

# Science and Mathematics Education

The Graduate Group in Science and Mathematics Education (known informally as SESAME) offers an interdisciplinary graduate program leading to a doctoral degree in science and mathematics education. The program is designed to produce graduates who have advanced expertise in a scientific discipline as well as in educational theory and research methodologies. The graduate group was established so individuals with training or experience in a mathematical, scientific or technical discipline could pursue advanced students focused on educational issues in these disciplines.

To enter the program, students must have an excellent academic record with a bachelor's or, preferably, a master's degree in mathematics, a natural science, or engineering/computer science. Experience teaching, developing instructional materials, or doing educational or psychological research in these areas will also be favorably considered. Knowledge of psychology, cognitive science, education, or statistics is helpful but not required.

Students enrolled in the program will be expected to attain in their chosen scientific discipline a degree of competence comparable to that of a departmental PhD candidate in that discipline. Their thesis research will consist of a project dealing with the development of improved educational approaches research on new instructional models or basic research on learning or cognition in mathematics and science. Upon satisfactory completion of their studies and thesis work, students will obtain the degree of PhD in Science and Mathematics Education.

## Admission to the University

### Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an IELTS Band score of at least 7 on a 9-point scale (note that individual programs may set higher levels for any of these); and
4. Sufficient undergraduate training to do graduate work in the given field.

### Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without the need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master's or professional master's degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

## Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted*, then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted*, an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries or political entities in which the official language is not English are required to submit official evidence of English language proficiency. This applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:
  - courses in English as a Second Language,
  - courses conducted in a language other than English,
  - courses that will be completed after the application is submitted, and
  - courses of a non-academic nature.

If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests. Official TOEFL score reports must be sent directly from Educational Test Services (ETS). The institution code for Berkeley is 4833. Official IELTS score reports must be mailed

directly to our office from the British Council. TOEFL and IELTS score reports are only valid for two years.

## Where to Apply

Visit the Berkeley Graduate Division application page (<http://grad.berkeley.edu/admissions/apply/>).

## Admission to the Program

### Requirements

1. A bachelor's degree or its recognized equivalent from an accredited institution;
2. Superior scholastic record, normally well above a 3.0 GPA;
3. Indication of appropriate research goals, described in the statement of purpose;
4. Results of the General Test of the Graduate Record Exam (GRE); and
5. For international applicants whose academic work has been in a language other than English, the Test of English as a Foreign Language (TOEFL).

### Selection Criteria

SESAME accepts three to six PhD students each year from more than 50 applications. Applicants are judged on a number of factors. Good scores and a high GPA are necessary, but not sufficient. The deciding factor is the ability to demonstrate a research record and agenda that fit well with specific SESAME faculty. In a small, interdisciplinary program, it is important that applicants clearly indicate in the statement of purpose which faculty member(s) they are interested in doing research with and why. SESAME only accepts applications for the fall semester.

### Statement of Purpose and Personal History

The statement of purpose and personal history are two separate essays.

The statement of purpose should succinctly explain your reasons for applying to SESAME, briefly review our relevant academic preparation and work experience, and describe your future academic or professional goals once the degree is acquired. The focus should be on your preparation, experience and aims rather than a discussion of the trends or importance of education in general. The most successful statements are one to two pages in length and focus on the strengths and experiences of the applicant, providing the reviewers with evidence and justification for admitting those applicants who are qualified and well-suited for SESAME.

The personal history should include any relevant information not already included in the statement of purpose. Additional suggestions may be found in the Graduate Division's Personal Statement Guide. There is no minimum length for the personal history.

These two essays are used in part to evaluate the candidate's writing skills. Pursuant to UC Berkeley Policy, the two statements must be written by the candidate her or himself.

### Three Letters of Recommendation

PhD applicants should provide at least three and no more than five letters that speak directly to their ability and potential to perform academic work at the doctoral level.

## Normative Time Requirements

### Total Time to Advancement and Total Normative Time

Milestone	Admitted with MA	Admitted without MA
Advancement to Candidacy	7 semesters	8 semesters
Completion of all PhD Requirements	10 semesters	12 semesters

Use this checklist if you entered the program with master's degree in your mathematics, science, or engineering discipline:

Year	Semester	Expectations
1	Fall (1)	<b>Discuss with adviser(s):</b> Interests and professional development, Course planning to meet requirements, Research work plan, goals for year 1
	Spring (2)	<b>Preliminary Exam</b> (incl. required essay revisions) <b>Discuss with adviser(s):</b> Feedback from prelim exam, Progress on course requirements, professional goals; possible conference submission
2	Fall (3)	Supplementary requirements from Preliminary Exam <b>Discuss with adviser(s):</b> Suggested coursework, reading, Research and writing work plan
	Spring (4)	Submit <b>PhD outline of program</b> (available in program office). <b>Discuss with adviser(s):</b> Progress on course requirements, professional goals
		Meet with additional faculty for advice on research
3	Fall (5)	<b>Discuss with adviser(s):</b> Progress on course requirements, professional goals, plans toward publication, Research and writing work plan

4	<b>Spring (6)</b>	Meet with additional faculty for advice on research  <b>Discuss with advisor(s):</b> Progress on research, reading/writing, personal goals, Identify candidates for 4-member QE committee (incl. one outside SESAME. Refer to SESAME QE Plan form available from program office.
	<b>Fall (7)</b>	<b>Qualifying Exam (QE) / Advancement to Candidacy:</b> All required coursework completed; Masters's Degree filed or Equivalency Plan Approved Dissertation prospectus (10-15 pages), Plan B application for candidacy submitted (including identifying 3-member dissertation committee). <b>Doctoral Completion Fellowship</b> (admitted fall 2010 or later) if eligible  <b>Discuss with advisor(s):</b> Results of QE and revisions for dissertation proposal
	<b>Spring (8)</b>	<b>Dissertation Proposal Review</b> (w/in 3 mos of QE): Dissertation proposal (max 30 dbl-spaced pages), Proposal review meeting  <b>Discuss with advisor(s):</b> Plans for completing dissertation, Progress on professional goals
	<b>Fall (9)</b>	Meet with dissertation committee members
5	<b>Spring (10)</b>	<b>Complete dissertation</b>

Use this checklist if you entered the program without a master's degree in your mathematics, science or engineering discipline:

Year	Semester	Expectations
1	<b>Fall (1)</b>	<b>Discuss with advisor(s):</b> Interests and professional development, Course planning to meet

2	<b>Spring (2)</b>	requirements, Research work plan, goals for year 1, Plans for completing MS (or equivalent)  <b>Preliminary Exam</b> (incl. required essay revisions)  <b>Discuss with advisor(s):</b> Feedback from prelim exam, Progress on course requirements, professional goals; possible conference submission
	<b>Fall (3)</b>	Supplementary requirements from prelim exam  <b>Discuss with advisor(s):</b> Suggested coursework, reading, Research and writing work plan
	<b>Spring (4)</b>	Submit <b>PhD outline of program</b> (form available in program office)  <b>Discuss with advisor(s):</b> Progress on course requirements, professional goals
	<b>Fall (5)</b>	<b>Master's degree</b> (or equivalent) in discipline  <b>Discuss with advisor(s):</b> Progress on course requirements, professional goals, plans toward publication, Research and writing work plan
3	<b>Spring (6)</b>	Meet with additional faculty for advice on research
	<b>Fall (7)</b>	Meet with additional faculty for advice on research

**Discuss with advisor(s):** Progress on research, reading/writing, personal goals, Identify candidates for 4-member QE committee (incl. one outside SESAME) Use form available in program office

	<b>Spring (8)</b>	<b>Qualifying Exam (QE) / Advancement to Candidacy:</b> All required coursework completed; Master's Degree filed or Equivalency Plan approved, Dissertation prospectus (10-15 pages) OR Description of proposed dissertation research, Plan B application for candidacy submitted (incl. identifying minimum 3-member dissertation committee) <b>Doctoral Completion Fellowship</b> if eligible
5	<b>Fall (9)</b>	<b>Dissertation Proposal Review</b> (w/in 3 mos of QE): Dissertation proposal (max 30 dbl-spaced pages), Proposal review meeting
	<b>Spring (10)</b>	<b>Discuss with advisor(s):</b> Plans for completing dissertation, Progress on professional goals
6	<b>Fall (11)</b>	Meet with committee members
	<b>Spring (12)</b>	<b>Complete and file dissertation</b>

## Time to Advancement Curriculum

The SESAME program requires doctoral students to complete coursework in each of the following seven areas. These courses provide exposure to the major concerns and issues of this field of study. Students, in consultation with their adviser(s), choose from the list of approved courses under each category. Students who wish to substitute other courses to meet the requirements may petition the SESAME Executive Committee.

Note: Students must take required courses for a letter grade. A student's transcript is required to have a balance of courses with letter grades and satisfactory/unsatisfactory such that two-thirds of the course units have earned a letter grade.

### First Year Seminar

Two semesters during first year of enrollment:

SCMATHE 210	Practicum in Science and Math Education Research and Development	1-4
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### Colloquia

Four semesters in first two years of enrollment:

SCMATHE 292	Research Seminar and Colloquium	1
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### Individual & Social Cognition

Select two from following courses involving a cognitive science approach to thinking, learning or instruction:

EDUC 200H	Cognitive Development: Neo Vygotskian Approaches	3
EDUC 221C	Scientific Cognition: Development, Learning, and Instructional Design	3
EDUC 226	Constructive Epistemology	3
EDUC C229A	Proseminar: Problem Solving and Understanding	3
EDUC 229D	Discourse and Learning in Math and Science Classrooms	3
EDUC 229F	Conceptual Change	3

### Discipline

Select one of the following project-based courses on learning and instruction in a particular subject area (mathematics, computer science, or one of the physical sciences). In addition to extensive readings, the student must conduct, report on, and write up an empirical study (an experiment, clinical interviews, models of out-loud protocols, field work, etc.) germane to the course:

EDUC 224A	Mathematical Thinking and Problem Solving	3
EDUC 224B	Paradigmatic Didactical Mathematical Problematic Situations	3
EDUC 290C	Special Topics Seminars: Cognition and Development (Scientific Thinking and Learning )	1-4

### Curriculum and Technology Design

Select one of the following project-based courses on the principled development of instructional materials. A major part of such courses is the production and/or evaluation a substantial piece of instruction:

EDUC 221A	Towards Ambitious Instruction in Mathematics: Research Into Practice	3
EDUC 222C	Design-Based Research Forum	3
EDUC 290C	Special Topics Seminars: Cognition and Development (Scientific Cognition: Development, Learning & Instruction )	1-4
EDUC 295B	Technology, Computing, and Data in Classrooms	3
SCMATHE 220C	Instructional Design in Science and Mathematics Education	3

### Methodology

Select three of the following, one chosen from Qualitative Methodology Group A, a second course chosen from Quantitative Methodology and a third methodology course chosen in consultation with your faculty adviser. Students may petition for a waiver or substitution of a course to meet this requirement:

Qualitative Methodology - Group A:		
EDUC 228A	Qualitative Methodology	3

## Qualitative Methodology - Group B:

EDUC 293V	Video-Analysis Seminar	1-3
EDUC 290C	Special Topics Seminars: Cognition and Development	1-4

**Quantitative Methodology**

EDUC 293A & EDUC 293L	Data Analysis in Education Research and Educational Data Analysis Laboratory	5
EDUC 275B & EDUC 275L	Data Analysis in Educational Research II and Educational Data Analysis Laboratory II	5

**Research Groups**

All students are expected to be enrolled in one or more research groups each semester:

EDUC 223B	Special Problems in Mathematics, Science and Technology Education	2-6
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Total Units	61-79
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**Preliminary Examination**

The preliminary exam occurs in the spring semester. The exam is based upon the preliminary examination reading list compiled by the executive committee. However, the exam is more than just a review of the required readings. Students are expected to be able to analyze and synthesize what they have read in order to take a position on the main issues in cognitive and educational research. The exam typically consists of a written essay component and a one-hour oral debriefing based upon the same questions answered on the written component. The exam is used as one source of information during the students' year-end evaluation. It provides the faculty with a common piece of work from each student and a basis upon which to judge if students have become socialized to the SESAME intellectual community.

**Science and Mathematics Education**

Expand all course descriptions [+] Collapse all course descriptions [-]

**SCMATHE 210 Practicum in Science and Math Education Research and Development 1 - 4 Units**

Terms offered: Fall 2021, Spring 2021, Fall 2020

Practical experience on an educational research or development project on campus or elsewhere for 8-12 hours per week. Class meetings augment research experience with discussions of readings and interaction with guest speakers.

Practicum in Science and Math Education Research and Development: Read More [+]

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Letter grade.

Practicum in Science and Math Education Research and Development: Read Less [-]

**SCMATHE 220C Instructional Design in Science and Mathematics Education 3 Units**

Terms offered: Spring 2021, Spring 2019, Spring 2017

Survey of literature on design of instruction in science and mathematics, including development of computer-based instruction. Includes consideration of evaluation methods and development of instruction modules for topics in science and mathematics.

Instructional Design in Science and Mathematics Education: Read More [+]

**Rules & Requirements**

**Prerequisites:** 220B or consent of the instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Letter grade.

Instructional Design in Science and Mathematics Education: Read Less [-]

**SCMATHE 292 Research Seminar and Colloquium 1 Unit**

Terms offered: Fall 2021, Spring 2021, Fall 2020

Discussion of current education research carried on by students, faculty, and guest speakers. A written analysis of several presentations required. Research Seminar and Colloquium: Read More [+]

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of colloquium per week

**Additional Details**

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Research Seminar and Colloquium: Read Less [-]



## SCMATHE 294 Formulation of Educational Research 1 - 3 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Development of thesis proposal under supervision of faculty member.

Formulation of Educational Research: Read More [a+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Letter grade.

Formulation of Educational Research: Read Less [-]

## SCMATHE 295 Research 1 - 12 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Independent research activities under supervision of a faculty member.

Research: Read More [a+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Letter grade.

Research: Read Less [-]

## SCMATHE 299 Individual Reading and Study 1 - 5 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Individual reading and study under the supervision of a faculty member.

Individual Reading and Study: Read More [a+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Science and Mathematics Education/Graduate

**Grading:** Letter grade.

Individual Reading and Study: Read Less [-]

## SCMATHE 602 Individual Study for Qualifying Examination 1 - 8 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Individual study, under the supervision of a faculty member, designed to prepare the student for Ph.D qualifying examination.

Individual Study for Qualifying Examination: Read More [a+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Credit Restrictions:** Course does not satisfy unit or residence requirements.

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Science and Mathematics Education/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Study for Qualifying Examination: Read Less [-]