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, mathematics, technology, and engineering education. The program is designed to give graduates advanced expertise in a STEM discipline as well as in educational theory and research methodologies.

This Graduate Group was established so individuals with training or experience in a mathematical, scientific, or technical discipline can pursue advanced studies focused on educational issues in these disciplines. SESAME produces scholars who can communicate effectively with scientists, mathematicians, and engineers as well as with educational researchers and practitioners. SESAME students are expected to attain a level of expertise equivalent to that of a Master’s student in their chosen discipline.

Thesis work typically consists of basic research on learning or cognition in a STEM field or the development of improved pedagogical approaches based on relevant models and research. Upon satisfactory completion of their studies and thesis work, students will obtain the degree of Ph.D. in Science and Mathematics Education.

SESAME also offers a Learning Sciences Certificate in Instructional Design, Learning Technologies, and Education Research (https://sesame.berkeley.edu/learning-sciences-certificate-program/).

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 has completed a basic degree 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 who have completed a basic degree from a country or political entity in which the official language is not English are required to submit official evidence of English language proficiency. This applies to institutions in 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 sent electronically from the testing center to University of California, Berkeley, Graduate Division, Sproul Hall, Rm 318 MC 5900, Berkeley, CA 94720. 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. Particularly valued are potential as a researcher and educator, a strong background in a STEM discipline, and an agenda that fits well with the work of specific faculty in this small, interdisciplinary program. Applicants should clearly indicate in their statement of purpose which faculty member(s) they are interested in doing research with and why.

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. See SESAME Admissions (https://gse.berkeley.edu/academics/additional-degree-programs/graduate-group-science-and-mathematics-education-sesame/) for more information. SESAME accepts applications for only 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.

Three Letters of Recommendation
Ph.D. 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

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Admitted with MA</th>
<th>Admitted without MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advancement to Candidacy</td>
<td>7 semesters</td>
<td>8 semesters</td>
</tr>
<tr>
<td>Completion of all PhD Requirements</td>
<td>10 semesters</td>
<td>12 semesters</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fall (1)</td>
<td>Discuss with adviser(s): Interests and professional development, Course planning to meet requirements, Research work plan, goals for year 1</td>
</tr>
<tr>
<td></td>
<td>Spring (2)</td>
<td>Preliminary Exam (incl. required essay revisions)</td>
</tr>
<tr>
<td></td>
<td>Fall (3)</td>
<td>Supplementary requirements from Preliminary Exam</td>
</tr>
<tr>
<td></td>
<td>Spring (4)</td>
<td>Submit PhD outline of program (available in program office)</td>
</tr>
<tr>
<td>2</td>
<td>Fall (3)</td>
<td>Discuss with adviser(s): Suggested coursework, reading, Research and writing work plan</td>
</tr>
<tr>
<td></td>
<td>Spring (4)</td>
<td>Discuss with adviser(s): Progress on course requirements, professional goals</td>
</tr>
</tbody>
</table>
**Science and Mathematics Education**

### Year 1

#### Fall (1)
- Discuss with advisor(s): Interests and professional development, Course planning to meet requirements, Research work plan, goals for year 1, Plans for completing MS (or equivalent)

#### Spring (2)
- Preliminary Exam (incl. required essay revisions)
- Discuss with advisor(s): Feedback from prelim exam, Progress on course requirements, professional goals; possible conference submission

### Year 2

#### Fall (3)
- Supplementary requirements from prelim exam
- Discuss with advisor(s): Suggested coursework, reading, Research and writing work plan

#### Spring (4)
- Submit PhD outline of program (form available in program office)
- Discuss with advisor(s): Progress on course requirements, professional goals, Master's degree (or equivalent) in discipline

### Year 3

#### Fall (5)
- Meet with dissertation committee members
- Discuss with advisor(s): Progress on course requirements, professional goals, plans toward publication, Research and writing work plan

#### Spring (6)
- Complete dissertation

### Year 4

#### Fall (7)
- Qualifying Exam (QE) / Advancement to Candidacy: 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), Doctoral Completion Fellowship (admitted fall 2010 or later) if eligible
- Discuss with advisor(s): Results of QE and revisions for dissertation proposal

#### Spring (8)
- Dissertation Proposal Review (w/in 3 mos of QE): Dissertation proposal (max 30 dbl-spc pages), Proposal review meeting
- Discuss with advisor(s): Plans for completing dissertation, Progress on professional goals

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fall (1)</td>
<td>Discuss with advisor(s): Interests and professional development, Course planning to meet requirements, Research work plan, goals for year 1, Plans for completing MS (or equivalent)</td>
</tr>
<tr>
<td>2</td>
<td>Fall (3)</td>
<td>Supplementary requirements from prelim exam</td>
</tr>
<tr>
<td>3</td>
<td>Fall (5)</td>
<td>Meet with dissertation committee members</td>
</tr>
<tr>
<td></td>
<td>Spring (6)</td>
<td>Complete dissertation</td>
</tr>
</tbody>
</table>
Spring (6) Discuss with advisor(s): Progress on research, reading/writing, professional goals

Fall (7) 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

Spring (8) Qualifying Exam (QE) / Advancement to Candidacy: 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) Doctoral Completion Fellowship if eligible

Discuss with advisor(s): Results of QE and revisions for dissertation proposal

Fall (9) Dissertation Proposal Review (w/ in 3 mos of QE): Dissertation proposal (max 30 dbl-spc pages), Proposal review meeting

Spring (10) Discuss with advisor(s): Plans for completing dissertation, Progress on professional goals

Fall (11) Meet with committee members

Spring (12) Complete and file dissertation

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**Time to Advancement Curriculum**

The SESAME program requires doctoral students to complete coursework in each of the following 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. No more than a third of the total course units can be taken for a satisfactory/unsatisfactory grade.

**First Year Seminar**

Two semesters during first year of enrollment:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCMATHE 210</td>
<td>Practicum in Science and Math Education Research and Development</td>
<td>1-4</td>
</tr>
</tbody>
</table>

**Colloquia**

Four semesters in first two years of enrollment:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCMATHE 292</td>
<td>Research Seminar and Colloquium</td>
<td>1</td>
</tr>
</tbody>
</table>

**Individual & Social Cognition**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 203</td>
<td>Cultivating Cognitive Development: From Sensorimotor Intelligence to Embodied STEM Concepts</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 254</td>
<td>Introduction to Cultural Historical Activity Theory</td>
<td>3</td>
</tr>
</tbody>
</table>

**Discipline**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 282</td>
<td>Introduction to Disciplined Inquiry</td>
<td>3</td>
</tr>
</tbody>
</table>

**Curriculum and Technology Design**

A project-based course on the principled development of instructional materials. A major part of such courses is the production and evaluation a substantial piece of instruction. Possible courses include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 222C</td>
<td>Design-Based Research Forum</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 295B</td>
<td>Technology, Computing, and Data in Classrooms</td>
<td>3</td>
</tr>
<tr>
<td>SCMATHE 220C</td>
<td>Instructional Design in Science and Mathematics Education</td>
<td>3</td>
</tr>
</tbody>
</table>

**Methodology**

At least one Qualitative Methodology course, at least one Quantitative Methodology course, and a third methodology course chosen in consultation with your faculty adviser. EDUC 274A can satisfy either the Qualitative or Quantitative requirement. Students may petition for a waiver or substitution of a course to meet this requirement.

Qualitative Methodology

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 240A</td>
<td>Language Study for Educators</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 271B</td>
<td>Introduction to Qualitative Research Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

Quantitative Methodology

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 274A</td>
<td>Measurement in Education and the Social Sciences I</td>
<td>4</td>
</tr>
<tr>
<td>EDUC 293A &amp; EDUC 293L</td>
<td>Data Analysis in Education Research and Educational Data Analysis Laboratory</td>
<td>5</td>
</tr>
</tbody>
</table>

**Research Groups**

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

The preliminary exam occurs in Spring semester of the first year. The exam is based upon the first year's coursework, and is more than a review of the readings. Students are expected to be able to analyze and synthesize what they have read, and to take a position on the main issues in cognitive and educational research. The exam consists of a written essay component followed by a one-hour oral conversation based upon the written essays. The exam is intended to provide not a barrier but a snapshot, for the student’s year-end evaluation, of growth and enculturation into the intellectual community.

The Learning Sciences Certificate in Instructional Design, Learning Technologies, and Education Research prepares students for careers involving education design and research. This program is designed to meet the needs of both doctoral and professional master’s students in Berkeley’s science, technology, engineering, and mathematics (STEM) departments and in its professional schools.

Students who complete the certificate will be prepared to:

• Design courses for undergraduates and graduate students
• Use learning sciences research in design, implementation, and assessment of educational programs
• Use and refine learning technologies, including online courses, learning management systems, interactive models and simulations, and educational games
• Succeed in K-12 settings; undergraduate, graduate, and research institutions; out-of-school settings; non-profits, education startups, and industries that develop technical training and novel approaches to learning
• Meet the needs of students with varied cultural, educational, and personal experiences, including emergent bilinguals, underrepresented minorities, and students new to technology.

For further information, visit https://sesame.berkeley.edu/learning-sciences-certificate-program/ or contact Lloyd Goldwasser (goldwasser@berkeley.edu).

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

Terms offered: Spring 2022, Fall 2021, Spring 2021
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.

Rules & Requirements

Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

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.

Rules & Requirements

Prerequisites: 220B or consent of the instructor

Science and Mathematics Education

Expand all course descriptions [+]
Collapse all course descriptions [-]
SCMATHE 292 Research Seminar and Colloquium 1 Unit
Terms offered: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
Development of thesis proposal under supervision of faculty member.
Formulation of Educational Research: 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 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: Spring 2022, Fall 2021, Spring 2021
Independent research activities under supervision of a faculty member.
Research: 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 independent study per week

Additional Details
Subject/Course Level: Science and Mathematics Education/Graduate
Grading: Letter grade.
Research: Read Less [-]
SCMATHE 602 Individual Study for Qualifying Examination 1 - 8 Units
Terms offered: Spring 2022, Fall 2021, Spring 2021
Individual study, under the supervision of a faculty member, designed to prepare the student for Ph.D qualifying examination.

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 [-]