

Mathematics and Science Education

In the College of Sciences and
In the College of Education

For further information regarding programs, consult the following:

Ph.D. Program CRMSE
6475 Alvarado Rd., #206
619-594-5090
e-mail: mathsciphd@sdsu.edu

M.A. Program Mathematics and Statistics
619-594-6191
Teacher Education
619-594-6131

Mathematics and Science Education Faculty

Joanne Lobato, Ph.D., Associate Professor of Mathematics, Coordinator for Ph.D. Program
Nadine S. Bezuk, Ph.D., Professor of Teacher Education
Kathleen M. Fisher, Ph.D., Professor of Biology, Emeritus
Fred M. Goldberg, Ph.D., Professor of Physics
Sandra P. Marshall, Ph.D., Professor of Psychology
Cheryl L. Mason, Ph.D., Professor of Teacher Education
B. Ricardo Nemirovsky, Ph.D., Professor of Mathematics
Walter C. Oechel, Ph.D., Professor of Biology
Randolph A. Philipp, Ph.D., Professor of Teacher Education
Stephen K. Reed, Ph.D., Professor of Psychology
Alexander W. Chizhik, Ph.D., Associate Professor of Teacher Education
Victoria R. Jacobs, Ph.D., Associate Professor of Teacher Education
Lisa L. Lamb, Ph.D., Associate Professor of Teacher Education
Chris L. Rasmussen, Ph.D., Associate Professor of Mathematics (Ph.D. Graduate Adviser)
Alberto J. Rodriguez, Ph.D., Associate Professor of Policy Studies in Language and Cross-Cultural Education
Rafaela M. Santa Cruz, Ph.D., Associate Professor of Teacher Education
Susan D. Nickerson, Ph.D., Assistant Professor of Mathematics (M.A.T.S. Graduate Adviser)

Committee for Mathematics Education

Nadine S. Bezuk, Ph.D., Professor of Teacher Education
B. Ricardo Nemirovsky, Ph.D., Professor of Mathematics
Randolph A. Philipp, Ph.D., Professor of Teacher Education
Janet S. Bowers, Ph.D., Associate Professor of Mathematics
Victoria R. Jacobs, Ph.D., Associate Professor of Teacher Education
Lisa L. Lamb, Ph.D., Associate Professor of Teacher Education
Joanne Lobato, Ph.D., Associate Professor of Mathematics
Chris L. Rasmussen, Ph.D., Associate Professor of Mathematics
Rafaela Santa Cruz, Ph.D., Associate Professor of Teacher Education
Rachelle Feiler, Ph.D., Assistant Professor of Teacher Education
Diane K. Masarik, Ph.D., Assistant Professor of Teacher Education
Susan D. Nickerson, Ph.D., Assistant Professor of Mathematics

Section I. Master's Degree Program

General Information

The Department of Mathematics and Statistics offers two specializations in its program of graduate study leading to a Master of Arts degree for teaching service. The specialization for community college teaching offers candidates a program designed to provide them with the mathematical breadth necessary to teach a wide variety of lower-division collegiate mathematics courses, while also providing them with a better understanding of the issues involved in teaching and learning mathematics. The specialization for secondary teaching offers coursework designed to strengthen the mathematical background of secondary teachers, to provide teachers with a deeper understanding of learning and teaching mathematics in grades 7-12, and to allow teachers the opportunity to analyze curriculum and evaluation efforts in a manner that can lead them to make reasoned judgments about curricular, testing, and instructional issues in grades 7-12 mathematics.

Courses described in this section may also be of interest to students seeking the Master of Arts degree in education with concentrations in elementary curriculum and instruction or secondary curriculum and instruction, offered by the School of Teacher Education.

Associateships

Graduate teaching associateships in mathematical sciences are available to qualified students. Support for qualified candidates may also be available through the School of Teacher Education, through the Center for Research in Mathematics and Science Education or through employment on faculty research grants. Applications are available from the appropriate campus offices.

All students must satisfy the general requirements for admission to the university with classified graduate standing, as described in Part Two of this bulletin.

Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy as described in Part Two of this bulletin. In addition, students seeking the Master of Arts degree for teaching service must have passed a qualifying examination in mathematics education.

Specific Requirements for the Master of Arts Degree for Teaching Service in Mathematics

(Major Code: 17011)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Two of this bulletin, the students must complete a graduate program of at least 30 units, 24 of which must be from the Department of Mathematics and Statistics. At least 15 of the 24 must be 600- and 700-numbered courses. A student's program must be prepared in conference with and approved by the graduate adviser.

The two specializations leading to the Master of Arts for teaching service require completion of a specific pattern of graduate units described below.

Specialization in Mathematics for Community College Teaching. This specialization is designed to satisfy the requirements for teaching service at the community college level. Students must have completed a bachelor's degree in mathematics (or equivalent) before entering the program and must have completed six units selected from Mathematics 521A, 524, and 534A. The third course can be taken prior to entrance to the program or as part of the 30-unit degree requirements.

Plan A requires Mathematics 600, 601, 602, and Mathematics Education 603; six units selected from Mathematics 509, 720, Mathematics Education 604, 605, 606; nine units of electives selected with the approval of the adviser; and Mathematics 799A, Thesis.

Plan B requires Mathematics 600, 601, 602, and Mathematics Education 603; nine units selected from Mathematics 509, 720, Mathematics Education 604, 605, 606; and nine units of electives selected with the approval of the adviser. In addition, students must pass a comprehensive examination in mathematics education.

Specialization in Mathematics for Secondary Teaching. This specialization is designed to strengthen the mathematical background of secondary teachers, while providing coursework to better understand the learning and teaching of mathematics in grades 7-12. Students should have the equivalent of a bachelor's degree in mathematics before entering the program.

Plan A requires Mathematics 524; Mathematics Education 603; three units selected from Mathematics 510, 511, 512, or 600; three units selected from Mathematics 521A or 601; three units selected from Mathematics 534A or 602; six units selected from Mathematics 509, 720, Mathematics Education 604, 605, 606; six units of electives selected with the approval of the adviser; and Mathematics 799A, Thesis.

Plan B requires Mathematics 524; Mathematics Education 603; three units selected from Mathematics 510, 511, 512, or 600; three units selected from Mathematics 521A or 601; three units selected from Mathematics 534A or 602; nine units selected from Mathematics 509, 720, Mathematics Education 604, 605, 606; and six units of electives selected with the approval of the adviser. In addition, students must pass a comprehensive examination in mathematics education.

Section II.
Doctoral Program
<http://crmse.sdsu.edu/msed>

General Information

San Diego State University and the University of California, San Diego, offer jointly a doctoral program in mathematics and science education. The program faculty at SDSU are members of the College of Sciences and the College of Education and are affiliated with the Center for Research in Mathematics and Science Education (CRMSE). They represent a number of different disciplines, including biology, geological sciences, mathematics, physics, psychology, and teacher education. The program faculty at UCSD, also an interdisciplinary group, are members of the Division of Natural Sciences (biology, chemistry, mathematics, and physics) or the Division of Social Sciences (cognitive science, philosophy, and sociology). The program is administered under the College of Sciences at SDSU and under the Division of Natural Sciences at UCSD.

The research interests of the participating faculty members cover a wide range of issues in the learning and teaching of mathematics and the sciences. Graduates of the program will be qualified to take a variety of professional positions, including faculty appointments in universities, colleges, and community colleges; specialist positions in public school districts; and out-of-school employment in settings that require expertise in mathematics and science education.

Doctoral Faculty

The following faculty members of the cooperating institutions participate in the joint doctoral program, being available for direction of research and as departmental members of joint doctoral committees.

San Diego State University:

Coordinator: Joanne Lobato
Graduate Adviser: Chris L. Rasmussen
Staff Adviser: Deb Escamilla
Doctoral Program Members: Bezuk, Chizhik, Feiler, Fisher, Goldberg, Jacobs, Lamb, Lobato, Marshall, Masarik, Mason, Nemirovsky, Nickerson, Oechel, Philipp, Rasmussen, Reed, Riggs, Rodriguez, Yerrick

University of California, San Diego:

Coordinator: Barbara Sawrey
Graduate Adviser: Gabriele Wienhausen
Staff Adviser: Caren Duncanson
Doctoral Program Members: Appelbaum, Batali, Case, Cole, Churchland, Evans, Harel, Hutchins, Jones, Magde, Manaster, Mehan, Núñez, Rabin, Sawrey, Smith, Wienhausen

Admission to Doctoral Study

Applicants for admission to the doctoral program in mathematics and science education must meet the general requirements for admission to both universities with classified graduate standing as outlined in the respective current catalogs. Applicants must also meet the special requirements of this program. These include: (a) an acceptable baccalaureate degree in mathematics or science (or a related discipline); (b) a master's degree, or its equivalent, in biology, chemistry, physics, or mathematics; (c) a GPA of at least 3.25 in the last 30 semester (or 45 quarter) units of upper division work and at least a 3.5 in the graduate work attempted; (d) good standing in the last institution attended; (e) suitable scores in quantitative, verbal, and analytic sections of the Graduate Record Examinations.

Students with a master's degree in mathematics education can also be considered for admission if they meet the following requirements: (a) a bachelor's degree in mathematics; (b) a master's degree in mathematics education that includes graduate level mathematics courses in analysis and algebra; and (c) coursework in geometry at the advanced undergraduate or graduate level. The GPA, GRE, and graduate standing requirements specified in the previous paragraph must also be met. Students entering the program with a master's degree in mathematics education are required to take additional mathematics courses as specified in "Specific Requirements for the Doctor of Philosophy Degree." Students with a master's degree in physics education, chemistry education, or biology education should contact the MSED program coordinators.

Students applying for admission to the doctoral program should electronically submit the university application available at <http://www.csumentor.edu> along with the \$55 application fee.

All applicants must submit admissions materials separately to SDSU Graduate Admissions and to the Mathematics and Science Education Ph.D. Program.

Graduate Admissions

The following materials should be submitted as a complete package directly to:

Graduate Admissions
Enrollment Services
San Diego State University
San Diego, CA 92182-7416

- (1) Official transcripts (in sealed envelopes) from all postsecondary institutions attended;

Note:

- Students who attended SDSU need only submit transcripts for work completed since last attendance.
- Students with international coursework must submit both the official transcript and proof of degree. If documents are in a language other than English, they must be accompanied by a certified English translation.

- (2) GRE scores (<http://www.ets.org>, SDSU institution code 4682);
- (3) TOEFL score, if medium of instruction was in a language other than English (<http://www.ets.org>, SDSU institution code 4682).

Mathematics and Science Education

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The following materials should be delivered or mailed to:
Mathematics and Science Education Ph.D. Program
CRMSE, San Diego State University
6475 Alvarado Road, Suite 206
San Diego, CA 92120-5013

- (1) Application for doctoral program in mathematics and science education (http://www.sci.sdsu.edu/crmse/crmse_app02.pdf);
- (2) Mathematics and Science Education recommendation form as cover sheet (http://www.sci.sdsu.edu/crmse/rec_form.pdf);
- (3) At least three letters of recommendation.

Specific Requirements for the Doctor of Philosophy Degree

(Major Code: 08997)

Residency Requirements. After formal admission to the doctoral program, the student must complete a 36-unit residency at the University of California, San Diego, of which a maximum of 12 units can be upper division undergraduate courses (100 level). Lower division undergraduate courses do not count toward residency. Students must also complete an 18-unit residency at San Diego State University. The residency requirements cannot be replaced by coursework taken elsewhere.

Language Requirement. There is no formal language requirement for the program.

Course Requirements. All students admitted into the doctoral program will fulfill the following requirements. Any alternative method of fulfilling these requirements must be approved by the graduate advisers.

- A. Three research apprenticeship experiences:
SDSU: MSE 801, 802 *and*
SDSU: MSE 820 *or* UCSD: MSED 298.
- B. Core courses in Mathematics or Science Education.
UCSD: MSED 296A, 296B, 296C *and*
SDSU: MTHED 603.
Science Education students must also take SDSU: NSCI 600.
Mathematics Education students must select two of the following additional courses: SDSU: MTHED 604, 605, 606.
- C. Three courses on quantitative and qualitative research methods.
Select SDSU: MSE 810 *and* one of the following sequences:
UCSD: PSYC 201A, 201B *or*
UCSD: MA 282A, 282B *or*
SDSU: PSY 670A, 670B.
- D. Two courses in cognitive science at UCSD selected from:
COGS 102A *or* 234; COGS 102B, 200, 260; *or one of* COGS 101A, 101B, 101C.
- E. One teaching practicum.
SDSU: MSE 805, 806, *or* 807 *or*
UCSD: TEP 129A/139, *or* Discipline 500.
- F. Two courses from different categories are selected with advisers according to the student's needs and background.
 - (1) Philosophy and History. UCSD: PHIL 145, 146, 147, 209A; HISC 107, 108, 109, 160/260, 163/263, 164/264, *or* 165/265.
 - (2) Sociology. UCSD: SocG 270, SocB 117/TEP 117, *or* SocC 126/TEP 126.
 - (3) Mathematics and Science: Graduate level courses in biology, chemistry, mathematics, *or* physics.
 - (4) Teaching Experience: An option for students who have not yet had teaching experiences at both the K-12 and collegiate levels is to take a second teaching practicum.
 - (5) Other. Other types of courses (at the graduate or upper division undergraduate level) can be approved by the advisers if they contribute to a coherent program.

G. Two doctoral research courses:

SDSU: MSE 830 *and*

SDSU: MSE 899 *or* UCSD: MSED 299.

Beyond these requirements, no specified number of courses is required for the doctoral degree. It is expected, however, that all the doctoral students will supplement the requirements with electives that contribute to individual career objectives.

Additional Requirements for Students Entering with a Master's Degree in Mathematics Education. Students who are admitted into the doctoral program with a master's degree in mathematics education will increase the breadth and depth of their mathematical knowledge by fulfilling the requirements specified for Option A *or* Option B:

Option A.

UCSD: MATH 240A, 240B, 240C *and*

Pass the UCSD comprehensive examination on analysis at the master's level *and*

One graduate algebra course: UCSD: MATH 200A *or* SDSU: MATH 627A *or* 623. MATH 623 can only be selected if the student has already taken a graduate level abstract algebra course.

Option B.

Select two of SDSU: MATH 627A, 627B, 623, *and*

Pass the SDSU comprehensive examination on algebra at the master's level *and*

UCSD: MATH 240A

Whether the student selects Option A *or* Option B, the year-long sequence in algebra or analysis must be taken in Year 1 of the doctoral program. All of the requirements for Option A *or* Option B must be completed prior to the second year examination; however, students are strongly encouraged to fulfill all of the requirements in Year 1. A grade of B or better must be earned in each course.

Examinations. Students in the doctoral program will be evaluated at the following levels:

- (1) **First Year Evaluation.** The student's ability to master graduate level course material may be assessed after completion of no more than 24 semester units of coursework. This evaluation may take place not later than the third semester of the student's enrollment in the program. The evaluation will be based on the student's performance in coursework and on indicated research competence, and it will be undertaken by the student's advisory committee together with instructors from the student's first year courses.
- (2) **Comprehensive Examinations.** At the end of the second year, the student will take a written comprehensive examination in general cognition and an oral examination on issues of learning pertinent to the student's area of specialization.
- (3) **Oral Examination.** During the third year in the program, the student will make an oral presentation to the dissertation committee to accompany a written proposal for the doctoral thesis. The student will be questioned on both the topic of the investigation and on the proposed research methodology. Upon successful completion of this presentation, the student will be recommended for advancement to candidacy for the doctoral degree.
- (4) **Dissertation Defense.** After completion of the dissertation, the candidate will present a public defense of the doctoral dissertation. A copy of the dissertation must be made available to the doctoral faculty at both institutions four weeks prior to the defense. Copies of the abstract of the dissertation, along with the announcement of the defense, must be publicly available four weeks before the defense. The student's dissertation committee will make a recommendation to the graduate deans to pass *or* fail the student.

Faculty Advisers. Upon admission to the doctoral program, the program directors will assign each student a faculty adviser at both universities. The faculty advisers will serve as advisers until the student's dissertation committee is appointed.

Dissertation Committee. The dissertation committee will be composed of five members with at least two faculty members from each campus. The student will select members of the dissertation committee in consultation with program faculty and the graduate advisers.

Dissertation. Following the successful completion of all prescribed coursework and qualifying examinations, the major remaining requirement for the Ph.D. degree will be the satisfactory completion of a dissertation consisting of original research carried out under the guidance of the major professor. Approval of the completed dissertation attests that an organized investigation that expands the frontiers of knowledge and understanding in mathematics and science education has been carried out.

Award of the Degree. The Doctor of Philosophy degree in Mathematics and Science Education will be awarded jointly by the Regents of the University of California and the Trustees of The California State University in the names of both cooperating institutions.

Financial Support

San Diego State University and the University of California, San Diego have a number of research and teaching associateships available to support students admitted to the Joint Doctoral Program. All students applying to the program will be considered for financial support.

Section III. Certificate Program

Mathematics Specialist Certificate

(Offered through the College of Extended Studies)

The mathematics specialist certificate program, prepares credentialed teachers to become mathematics specialists in the elementary grades. Two different certificates are offered, one focusing on the primary grades and the other on the upper elementary grades. Persons earning the certificates will develop special expertise in the teaching of mathematics in elementary schools. For application or further information, contact Dr. Nadine S. Bezuk (nbezuk@mail.sdsu.edu) or Dr. Nicholas Branca (nbranca@sunstroke.sdsu.edu).

Prerequisites for admission include the following:

1. Teaching credential.
2. Two years of classroom teaching experience.
3. Two letters of recommendation.

Requirements for the primary mathematics specialist certificate (12 units):

1. Six units to include Mathematics 501A, 501B, 502A, 502B, 503A, 503B.
2. Six units to include Mathematics Education 571 and 572.

Requirements for the upper elementary mathematics specialist certificate (12 units):

1. Six units to include Mathematics 501A, 501B, 502A, 502B, 504A, 504B.
2. Six units to include Mathematics Education 573 and 574.

Students must pass all courses with Cr/NC grading or receive at least a C (2.0) in all courses taken for a letter grade. With consent of the adviser, six units of education coursework may be applied toward a master's degree in education.

Refer to the Mathematics section in the General Catalog for a listing of courses for the certificate program.