
**MS** in Mathematics 1992, PhD in Mathematics 1996  
1996-99 Boston University,  
Postdoctoral Visiting Assistant Professor in Dynamical Systems

**B. POSITIONS**

**Long Term**
San Francisco State University, Associate Professor (2003--)
San Francisco State University, Assistant Professor (1999-2003)
Boston University, Visiting Assistant Professor (1996--99)
University of Illinois at Chicago, University Fellow, Research and Teaching Assistant (1991-96)

**Short Term**
IMPA, Rio, Brazil (January--March 2006)
IHES, Bures sur Yvete, France (November 2004 { January 2005)
CNRS, Marseille, France (summer 2001)

**C. GRANTS RECEIVED, DISTINCTIONS, HONORS AND COMPETITIONS**
• NSF International Fellowship Grant, Fall 2002-2005
• Three year NSF research grant in Geometric Analysis, Fall 2001-2004
• SFSU Center for Computing for Life Sciences mini-grant, 2005
• SFSU Office of International Program Curriculum Grant, Fall 2004
• SFSU Presidential mini-grant, Spring 2003.
• SFSU Presidential Semester Research Leave, Spring 2002
• Technology Enhanced Course Delivery Initiative Grant, Fall 2000 and 2001
• SFSU Presidential Summer Research Grant, Summer 2000
• SFSU Provost Course Release Award, Spring 2000
• University Fellowship Award (University of Illinois at Chicago, 1994-95)
• United States Department of Education Graduate Fellowship (1991-94)
• Competitions
  – Top 200 in Putnam Examination
  – Fourth prize in the National Mathematics Olympiad in all of Poland
  – 14th place in Poland in the National Physics Olympiad
  – 18th place in Poland in the National Olympiad in Astronomy

D. SELECTED 10 PUBLICATIONS

E. SOFTWARE PLATFORM DEVELOPED
Stream architecture for automatics mathematics recording and cataloging. SFSU 2001-2007

F. SYNERGISTIC ACTIVITIES
Leadership in new pedagogical tools with broad impact.
Architect and developer of an infrastructure for streaming and archiving mathematics lectures at San Francisco State University. Series of lectures are cataloged according to topics and keywords and are available to the community members, which include underrepresented minority and homebound persons.
Developed, successfully implemented, and disseminated cutting-edge technology in class: interactive computer presentation using Mathematica, Java. Tools are used by other faculty in teaching.

Wide Research Dissemination. Delivered over sixty research talks and expository talks at international conferences and at various universities in the U.S. and abroad.
Examples include:
Recent talks at conferences
Banach Center, Warsaw, June 2005.
Algebraic Dynamics Workshop (main speaker), Sydney, February 2005.
Annual Northern California MAA meeting, invited address, February 2003.
Workshop on Piecewise Isometries, a minicourse, Marseille, June 2002.
International Conference on Dynamics and Fractals (Univ. of Graz), June 2001.
Workshop in Dynamical Systems (Univ. of Luminy, France), February 2001.

Service to community.
Co-organizer (Peter Ashwin and Anthony Quas) of Banff weeklong research conference on Piecewise Isometries.
Co-organizer (with Peter Ashwin, Franco Vivaldi and Sebastien Van Strien) of the Workshop on Geometric Dynamics with Singularities, the University of Exeter, Great Britain, December 2005
National Grant proposal reviewer (The Engineering and Physical Sciences Research Council (the British equivalent of the NSF), Fall 2005
Grant Panelist, Colorado Institute of Technology, May 2004.
One of the main organizers and promoters of the International Workshop on Piecewise Isometries, Marseille, June 2002.
Served on doctoral committee for Guillaume Poggiaspalla.
Frequent referee for international journals: Transactions of the American Mathematical Society, Nonlinearity, Ergodic Theory and Dynamical Systems, Dynamical Systems and Applications, and Continuous and Discrete Dynamical Systems.

F. COLLABORATORS & OTHER AFFILIATIONS Peter Ashwin (current), Anthony Quas (current), Michael Boshernitzan (2001), Miguel Mendes (2000), Guillaume Poggiaspalla (2002);


Technical skills: PhP, mysql, javascript, Mathematica, video production, streaming, ajax, accessibility.

ERIC HSU
Associate Professor, Department of Mathematics
San Francisco State University, San Francisco, CA 94132
erichsu@math.sfsu.edu

EDUCATION
University of California, Berkeley Ph.D., Mathematics 1991-1998
PROFESSIONAL EDUCATION

San Francisco State University Associate Professor, Mathematics 2006-present
Assistant Professor, Mathematics 2001-2006

University of Texas at Austin NSF PFSMETE Postdoctoral Fellowship 1999-2001
Postdoctoral Fellowship, Math Education 1998-1999

HONORS AND AWARDS

• 2007 Content Review Panelist, California State Textbook Adoption Committee
• 2002-2007 Elected to three two-year terms as Secretary of the SIGMAA on RUME (Special Interest Group of the Mathematical Association of America on Research in Undergraduate Math Education), 1100+ members.
• 2005 NSF Cyberlearning Task Force on Virtual Communities of Practice, one of twenty members by special invitation of the Computing Research Association and the International Society of the Learning Sciences
• 2004-2009 NSF CAREER Award, "Online and Live Communities of Teachers" ($489K)
• 2002-2005 Co-PI on "Revitalizing Algebra", NSF Math Science Partnership ($3.3M + $513K supplemental)
• 2002 SFSU Affirmative Action Faculty Development Program
• 2002 SFSU Summer Research Stipend
• 2001-2002 NSF Research Starter Grant, SFSU. ($50,000)
• 2001-2002 MAA Dolciani Project NExT Fellow, SFSU.
• 2000-2001 Mentoring Grant from the SIGMAA on RUME, SFSU and University of Texas at Austin.
• 2000 International Conference on Learning Sciences (ICLS) Fellowship for Special Workshop on Methodology, University of Michigan.
• 1999-2001 NSF PFSMETE Postdoctoral Fellowship, U.T. Austin
• 1998-1999 University of Texas at Austin Postdoctoral Fellowship
• 1997-1998 University of California Teaching Effectiveness Award
• 1997-1998 University of California Outstanding Graduate Instructor
• 1996-1997 University of California Graduate Division Fellowship

PROFESSIONAL AND CIVIC ACTIVITIES (Campus)

• 2007, Co-presenter, Grantwriting Workshop for University Faculty-Staff Retreat
• 2006-2007 Member, University Teacher Credential Committee.
• 2005-2007 Member, Mathematics Department Math Education Committee
• 2006-2007 Member, Mathematics Department Graduate Committee
• 2006 Co-author, Response to Department Program Review.
• 2002-2007 Supervisor, SFSU Math Graduate Teaching Instructors.
• 2006, Co-presenter, Grantwriting Workshop for University Center for Teaching and Faculty Development
• 2005-2006 Chair, Planning Committee for the College of Science and Engineering Education Center
• 2006 SFSU Representative, CSU Summit on Math and Science Teachers, Industry, CA.
• 2006 SFSU Representative, MSRI Math Education Conference, Berkeley, CA.
• 2006 SFSU Representative, CSU Conference on Early Assessment Program, Oakland, CA.
• 2005 Member, Liberal Studies Council
• 2005 Presenter and Facilitator, SFSU Community Access and Retention Program, Spring Tutor Orientation
• 2003-2005 Ran Revitalizing Algebra weekly workshop for two cohorts of 9 K-12 teachers, 9 grad instructors, 9 math major UGs (with Diane Resek and Judy Kysh)
• 2003-2005 Member, SFSU Math Department Faculty Council
• 2002-2006 Judge at SFSU COSE Student Project Showcase
• 2002-2004 Member, SFSU Math Department Hiring Search Committee
• 2002 Chair, SFSU Math Department Calculus Textbook Committee
• 2002 Participant, SFSU College of Education CAD/MS Workshop with Vera Lane
• 2001 Leader, One-day workshop for K-12 in-service math teachers on Economics and Math for National Council on Economic Education (with Prof. Blecha, SFSU)

PROFESSIONAL AND CIVIC ACTIVITIES (Off-Campus)

• 2006-2007 Consultant and co-leader, CA Math Science Partnership with San Rafael Elementary School District
• 2006-2007 Member, Advisory Board for Emerging Scholars Program (MAA PREP)
• 2003-2007 Referee, Mathematics Teacher Journal
• 2002-2007 Reviewer, National Association of Research in Science Teaching, Annual Conference
• 2001-2007 National Science Foundation Review Panels for Math Science Partnership RETA (Research Evaluation Technology Assistance); Teacher Professional Continuum, and NSF-NATO Postdoctoral Fellowships

• 2002,2006 SIGMAA on RUME Elections Committee

• 2003-2005 Teacher Advisory Panel, Mathematics Teacher Journal

• 2003-2005 Referee, Journal for Research in Mathematics Education

• 2003-2005 Item Reviewer, California High School Exit Exam


• 2004 Reviewer, 10th International Congress on Mathematics Education

• 2003 Reader, AP Calculus exams, June 2003

• 2003 Referee, NCTM's Online Journal For School Mathematics


• 2001-2003 Referee, National Association of Research in Science Teaching Conference

• 2000-2005 SIGMAA on RUME, Member of Web Committee and Literature Committee

• 2000-2005 SIGMAA on RUME, Director of Literature Database Project

• 2002 Reviewer, Houghton-Mifflin College Algebra Text

• 2002 Participant, CSU Math Educators Face-to-Face Meeting at Asilomar

• 2002 SIGMAA on RUME Conference Program Committee

• 2002 Participant, MAA Preparing Mathematicians to Education Teachers Workshop at San Diego

• 2002 Judge, Joint Meetings Undergraduate Poster Session

• 2001 California Postsecondary Education Commission Eisenhower State Grant Reader

• 2001 Reviewer, MAA Mathematical Sciences Digital Library Project

• 2001 Judge, Intel International Science and Engineering Fair, Grand Mathematics Awards

GRADUATE THESIS SUPERVISED

MA Completed

Kerin Keys, Read Vanderbilt, Stefanie Kawasaki

PUBLICATIONS


• Hsu, E., Murphy, T. J., & Treisman, U. (in press). Supporting High Minority Achievement in Introductory Collegiate Mathematics Courses: The Emerging Scholars Program Turns 30. In M. Carlson & C. Rasmussen (Eds.), Making the Connection: Research and Practice in Undergraduate Mathematics Education: Mathematical Association of America.


• Hsu, E. (1996) *The Professional Development Program Teaching Assistant Teaching Manual*, Berkeley, CA; PDP.

**PRESENTATIONS (INVITED)**

• Math Education Colloquium at Sonoma State University, Spring 2007

• Keynote speech: "Thinking About Thinking In Context", Conference of the Alameda County Collaborative for Learning and Instruction in Mathematics, Hayward, CA. March 2006.

• Invited Talk and Panel: "Ethnicity and College Math: Some Recent Trends and Ideas", American Association of Physics Teachers Summer Meeting, Salt Lake City, UT. August 2005


• Keynote speech: "What Were They Thinking?! Learning, Teaching and Overlapping Communities" Conference of the Alameda County Collaborative for Learning and Instruction in Mathematics, Hayward, March 2005.

• Invited Panel of NSF CAREER Awardees, Association of Mathematics Teacher Educators, Dallas, January 2005.
• “Teaching Assistant Communities of Practice”, PMENA Working Group on Mathematics Teaching Assistant Preparation and Development Research, Toronto, Canada, October 2004.


• "Evaluating On-line Teacher Conversations With Statistics and Graphs" (with Megan Moore), AAAS (American Association for the Advancement of Science), San Francisco, June 2003.


• "Metaphors and Contexts: Students Wrestle With Rate", Math Education Colloquium, Harvard School of Education, April 2003


• Math Education Colloquium at Arizona State University, November 2002

• "Metaphor as a Theory of Learning," MAA Mathfest Research Pre-session on Research on Undergraduate Mathematics Education, Burlington, VT. Invited to be Moderator for a Plenary Panel Discussion with Rafael Nunez, Ed Dubinsky and Michelle Zandieh; July 2002.

• Math Education Colloquium at Sonoma State University, Fall 2001

• Math Education Colloquium at San Francisco State University, Spring 2001

• Math Education Colloquium at Arizona State University, Spring 2001

• Math Education Colloquium at California State University, Monterey Bay, Spring 2001

PRESENTATIONS (REFEREED)

• “Revitalizing Algebra” (with Judy Kysh and Diane Resek), California Math Council / North 49th Annual Asilomar Conference, December 2006.

• "Graduate Teacher Social Networks" (with Tim Gutmann), Research on Undergraduate Mathematics Education Conference, Rutgers University, NJ. Talk, February 2006.


• "On-line Teacher Communities: Measuring Engagement, Responsiveness and Refinement" (with Megan Moore), PME-PME/NA 2003 (Psychology of Mathematical Education, North America), Manoa, HI. Talk, July 2003.


- "Investigations of the Major Conceptual Strands of First Semester Calculus: The Role of Theory in Research and Practice," NCTM Research Presession (National Council of Teachers of Mathematics), Las Vegas, NV. Two and a half hour presentation with Marilyn Carlson and Mike Oehrtman, April 2002.


LETTER OF SUPPORT FROM ACTING CHAIR OF MATHEMATICS DEPARTMENT,
SAN FRANCISCO STATE UNIVERSITY

April 23, 2007

Dr. Pamela Vaughn,
Associate Dean
Center for Teaching and Faculty Development
San Francisco State University

Dear Dr. Vaughn:

Professors Arek Goetz and Eric Hsu are submitting a proposal Calculus in the new millennium: A blended first semester Calculus with collaborative groups, on-line homework and multimedia aids intended to serve as Demonstration project to be funded by the CSU Transforming Course Design initiative. I strongly support this proposal for the following reasons.

1. First semester calculus is a critical gateway course for beginning science students. Each semester about 400 students enroll, but only about 50% pass with a grade of C or better. Thus Calculus I is a serious bottleneck which impedes greatly the progress of a near majority of science students. I believe the proposed project has a good chance of successfully improving the Calculus I pass rate while simultaneously improving the quality of learning when compared the traditional lecture/TA model. The key innovation is to keep students engaged with interactive on-line lectures and also offer three hours per week of supervised in-class problem solving.

2. The proposed model can be scaled to make more efficient us of instructional resources. The savings would allow the Mathematics Department to improve the quality of its program for both undergraduate and graduate majors.

3. Drs. Goetz and Hsu are nationally recognized experts having complementary expertise. Professor Goetz has developed innovative applications of technology for calculus instruction both in lecture format and online delivery. This includes computer animations, archived lectures, interactive online virtual classroom activity, and an interface for the submission and grading of written homework. Professor Hsu specializes in university-level mathematics education with a focus on creating and assessing teacher/student learning communities in the classroom. His work in this area has received national recognition in the form of a prestigious NSF Career Award. At SFSU, he created MATH 700, a course which trains GTAs in mathematics to be effective remedial math teachers and teaching assistants in calculus. The combined creativity and know-how of Drs. Goetz and Hsu augurs well for the success of their proposed pilot program.

If the project is funded, the department has sufficient depth in its instructional staff to meet its other instructional obligations. If you have any questions or concerns, please feel free to consult me.

Sincerely,

Eric Hayashi,
Acting Chair of Mathematics