Slugs on STEM:
preparing competent & diverse teachers

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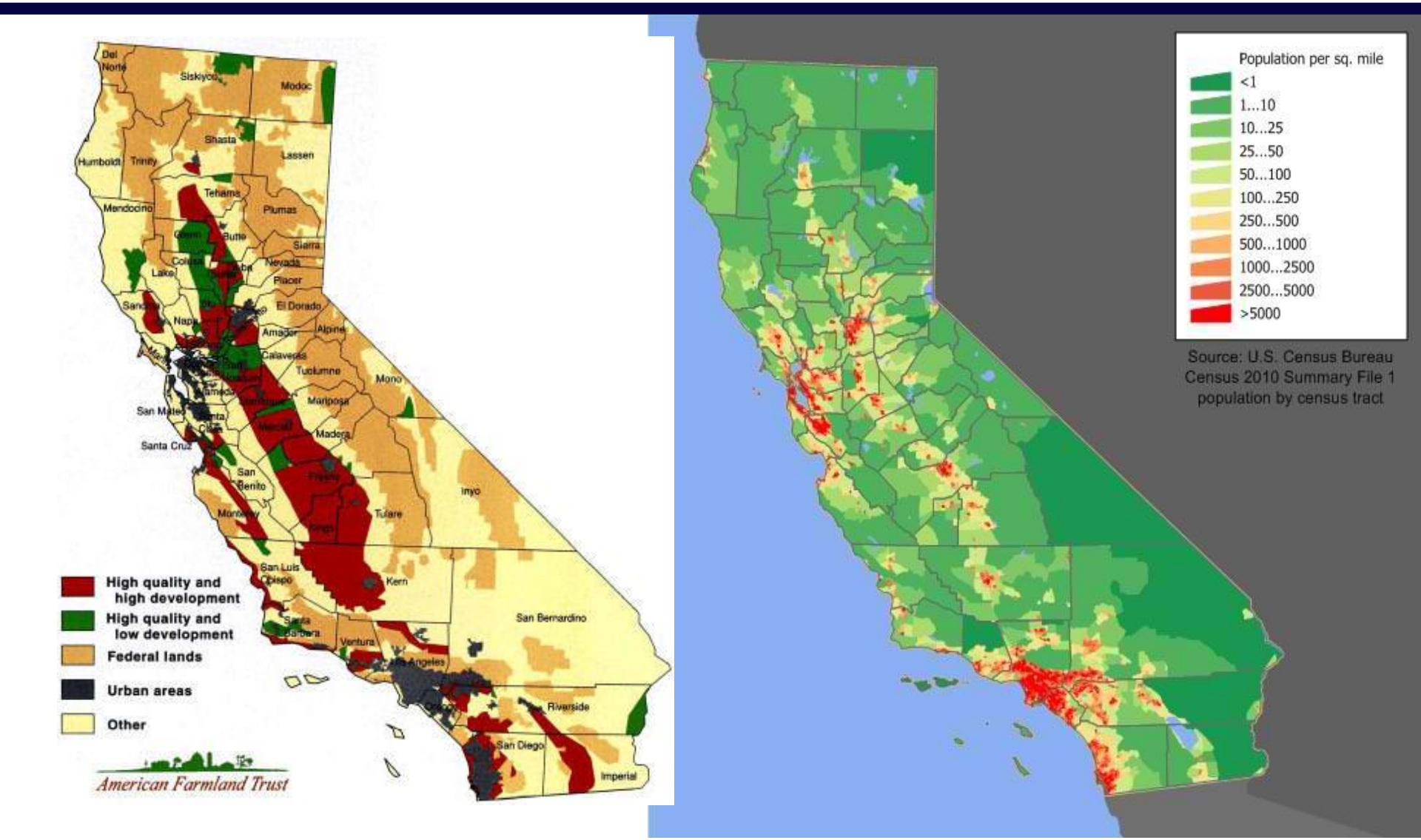


Supporting diversity & excellence

Many UCSC students come from affluent communities in the techno-centric Greater Bay Area.

Many UCSC students come from the agriculture-based communities of the Central Coast, many of which are high-need for qualified STEM teachers.

Specialized major pathways, learning support programs, and ample opportunities for research and teaching experience help students to formulate and achieve their educational and career goals.

Emphasis on teaching

- High quality instruction at all levels has been a top priority since the founding of UCSC in 1965.
- Student evaluations of instructors play a crucial role in personnel actions – a highly structured review process enforces the campus commitment to excellent in research ***and*** teaching.
- Several Academic Senate committees, both at UCSC and UC-wide, focus on pedagogy.

Oversight and guidance

Several Academic Senate committees focus on pedagogy:

- ✧ Teaching
- ✧ Educational Policy
- ✧ Graduate Council
- ✧ Preparatory Education
- Planning and Budget
- International Education
- Academic Freedom
- Career Advising
- Computing and Telecommunication
- Affirmative Action and Diversity

UCSC BA in Mathematics pathways

UCSC offers three pathways to a mathematics BA:

- Pure mathematics

  designed to serve grad school-bound students,

  provide adequate GRE prep by fall of senior year

- Mathematics education

  designed for prospective teachers,

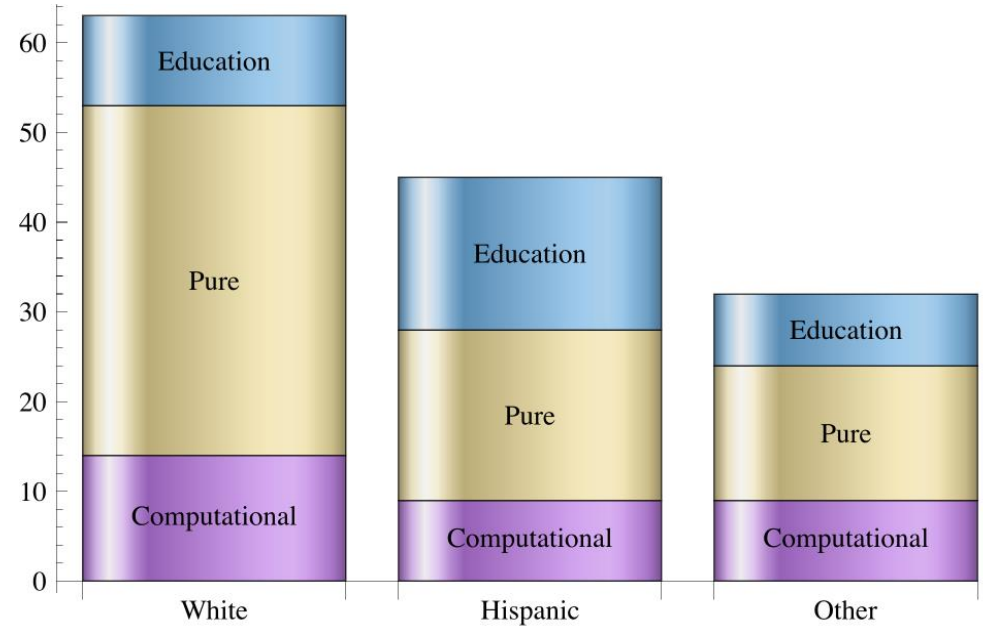
  meet CSET waiver requirements by graduation

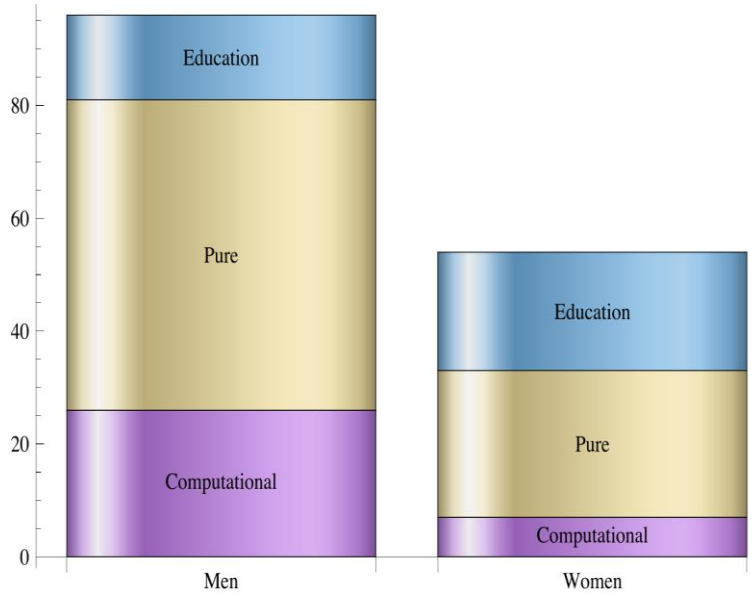
- Computational mathematics

  designed for students with broad STEM interests,

  accommodate major changes, outside pre-reqs

Math major demographics snapshot





A unified foundation

All three paths share common basic requirements:

- introductory requirements:
  - Calculus
  - Vector calculus
  - Linear algebra
  - Introduction to proof
- comprehensive requirement: senior seminar or thesis
- general education requirements.

Many students take precalculus, and possibly college algebra, at UCSC before progressing to calculus.

Advanced (mostly) requirements

Education*	Pure	Computational
Statistics (AMS)	Differential equations	Differential equations
Real *or* Complex analysis	Complex analysis	Real *or* Complex analysis
Number theory	Real analysis	Number theory
Algebra	Algebra	Algebra *or* Advanced linear algebra
Introduction to probability theory (AMS)	Advanced linear algebra	Ordinary *or* partial differential equations (adv)
Classical geometry: Euclidean & non-Euclidean	Advanced geometry (four options)	Advanced computational elective
History of mathematics	Three electives	Two electives (with options in engineering, applied sci.)
Supervised teaching (Cal Teach *or* departmental teaching)		

*For CSET waiver, three additional courses are required: Intro to Teaching Math, one additional math course, one computer science course.

On-campus teaching opportunities

UCSC math majors have many near peer instruction/tutoring opportunities:

- Academic Excellence Program (ACE) 1-on-1 drop-in tutoring/small group tutoring
- Learning Support Services funded Modified Supplemental Instruction (MSI) Sessions
- Supervised Teaching Experience

Some are teach-as-you-are, while others involve substantial mentoring and oversight from the instructor of record.

Academic Excellence Program (ACE)

ACE is an academic support program dedicated to increasing the diversity of UCSC STEM graduates (modeled on Uri Treisman's UCB program).

ACE is a community of scholars who strive for and commit to academic excellence.

How does ACE Work?

ACE offers active learning secondary discussion sections and peer mentoring for selected courses in gateway STEM courses. Discussion sections meet twice each week for 1 hour and 45 minutes. ACE students also attend a one-hour, small-group peer mentoring session each week.

Modified supplemental instruction (MSI) provides crucial learning support for students in introductory courses & instructional experience for advanced students.

Participation in MSI reduced the no pass rate in Physical and Biological Sciences courses from 19% to 13%.

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Student Job Listing

Modified Supplemental Instruction (MSI)

What is MSI?

Modified Supplemental Instruction gives students the opportunity to learn together in small groups led by advanced Student Learning Assistants. MSI is guaranteed study/learning time facilitated by someone who has already been successful in the class.

How MSI works:

Unless otherwise noted, you may attend any MSI session at any time during the quarter without making a weekly commitment. MSI sessions are available on a first-come, first-serve basis. Please see the Professor or the Learning Assistant in your class for more information.

Comments about MSI

- It's nice to have people who are all in need of help coming together. I've met new people from my class and I understand the concepts better. (Chem 1C Student)
- The Learning Assistant included everyone and made sure every person understood a concept

Click here for Complete Schedule

Announcements

MSI will begin during the 2nd full week of the quarter. Classes have been selected; see the list below. Please see the MSI Learning Assistant if you have any questions.

MSI Classes for Spring 2014:

- AMS 5, 7, 11A, 11B,
- ASTR 3
- BIOE 20B
- BIOL 20A, 100, 105*, 115, 135
- CHEM 1A*, 1B*, 1C*, 108B
- CMPE 12, 16, 100
- CMPS 11, 12A, 12B, 17, 101
- EART 110C
- ECON 1, 2, 100A, 100B, 113
- MATH 3*, 11A, 11B, 19A, 19B, 22, 23A

Supervised Teaching Experience: Math 188

- Gives students hands-on teaching experience in courses such as pre-calculus and calculus
- Commitment is 15 hours/week
- Students get to observe big lecture courses, as well as try out independent teaching in small sections
- Students are mentored by department lecturers and faculty to develop curriculum and evaluation strategies

CALTEACH
UC Science and Math Initiative

Cal Teach goal

to increase the number of UC grads who pursue science and math teaching careers

Cal Teach provides undergraduates with

coursework and field experiences in K-12 schools

rather than waiting until post-bacc credential year (as is the norm in California)

CALTEACH
UC Science and Math Initiative

Cal Teach features

- Recruitment and advising
- Collaboration among science, math and education faculty
- Sequence of K-12 internships with supporting education coursework
- Mentoring by experienced K-12 teachers
- Financial incentives for students and mentors
- Summer teaching and research opportunities
- Community of future teachers

Cal Teach Course @ UCSC

Cal Teach Placement @ a Local School

CALTEACH for UCSC math majors

- Math Education Track
  - CaT1 and CaT2 satisfy supervised teaching requirement
- STEM Education Minor
  - CaT1, 2, and 3 are 3 of 7 courses
- GE Requirement (may increase recruitment)
  - satisfy PR-S (Practice - Service Learning)
- Communication and teaching skills
- Community of peers and mentors
- Access to scholarships

Financial support for Cal Teach participants

Reimbursements

- CBEST, CSET, fingerprinting

Access to scholarships

- Internship Scholarships
  - $150 - $600
- Mark Bruce Fellowship
  - $1,000 - $20,000
- NSF Noyce Scholarships
  - $20,000 or *more

*for some transfer students

NSF Noyce and Mark Bruce Scholarship Recipients

Support for teachers in the field: Monterey Bay Area Math Project

MBAMP provides ongoing training and support for K-12 math teachers:

- Summer courses
- Spring workshop

MBAMP is part of the California Mathematics Project

The California Mathematics Project is a network of K-12 teachers and university faculty dedicated to providing students a rich, rigorous, and coherent mathematics curriculum taught by competent and confident mathematics teachers.

CMP enhances teachers' mathematical content knowledge and pedagogical content knowledge.

Challenges and obstacles

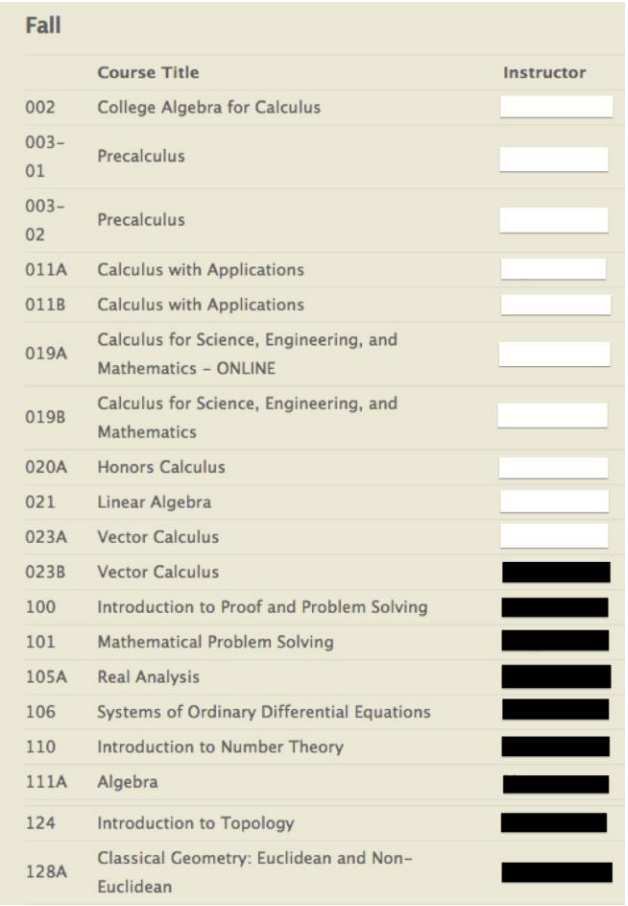
- Transition from plug and chug computation to exposition-based exploration
- Limited departmental resources
- Pure ‘versus’ education elitism
- Career uncertainty

Making the leap

The transition to advanced coursework can undermine students' mathematical confidence:

- very rapid increase in abstraction and rigor
- demands on underdeveloped expository skills
- unfamiliar and potentially intimidating instructors
- loss of many UCSC learning support programs
- negative student expectations

UCSC Math relies heavily on lecturers – many of whom are exceptional instructors – and has few ladder rank faculty.

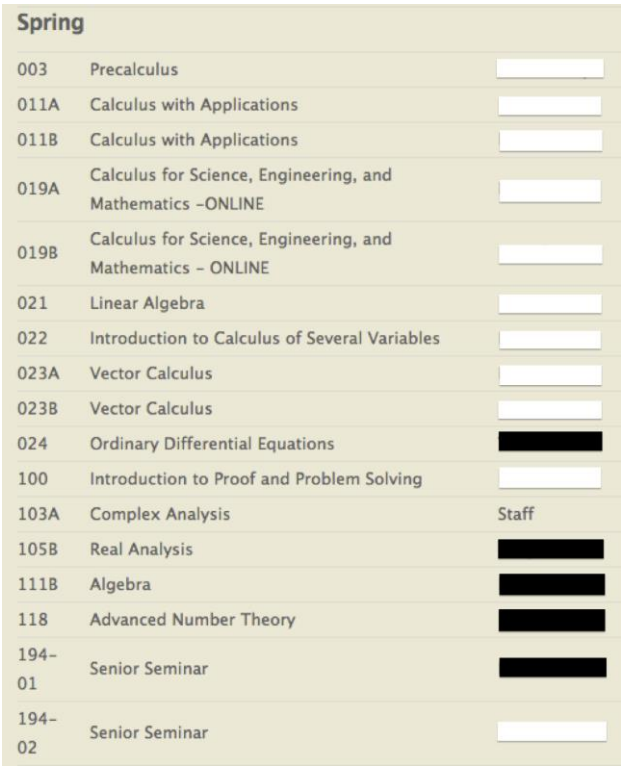


Fall

	Course Title	Instructor
002	College Algebra for Calculus	
003–01	Precalculus	
003–02	Precalculus	
011A	Calculus with Applications	
011B	Calculus with Applications	
019A	Calculus for Science, Engineering, and Mathematics – ONLINE	
019B	Calculus for Science, Engineering, and Mathematics	
020A	Honors Calculus	
021	Linear Algebra	
023A	Vector Calculus	
023B	Vector Calculus	
100	Introduction to Proof and Problem Solving	
101	Mathematical Problem Solving	
105A	Real Analysis	
106	Systems of Ordinary Differential Equations	
110	Introduction to Number Theory	
111A	Algebra	
124	Introduction to Topology	
128A	Classical Geometry: Euclidean and Non-Euclidean	

Winter

002	College Algebra for Calculus	
003	Precalculus	
011A	Calculus with Applications	
011B	Calculus with Applications	
019A	Calculus for Science, Engineering, and Mathematics	
019B	Calculus for Science, Engineering, and Mathematics	
020B	Honors Calculus	
021	Linear Algebra	
022	Introduction to Calculus of Several Variables	
023A	Vector Calculus	
023B	Vector Calculus	
100	Introduction to Proof and Problem Solving	
103A	Complex Analysis	
105A	Real Analysis	
111A	Algebra	
117	Adv Linear Algebra	
181	History of Mathematics	
194	Senior Seminar	



Spring

003	Precalculus	
011A	Calculus with Applications	
011B	Calculus with Applications	
019A	Calculus for Science, Engineering, and Mathematics –ONLINE	
019B	Calculus for Science, Engineering, and Mathematics – ONLINE	
021	Linear Algebra	
022	Introduction to Calculus of Several Variables	
023A	Vector Calculus	
023B	Vector Calculus	
024	Ordinary Differential Equations	
100	Introduction to Proof and Problem Solving	
103A	Complex Analysis	Staff
105B	Real Analysis	
111B	Algebra	
118	Advanced Number Theory	
194–01	Senior Seminar	
194–02	Senior Seminar	

Sharp differences between lower and upper division courses and instructor pools increase the stress on weak students.

Healing the perceived pure/education split

- De facto direction of students with weak K-12 math prep onto education path, students with stronger math backgrounds into pure path
- Many Latinos and Latinas choose the education path, some are pushed onto it
- Study groups tend to consistent of pure or pure/ computational path students or all educational path ones – little mixing
- Many math majors believe that Cal Teach is only for students in the education path

If not a math teacher, then what?

- Not all declared math majors thrive in the major
- Content mastery (or lack thereof) aside, our department is reluctant to send into the classroom teachers who regard math as something to be survived
- Does the mathematical training of teachers help them to find rewarding new career paths if they don’t enter or choose to leave the profession?
- How can the pathways be improved to increase both success in the chosen path and versatility?